NOVATO SANITARY DISTRICT

Sanitary District No. 6 of Marin County

STANDARD SPECIFICATIONS AND DRAWINGS

APRIL 1975*

*** Please also refer to Addendum #1 (issued March 2008) and Addendum #2 (issued November 2009) at www.novatosan.com / Documents / Permits and Requirements**

NOVATO SANITARY DISTRICT

Sanitary District No. 6 of Marin County
500 Davidson Street - Novato, California

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S T A N D A R D S P E C I F I C A T I O N S

A N D D R A W I N G S

April 1975

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PART A - GENERAL INFORMATION

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. However, the provisions of Part C - District Contract Requirements (Sections 8 through 13) and the payment provisions of other sections will apply and be enforced by the District only on District contract work.

The jurisdiction of the District includes the entire sewerage system and its appurtenances from the point of connection with the building plumbing to the discharge terminus of the treatment plant outfall. In general, the service area of the District covers the City of Novato and surrounding areas. 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 Engineer and shall be considered as part of the specifications for the work.

1-02 Master Plan. The District Board of Directors has adopted a Long Range Master Plan for Sewage Collection, Treatment and Disposal to serve as a guide for future construction of sewerage facilities. Copies of this Master Plan are on file in the District office and it is suggested that any person who proposes to construct sewers within the District consult this plan prior to design or layout.

1-03 District Sanitary Code. The Sanitary Code of the District (Ordinance No. 14 and amendments) comprises 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 Engineer and Sewer 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.

1-04 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 an established annexation procedure and further information can be gained by contacting the District office.

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 or public use. In the case of public streets, further dedication

is not necessary unless specifically required. With the exception of easements dedicated on subdivision final maps, all new easements must be granted or deeded directly to the District as sewer easements. Unless otherwise specifically permitted or required by the District Engineer, all easements shall be ten (10) feet in width and the easement shall be centered on the sewer line in all cases. Easements shall be dedicated for sewers or 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 the 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, 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 or 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, 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 or the permittee of his responsibility to meet all requirements of the District. The plans and specifications for any job shall be revised or supplemented at any time it is determined that the full requirements of the District have not been met.

1-08 Environmental Impact Report Regulations. The District Board of Directors has adopted "Local Guidelines for Implementation of the California Environmental Quality Act of 1970." 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 staff early in their planning process to determine exact District Environmental Impact Report requirements.

PART A - GENERAL INFORMATION

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:

Abbreviations

ACP	- Asbestos Cement Pipe	CL & CP	- Concrete Lined and Coated Steel Cylinder Pipe
AC	- Asphalt Concrete	CMP	- Corrugated Metal Pipe
AAN	- American Association of Nurserymen	Drop MH	- Drop Manhole
AASHO	- American Association of State Highway Officials	Fed.Spec.	- Federal Specifications
ACI	- American Concrete Institute	FL	- Flow Line
AREA	- American Railway Engineering Association	Inv. El.	- Invert Elevation
ASA	- American Standards Association	MH	- Manhole
ASCE	- American Society of Civil Engineers	NEMA	- National Electrical Manufacturers Association
ASME	- American Society of Mechanical Engineers	NSD	- Novato Sanitary District
ASTM	- American Society for Testing Materials	PCC	- Portland Cement Concrete
AWPA	- American Wood Preservers' Association	PMP	- Perforated Metal Pipe
AWS	- American Welding Society	PVC	- Poly Vinyl Chloride
AWWA	- American Water Works Association	RCP	- Reinforced Concrete Pipe
CIP	- Cast Iron Pipe	RI	- Rodding Inlet
CLP	- Concrete Lined Steel Cylinder Pipe	RPMP	- Reinforced Plastic Mortar Pipe
		S	- Pipe Slope
		St. P	- Steel Pipe
		Sta.	- Survey Station
		URB	- Untreated Rock Base (Aggregate Base)
		VCP	- Vitrified Clay Pipe

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 inclusion of property within District boundaries by proper legal procedures.

"As Built" Plans - 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 as built construction details.

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Building Drain - The building drain is that part of the lowest piping of a drainage system which receives the discharge from wastes and other drainage pipes inside the walls of the building and conveys it to the building sewer (side sewer), which begins two (2) feet outside the building wall (building foundation).

City - The City of Novato or any other 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 an to perform the work of installing sewers under District jurisdiction, 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.

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 Engineer. Similarly, the words approved, acceptable, satisfactory, shall mean approved by, acceptable to, or satisfactory to the Engineer.

District - The Novato Sanitary District (Sanitary District No. 6 of Marin County, California).

District Board - The governing body of the District.

Engineer - The District Engineer acting either directly or through authorized agents.

Fixture Units - The fixture unit load values for drainage piping as computed from Tables 1 and 2 of Chapter 4 of the Uniform Plumbing Code.

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

Job Engineer - The engineer, including the District 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.

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.

Owner - In the case of District projects, the term owner shall mean the Novato 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.

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Permit - The written authorization required pursuant to the rules and regulations of the District for the installation or construction of specific sewerage facilities under specific conditions at specific locations.

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

Plans - Construction plans, sewer plans and profiles, cross sections, detailed drawings, etc., or reproductions thereof, approved or to be approved by the District Engineer, 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 and 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 connected to the District sewerage system, done under permit or agreement with the District.

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 sewerage facilities.

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

Sewers -

Main Sewer - A public sewer which has been or is being constructed to accomodate more than one side sewer. (Normally six inches in diameter or larger).

Side Sewer - The privately owned and maintained sewer line which links the sanitary or waste plumbing of a house or other building with the main 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. (Normally four or six inches in diameter).

Lateral Sewer - That portion of the side sewer within a public road right of way. (Normally that portion between the main sewer and the property line).

Building Sewer - That portion of the side sewer (in cases where there is a lateral sewer) between the lateral sewer or property line and the point of connection to the sanitary plumbing of the structure.

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 sub-surface water and supplying to the District reports on the same.

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

Standard Drawings - The drawings of structures or devices commonly used on District work designated by the District Engineer 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 Novato 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 "Engineer" as defined hereinabove.

Streets or Roads - Any public highway, road, street, avenue, alley, way, easement or right-of-way used or to be used for vehicle movement.

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 Western Plumbing Officials Association, current edition.

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

PART B - ENGINEERING AND DESIGN REQUIREMENTS

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PART B - ENGINEERING AND DESIGN REQUIREMENTS

SECTION 3 - DESIGN CALCULATIONS AND PLAN PREPARATION

3-01 Design Calculations. When requested to do so by the District Engineer, 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 State of California registration number.

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 areas, 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 calculations 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.

3-02 Size of Plans and Data Required. Sheet sizes for plans for all sanitary sewerage facilities shall be 24 inches by 36 inches, unless otherwise specifically approved in advance by the District Engineer, 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, or main extension (this will be supplied by District) and each sheet shall bear the signature and registration number of the Job Engineer. Each map and plan sheet shall have a north arrow and appropriate scale or scales 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 existing or proposed utilities and other facilities in accordance with available information (see Section 17-02) Plans shall include sewer line sizes and designations and shall show all structures and their respective numbers, all property lines and corners adjacent to the sewer alignment, laterals and ties to property corners, all necessary and required stationing, horizontal curve data and street names. (Scale usually 40 or 50 feet to the inch if all required data can be adequately shown).

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 17-02), which cross the

alignment of the sewer and shall accurately indicate clearance when less than twelve (12) inches. (Scale usually 40 or 50 feet to the inch horizontally and 4 or 5 feet to the inch vertically, if all required data can be adequately shown.)

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

E. Location Map - If the plans consist of more than two sheets a small scale location map shall be included on the first sheet of the plans showing the overall sewer layout and appropriately indexing each plan sheet.

F. Line Stationing - Each sewer line with a separate designation shall be stationed continuously upgrade from 0+00 at its point of connection to another line.

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

H. Structure Numbers - Manholes, rodding inlets, and all other sewer structures shall be numbered consecutively upgrade by type of structure. The structure number shall appear on the plans and profiles whenever the structure is shown or referred to.

I. Side Sewer Locations and Elevations - All side sewers or 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 Job Engineer.

Where properties are fronting on a cul-de-sac and the main sewer terminates with a manhole, the laterals for these properties shall be connected to the 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 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 and accurately located.

J. Elevation Datum - The elevation datum used shall be USC & GS mean sea level. The plans shall include a note indicating the elevation datum and giving the elevation and describing the location of one or more bench marks in the area of the work.

PART B - ENGINEERING AND DESIGN REQUIREMENTS

K. 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 Novato Sanitary District Standard Specifications and Drawings."

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

3. "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."

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

5. "All sewer laterals shall be 4-inches in diameter and shall have a minimum slope of 1.5% and a minimum depth of cover at the property line of 4.0 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 may be dedicated on the subdivision final map. Outside of subdivisions, when sewers are to be installed on private property, an easement must be granted or deeded 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 Engineer, no sewer work will be permitted to proceed until the District receives and approves all required easements.

A. 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 signature and registration number of the Job Engineer. Bearings and distances of easement courses shown shall conform to those given in the easement description. Two (2) blue line prints of the easement map shall be submitted (for each grantor involved).

B. Easement Deeds - After receipt of the required easement map and description, the District will prepare the necessary easement deed forms for signature by the property owner or owners.

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

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3-05 Flood Control Approval. In the event that a proposed sewer is to cross a 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 on the plans and submitted to the Flood Control District for approval prior to approval of the plans by the District Engineer.

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 require a 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.

SECTION 4 DESIGN STANDARDS

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

A. Population Density - Population densities for determining the ultimate tributary population shall be as indicated in the District Master Plan, actual count, 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 ninety (90) 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 tabulated values below shall be used.

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Population Range	Ratio of Peak to Average Day 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:

For areas sewered prior to 1962 - 4,000 gallons per acre per day

For areas sewered after 1962 - 1,000 gallons per acre per day

For areas of anticipated population densities of less than five (5) persons per acre - 200 gallons per capita per day

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

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 the greater.

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

I. References - Reference is made to the District Master Plan (see Section 1-02), to W.P.C.F. and A.S.C.E. manuals, and to Minimum Design Standards of the Federal Housing Administration (FHA-G-4518.1).

4-02 Sewer Pipes.

A. Pipe Materials - All main sewer and lateral sewer pipes shall be vitrified clay pipe, asbestos-cement pipe, PVC plastic pipe, reinforced plastic mortar pipe or cast iron pipe, unless otherwise specifically required or approved by the District Engineer. Selection of the pipe type for a given project shall be

made by the Job Engineer, subject to the approval of the District Engineer. Lateral sewers shall be of the same pipe type as the main sewer when being installed concurrently with the main sewer. The type of pipe used for building sewer installation shall conform to the "Approved Building Sewer Pipe Materials List" on file in the office of the District Engineer. The type of pipe used for force mains shall be asbestos-cement pipe, PVC plastic pipe, reinforced plastic mortar pipe, cast iron pipe, or concrete steel cylinder pipe, as specifically approved for the particular project by the District Engineer. Special pipe and/or design provisions may be required at locations where the force main will not run full at all times.

B. Minimum Pipe Sizes - The minimum pipe size for main sewers shall be six (6) inches. The minimum pipe size 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 are to be connected, the side sewer shall have a six (6) inch minimum diameter. Also, 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 not less than six (6) inches in diameter.

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 Engineer may specify acceptable minimum slopes greater than those shown.

Pipe Size in Inches	Minimum Slope Ratio in Feet per Foot
6	0.006
8	0.0035
10	0.0025
12	0.0020
15	0.0015
18	0.0012
21	0.00095
24	0.0008

D. Minimum Slope - Side Sewers - The minimum slope for four (4) inch diameter side sewers shall be 1.5 feet per 100 feet (1.5%) provided, however, that where unusual conditions exist making it impractical to obtain this slope, a four (4) inch side sewer may have a slope of not less than 1.0 feet per 100 feet (1.0%) when specifically approved by the District Engineer. The minimum slope for side sewers greater than four (4) inches shall be 0.7 feet per 100 feet (0.7%).

E. Steep Slopes - For sewers installed in areas with steep ground slopes (1 to 1 or greater), and when flow velocities exceed fifteen (15) feet per second, special design features may be required. Depending upon conditions of the specific installation, such items as check dams, trench dams, special anchorage or special pipe materials may be required by the District Engineer.

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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 and/or backfill will be required as directed by the District Engineer.

1. Main Sewers - The minimum pipe cover for main sewers within street rights of way shall be 4.5 feet. The minimum cover for mains within easements or other rights of way not expected to become streets shall be 3.5 feet.

2. Side Sewers - That portion of a side sewer within a street right of way (lateral sewer) shall have a minimum cover of 4.0 feet at the property line (measured from the finished ground surface or the adjacent top of curb, whichever is lower). The minimum cover for side sewers from the property line to the building drain (building sewer) shall be eighteen (18) inches. However, when the cover over the building sewer is less than twenty-four (24) inches, special pipe, bedding and/or concrete encasement may be required by the District Engineer.

G. Pipe Strengths and Maximum Depths - The minimum pipe strengths and classes given as standard in these specifications (see Section 20-02), and in the "Approved Building Sewer Pipe Materials List", are based upon the attainment of standard bedding conditions (see Section 19-02G), maximum allowable trench widths (see Section 19-02B), and upon the assumption of average pipe depths (depths up to 12 feet). 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 average, special pipe, bedding, backfill and/or encasement may be required as directed by the District Engineer. Where pipe depths or other known conditions require 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 constructed to have a minimum of 12-inches clearance from all other utilities and/or improvements, unless a special approval is received from the District Engineer.

I. Horizontal and Vertical Curves - Horizontal curves may be used on curved streets when the alignment can be kept concentric with street improvements and when minimum radius requirements can be met. Vertical curves may be used in hilly terrain, when permitted by the District Engineer, in order to reduce the number of required manholes. The deflection in the joint between any two successive pipe sections shall not exceed 80% of the maximum deflection as recommended in writing by the pipe manufacturer. If other than standard joint lengths are required for a given curve in order to meet the deflection requirements, the required joint length shall be shown on the plans.

J. Sewer Connections to Existing System - Connection of new main or trunk sewers to the existing sewer system shall be made at existing manholes or by constructing a new manhole at the point of connection. Side sewer connections to existing main sewers shall be accomplished by connecting to

wye branches or laterals where they exist, by installing a standard saddle connection, or by connecting to an existing manhole. Side sewers 8-inches and larger shall be connected at manholes only.

K. 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). 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).

L. 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 6-inches in size or as directed by the District Engineer and shall be of an approved type of pipe. Stubs shall protrude a minimum of one (1) foot outside of the manhole base and shall be channeled as though a regular sewer line within the manhole. The outboard end of stubs shall be a standard pipe joint end and shall be plugged with a standard watertight plug or cap, as supplied by the pipe manufacturer.

M. 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 improvement, prior to street construction. The sewer extension shall terminate with the proper structure or fitting, which will minimize the amount of pavement to be disturbed by future sewer extensions.

N. 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. In addition, a note shall be placed on the plans to the effect that the Contractor shall obtain an encroachment permit from the City and/or County prior to starting work on sewers within existing street rights of way.

O. Sewers to be Installed in or Across Utility or Railroad Rights of Way - Where sewers are to be constructed across or within utility or railroad rights of way 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.

P. 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 Engineer when, in his judgement, the property is not likely to be divided in the future.

Q. Side Sewer Cleanouts Required - Cleanouts shall be installed in the side sewer as provided in Section 1107 of the Uniform Plumbing Code. The cleanout riser shall be equal in size to the side sewer.

PART B - ENGINEERING AND DESIGN REQUIREMENTS

R. Backwater Prevention Devices - Where a side sewer serves plumbing fixtures that are located less than one (1) foot above the rim elevation of the upstream manhole or rodding inlet in the reach of main sewer into which the side sewer connects, it shall be protected from backflow of sewage by installing an approved backwater prevention device, as detailed on the Standard Drawings.

4-03 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. Where practical, manholes shall be located near the center of street intersections. 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 following regulations shall also apply:

1. A standard drop manhole may 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.

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.

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 any main sewer when four (4) or more side sewer connections exist or are planned in the downstream reach of sewer. An exception may be made when the main sewer is planned to be extended.

B. Rodding Inlets - A rodding inlet may be installed at the terminus of a main sewer when less than four (4) side sewer connections exist or are planned in the downstream reach of sewer. The rodding inlet shall be located at least ten (10) feet into the property or beyond the projection of the nearest property line at the end of the main sewer.

C. Flushing Inlets - A flushing inlet shall be installed near each new pump station, at a location specified by the District Engineer, in order to provide easy access for flushing the system.

D. 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.

PART B - ENGINEERING AND DESIGN REQUIREMENTS

E. Pressure Frame and Covers - Pressure (water-tight) frames and covers shall be installed when specified by the District Engineer, where drainage conditions may cause storm waters to inundate sewer structures.

F. 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 Engineer prior to any remodeling work.

G. Special Structures - Trunk sewer manholes, siphons, pumping systems, and other unusual structures require specific design approval.

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 (3) weeks prior to the District Board meeting at which approval of plans is desired.

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

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

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

4. Two (2) copies of maps and descriptions for any required easements (other than those to be dedicated on a subdivision final map).

5. 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. 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 Engineer and 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.

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

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

3. One (1) copy of maps and descriptions for any required easements. (Submit one (1) copy for each grantor involved).

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

5. Any other pertinent plans, information or materials specifically required by the 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 twice each month (specific dates may be obtained from the District office) and the Job Engineer will need to schedule his work and the submittal of plans to meet an appropriate Board meeting date. After approval of the plans by the District Board, the District Engineer 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 approved 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 Engineer. 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 Engineer and distribution similar to the original plans. The Job Engineer shall be responsible for seeing that all revisions are appropriately shown on the "as-built" drawings for the project.

5-06 Statement of Fees and Charges. During District review of the plans but prior to final approval, the District Engineer will prepare a Statement of Fees and Charges which will be sent to the Owner, 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 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, etc. No work shall be permitted

to proceed until the main extension permit has been issued.

5-08 Subdivisions. Before approving the recordation of a subdivision final map, both the City and 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.

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.

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

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

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

4. 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?

5. 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?

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

7. Are all necessary easements prepared?

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

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 25 to 50 foot intervals, depending upon topography. Intervals of 25 feet, or less, shall be used through all horizontal and vertical curves. Stakes shall be appropriately marked to show the Engineer's station, the offset, and the cut to sewer invert.

6-02 Side Sewer Location. 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.

PART B - ENGINEERING AND DESIGN REQUIREMENTS

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 As-Built Plans. Upon completion of the work and prior to acceptance by the District, the Job Engineer shall provide "as-built" plans to the District. As-built plans 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:

1. Sewer line and structure locations.
2. Surface and invert elevations of structures.
3. Slope, size, type of pipe, and length between structures.
4. Wye and lateral locations.

The Job Engineer shall submit a preliminary copy of the as-built plans 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 "As-Built Plans".

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 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 an 8-inch or larger side sewer is to be installed and at any other time when specifically required by the District Engineer.

7-02 Licenses. Contractors performing work requiring permit by the District shall be licensed by the State of California (Chapter 37, Statutes of 1939, as amended). 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 extension (public sewer construction), the applicant shall furnish to the District a 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 Engineer. 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, shall 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.

Prior to the issuance of a permit for a sewer main extension, the applicant shall furnish to the District a labor and materials bond, cash deposit, or other security acceptable to the District, in the amount of the total estimated cost of the work as determined by the District Engineer. Such labor and materials bond, cash deposit, or other security shall be provided for the purpose of guaranteeing payment for all labor and materials performed and used on the project.

Contractors performing work under District contract shall furnish bonds in accordance with Section 10 of these specifications.

PART C - DISTRICT CONTRACT REQUIREMENTS

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PART C - DISTRICT CONTRACT REQUIREMENTS

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PART C - DISTRICT CONTRACT REQUIREMENTS

SECTION 8 PROPOSAL REQUIREMENTS AND CONDITIONS

8-01 Deposit for Plans and Specifications. As stated in the notice to bidders, a deposit is required of each bidder who desires to secure plans and specifications. This deposit shall constitute a guarantee that the plans and specifications will be returned in good condition to the Engineer not later than fifteen (15) days after the bids on the project have been opened. Such deposit will be liable to forfeiture if the plans and specifications are not returned within said time. When the notice to bidders states that all or a portion of the deposit is to be retained, such retention shall be construed as reimbursement for incidental costs of handling and mailing. The plans and specifications are the property of the District and are loaned to the bidder until the bids are due. The deposit and/or retention shall not be construed to be the purchased price of any part of these documents.

8-02 Estimated Quantities. The quantities given in the notice to bidders, and in the proposal and contract forms are approximate only, being given as a basis for the comparison of bids, and the District does not, expressly or by implication, agree that the actual amount of work will correspond therewith, but reserves the right to increase or decrease the amount of any class or portion of the work, or to omit portions of the work, as may be deemed necessary or advisable by the Engineer, and the Contractor shall not be entitled to any claim for damage or loss of anticipated profit.

8-03 Examination of Site, Plans and Specifications, etc. Each bidder shall visit the site of the proposed work and fully acquaint himself with the conditions to be encountered as to the character, quality, quantities of work to be performed, and materials to be furnished, so that he shall fully understand the facilities, difficulties, and restrictions attending the execution of the work under the contract. Bidder shall thoroughly examine and be familiar with the plans and specifications. The failure or omission of any bidder to receive or examine any form, instrument, addendum or other document or to visit the site and acquaint himself with conditions therein existing shall in no wise relieve any bidder from obligation with respect to his bid or to the contract. The submission of a bid shall be taken as prima facie evidence of compliance with this paragrpah.

8-04 Proposal. Proposals shall be made on the blank form prepared by the District without removal from the bound contract documents. All proposals shall give the prices proposed, both in writing and in figures, and shall be signed by the bidder or his authorized representative, with his address. If the proposal is made by an individual, his name and post office address must be shown; if made by a firm or partnerhsip, the name and post office address of the firm or partnership and the signature of one or both of the partners must be shown; if made by a corporation, the proposal shall show the name of the state under the laws of which the corporation is chartered, the name of the corporation, and the title of the person who signs on behalf of the corporation.

Each proposal shall be enclosed in a sealed envelope, endorsed as specified in the notice to bidders. Bidders are warned against making erasures or alterations of any kind, and proposals which contain omissions,

erasures, conditions, alterations, or additions not called for, additional proposals, or irregularities of any kind, may be rejected.

8-05 Withdrawal of Proposals. Any proposal may be withdrawn by the bidder at any time prior to, but not after, the time fixed in the notice to bidders for the opening of the bids, provided that a request in writing, executed by the bidder or his duly authorized representative, for the withdrawal of such bid is filed with the District. The withdrawal of a bid will not prejudice the right of a bidder to file a new proposal. After the bid opening, all bids shall be under the jurisdiction of and subject to final acceptance or rejection by the District until the District has awarded a contract for the work and an agreement has been entered into with the sucessful bidder. If an award is not made and an agreement entered into within thirty (30) days from the date of the bid opening, all of the proposals submitted shall be deemed to have been rejected by the District.

8-06 Public Opening of Proposals. Proposals will be opened and read publicly at the time and place indicated in the notice to bidders. Bidders or their agents are invited to be present.

8-07 Proposal Guaranty. No proposal or bid will be considered unless accompanied by a Certified or Cashier's Check or Bid Bond satisfactory to the District, in an amount not less than the amount stated in the notice to bidders.

8-08 Qualification of Bidders. Each bidder shall be licensed in accordance with the provisions of Chapter 9, Division 3 of the Business and Professions Code, and shall be skilled and regularly engaged in the general class or type of work called for under this contract. A statement setting forth his experience and business standing shall be submitted by each bidder on the form provided in the proposal.

It is the intention of the District to award a contract only to a bidder who furnishes satisfactory evidence that he has the requisite experience and ability and that he has sufficient capital, facilities, and plant to enable him to prosecute the work successfully and promptly, and to complete it within the time named in the contract.

To determine the degree of responsibility to be credited to a bidder, the District will weigh any evidence that the bidder or personnel guaranteed to be employed in responsible charge of the work has performed satisfactorily other contracts of like nature and magnitude or comparable difficulty at similar rates of progress.

8-09 Disqualification of Bidders. More than one proposal from an individual, firm or partnership, a corporation or an association under the same or different names, will not be considered. Reasonable ground for believing that any bidder is interested in more than one proposal for the work will cause the rejection of all proposals in which such bidder is interested. If there is reason to believe that collusion exists among the bidders, none of the participants in such collusion will be considered. Proposals in which the prices obviously are unbalanced may be rejected.

PART C - DISTRICT CONTRACT REQUIREMENTS

8-10 List of Subcontractors. In accordance with Chapter 2, Division 5, Title 1 of the Government Code, each proposal shall have listed the name and address of each subcontractor to whom the bidder proposes to sublet portions of the work. Subcontractors shall be listed on the form provided in the proposal.

SECTION 9 AWARD AND EXECUTION OF CONTRACT

9-01 Award of Contract. The award of the contract, if it be awarded, will be to the lowest responsible bidder whose proposal complies with all the specified requirements, and will be made within thirty (30) days after opening of the bids. The District may reject any and all proposals should it deem this for the public good and also the proposal of any party who has been delinquent or unfaithful in any former contract, and shall reject all proposals or bids other than the lowest regular proposal or bid of any responsible bidder, and may award the contract for said work or improvement to the lowest responsible bidder at the prices named in his bid or proposal. Decision as to which bidder is the lowest and best bidder or the lowest responsible bidder rests with the District Board, and its decision thereon shall be final and binding on all persons.

9-02 Failure to Execute Contract. Failure of the lowest responsible bidder, the second lowest responsible bidder, or the third lowest responsible bidder to execute the contract and file acceptable bonds as provided in Section 10-03 of these specifications within fifteen (15) days after such bidder has received notice that the contract has been awarded to him shall be just cause for the annulment of the award and the forfeiture of the proposal guaranty. The successful bidder may file with the Engineer a written notice, signed by the bidder or his authorized representative, specifying that the bidder will refuse to execute the contract if presented to him. The filing of such notice shall have the same force and effect as the failure of the bidder to execute the contract and furnish acceptable bonds within the time hereinbefore prescribed.

9-03 Execution of Contract. The contract agreement shall be signed by the successful bidder and returned, together with the contract bonds, within fifteen (15) days after written notice of award of the contract.

9-04 Return of Proposal Guaranties. Within ten (10) days after the bids are opened, the District will return the proposal guaranties accompanying such of the proposals as are not to be considered in making the award. All other proposal guaranties will be held until the contract has been fully executed, after which they will be returned to the respective bidders whose proposals they accompany.

9-05 Contract Parts. The contract shall consist of the following documents, each of which is on file in the office of the District Secretary and all of which are incorporated and made a part hereof by reference thereto: the notice to bidders, the proposal, the contract, the plans, the Standard Specifications, the Special Provisions, the contract bonds, the insurance certificates, and any addenda issued by the District prior to award of contract.

PART C - DISTRICT CONTRACT REQUIREMENTS

SECTION 10 BONDS AND INSURANCE

10-01 Faithful Performance Bond. As a part of the execution of the contract, the Contractor shall furnish, in triplicate, a bond of a surety company acceptable to the District conditioned upon the faithful performance of all covenants and stipulations under the contract. This bond shall be made effective for a period of one (1) year after the date of acceptance of the work by the District, and shall be in the amount of one hundred percent (100%) of the total contract price.

10-02 Material and Labor Bond. As a part of the execution of the contract, the Contractor shall furnish, in triplicate, a bond of a surety company acceptable to the District in a sum not less than one hundred percent (100%) of the total contract price, for payment in full of all persons, companies, or corporations who perform labor upon or furnish materials to be used in the work under the contract, in accordance with the provisions of Sections 3247 through 3252, Chapter 7, Part 4 of Division 3 of the Civil Code of the State of California, and any acts amendatory thereof.

10-03 Notification of Surety Companies. The surety companies shall familiarize themselves with all of the conditions and provisions of the contract, and they waive the right of special notification of any change or modification of the contract or of extension of time, or of decreased or increased work, or of the cancellation of the contract, or of any other act or acts by the District or its authorized agents, under the terms of the contract; and failure to so notify the aforesaid surety companies of changes shall in no wise relieve the surety companies of their obligations under the contract.

10-04 Public Liability and Property Damage Insurance. The Contractor shall take out and maintain during the life of the contract such public liability and property damage insurance as shall protect him and any subcontractor performing work covered by the contract from claims for property damages, which may arise because of the nature of the work or from operations under the contract, whether such operations be by himself or by any subcontractor or anyone directly or indirectly employed by either of them, even though such damages may not be caused by the negligence of the Contractor or any subcontractor, or anyone employed by either of them. The public liability and property damage insurance shall directly protect the District, its officers, agents and employees, as well as the Contractor and his subcontractors, and all insurance policies issued hereunder shall so state. The amounts of such insurance shall be as follows:

> Comprehensive bodily injury and property damage liability insurance including automobile, product and specifically including contractural liability covering liability assumed hereunder providing bodily injury liability limits of not less than $500,000 for each person and $1,000,000 for each occurrence, and property damage liability limits of not less than $500,000 for each accident or occurrence for claims which may arise from the operations of the Contractor or any subcontractor in the performance of the work herein provided for. This insurance must include coverage for contractural liability assumed by the Contractor under Section 16-08, Responsibility for Damage.

PART C - DISTRICT CONTRACT REQUIREMENTS

Before the execution of the contract, the successful bidder shall file in triplicate with the District a certificate or certificates of insurance covering the specified insurance. Each such certificate shall bear an endorsement precluding the cancellation, or reduction in coverage, of any policy evidenced by such certificate, before the expiration of ten (10) days after the District shall have received notification by registered mail from the insurance carrier.

If the Contractor fails to maintain such insurance, the District may take out the necessary public liability and property damage insurance and deduct and retain the amount of the premiums for such insurance from any sums due the Contractor.

10-05 Workers' Compensation Insurance. Before beginning the work, the Contractor shall furnish to the District, in triplicate, satisfactory proof that he has taken out, for the period covered by the work under the contract, full compensation insurance for all persons whom he may employ directly or through subcontractors, in carrying out the work contemplated under the contract, in accordance with the "Workers' Compensation and Insurance Act," Division IV of the Labor Code of the State of California and any acts amendatory thereof. Such insurance shall be maintained in full force and effect, during the period covered by the contract.

If the Contractor fails to maintain such insurance, the District may take out compensation insurance covering any claims which the District might be liable to pay under the provisions of the Act by reason of any employee of the Contractor being injured or killed, and deduct and retain the amount of the premiums for such insurance from any sums due the Contractor.

If any injury occurs to any employee of the Contractor for which the employee, or his dependents, in the event of his death, is entitled to compensation from the District under the provisions of said Act, or for which compensation is claimed from the District, the District may retain from the sums due the Contractor under the contract an amount sufficient to cover such compensation as fixed by said Act, until such compensation is paid, or until it is determined that no compensation is due, and if the District is compelled to pay such compensation, it will deduct and retain from such sums the amount so paid.

SECTION 11 - SCOPE OF WORK

11-01 Work to be Done. The work to be done consists of furnishing all plant, labor, materials, methods and processes, implements, tools and machinery, except as otherwise specified, which are necessary and required to construct and complete the work designated in the contract, and to leave

the grounds in a neat condition.

The District reserves the right to increase or decrease the quantity of any item or portion of work as may be deemed necessary or advisable by the Engineer; and to make such alterations or deviations, increases or decreases, additions or omissions, in the plans and specifications, as determined to be necessary and advisable.

11-02 Intent of Plans and Specifications. The intent of the plans and specifications is to describe the details for the construction and completion of the work which the Contractor undertakes to perform in accordance with the terms of the contract. Where the plans or specifications describe portions of the work in general terms, but not in complete detail, it is understood that only the best general practice is to prevail and that only materials and workmanship of the finest quality are to be used.

11-03 Extra Work. If extra work orders are given in accordance with the provisions of the contract, such work shall be considered a part thereof and subject to each and all terms and requirements of the contract. No order for extra work, at any time or place, shall in any manner or to any extent relieve the Contractor of any of his obligations under the contract.

In case of neglect or refusal by the Contractor to perform any work which may be authorized by the Engineer or to make satisfactory progress in the execution of the same, the District may employ any person or persons to perform such work and the Contractor shall not in any way interfere with or molest the person or persons so employed.

11-04 Removal of Obstructions. Where the completion of the work requires their removal, the Contractor shall remove and dispose of all structures, debris, or other obstructions encountered in making the improvement.

11-05 Disposal of Materials. The Contractor shall make his own arrangements for disposing of materials outside public rights-of-way, easements, construction areas, or limits of work, and he shall pay all costs involved. Unless otherwise provided in the Special Provisions, full compensation for all costs involved in disposing of materials shall be considered as included in the prices paid for the various contract items of work and no additional compensation will be allowed therefor.

11-06 Sanitation. The Contractor shall provide all necessary privy accommodations for the use of his employees on the work and shall maintain same in a clean and sanitary condition.

11-07 Modification of Work by District. The Engineer shall have the right, in writing to order additions to, omissions from, or corrections, alterations and modifications in the line, grade, form, dimensions, plan or materials contemplated, or any part thereof, either before or after the beginning of construction. The order of such additions, omissions, corrections, alterations, and modifications shall be in writing and signed by the Engineer, and such order shall then be binding upon the Contractor. Such alterations shall in no wise affect, vitiate, or make void the contract or any part thereof, except that which is necessarily affected by such

alterations and is clearly the evident intention of the parties to the contract.

11-08 Rights of Way. The District will provide all rights of way and easements in or beneath which pipes and other structures will be constructed by the Contractor under the contract. Contractor shall make his own arrangements, and pay all expenses for additional area required by him outside of the limits of the rights of way, unless otherwise provided in the specifications or drawings. In the event of delay on the part of the District, its officers, agents or employees in obtaining any such rights of way or easements for the work to be constructed, then the Contractor shall have extended the time for completion of the contract for the period or periods caused by such delay or delays but shall have no claim for damages against the District, its officers, agents or employees.

SECTION 12 PROSECUTION AND PROGRESS OF WORK

12-01 Legal Address of Contractor. Both the address given in the proposal and the Contractor's office in the vicinity of the work are hereby designated as places to either of which drawings, samples, notices, letters or other articles or communications to the Contractor may be mailed or delivered. The delivery at either of these places of any such thing from the District or its agents to the Contractor shall be deemed sufficient service thereof upon the Contractor, and the date of such service shall be the date of such delivery. The address named in the proposal may be changed at any time by notice in writing from the Contractor to the District. Nothing herein contained shall be deemed to preclude or render inoperative the service of any drawing, sample, notice, letter or other article of communication to or upon the Contractor personally.

12-02 Office of Contractor at Site. During the performance of the contract, the Contractor shall maintain suitable office at the site of the work which shall be the headquarters of a representative authorized to receive drawings, instructions, or other communications or articles from the District or its agents; and any such thing given to said representative or delivered at the Contractor's office at the site of the work in his absence shall be deemed to have been given to the Contractor.

12-03 Subletting and Assignment. The Contractor shall give his personal attention to the fulfillment of the contract and shall keep the work under his control. The right of general supervision by the District shall not make the Contractor an agent of the District, and the liability of the Contractor for all damages to persons or to public or private properties, arising from the Contractor's execution of the work shall not be lessened because of such general supervision.

No subcontractor will be recognized as such, and all persons engaged in the work of construction will be considered as employees of the Contractor and their work shall be subject to the provisions of the contract, including specifically these general stipulations, the specifications and the contract drawings. Should any subcontractor fail to perform in a satisfactory manner the work undertaken by him, such subcontract shall be terminated immediately by the Contractor upon notice from the Engineer.

PART C - DISTRICT CONTRACT REQUIREMENTS

The contract may be assigned in whole or in part only upon the written consent of the District Board of Directors.

12-04 Wages of Employees. The District has ascertained the general prevailing rates of wages applicable to the work to be performed under the contract. These are set forth in the notice to bidders, or elsewhere in these specifications. The Contractor shall comply with all provisions of Article 2, Chapter 1, Part 7, Division 2 (commencing with Section 1770) of the Labor Code. It shall be mandatory upon the Contractor and upon any subcontractor under him, to pay not less than the said specified rate to all laborers, workers and mechanics employed by them in the execution of the contract.

12-05 Trench Bracing and Shoring. Where the work to be done under the contract with the District involves an estimated expenditure in excess of twenty-five thousand dollars ($25,000), for the excavation of any trench or trenches five (5) feet or more in depth, the Contractor shall comply with the requirements of Section 6705 of the California Labor Code. This section requires the Contractor to submit to the Engineer a detailed plan showing the design of shoring, bracing, sloping or other provisions to be made by the Contractor for the purpose of worker protection from the hazard of caving ground during the excavation of trenches necessary for the construction of this project. If such plan varies from the shoring system standards established by the Construction Safety Order of the State Division of Industrial Safety, the plans shall be prepared and certified by a Registered Civil or Structural Engineer; however, use of systems that are less effective than those required by the Construction Safety Orders is prohibited.

Nothing in this requirement or within said Section 6705 of the Labor Code shall be construed to impose tort liability on the District, its agents and/or employees.

12-06 Additional or Emergency Protection. Whenever, in the opinion of the Engineer, the Contractor has not taken suffident precautions for the safety of the public or the protection of the works to be constructed under the Contract, or of adjacent structures or property which may be injured by the processes of construction on account of such neglect and whenever, in the opinion of the Engineer, an emergency shall arise and immediate action shall be considered necessary in order to protect public or private, personal or property interests, then and in that event, the Engineer, with or without notice to the Contractor, may provide suitable protection to the said interests by causing such work to be done and such material to be furnished as shall provide such protection as the Engineer may consider necessary and adequate.

The cost and expense of such work and materials so furnished shall be borne by the Contractor and if the same shall not be paid on presentation of the bills therefor, then such costs shall be deducted from any amounts due or to become due the Contractor.

The performance of such emergency work under the direction of the Engineer shall in no way relieve the Contractor from any damages which may occur during or after such precaution has been taken by the Engineer.

12-07 Retention of Imperfect Work. If any portion of the work done or materials furnished under the contract shall prove defective and not in accordance with the specifications and drawings, and if the imperfection in the same shall not be of sufficient magnitude or importance to make the work dangerous or undesirable, or if the removal of such work is impracticable or will create conditions which are dangerous or undesirable,

the Engineer shall have the right and authority to retain such work instead of requiring the imperfect work to be removed and reconstructed, but he shall make such deductions therefor in the payments due or to become due the Contractor as may be just and reasonable.

12-08 Re-examination of Work. Re-examination of any work may be ordered by the Engineer, and, if so ordered, the work must be uncovered by the Contractor. If such work is found to be in accordance with the contract documents, the District shall pay the cost of re-examination and replacement. If such work is not in accordance with the contract documents, the Contractor shall pay such costs.

12-09 Effect of Inspections and Payments. Neither the inspection by the Engineer nor by an inspector, nor any order, measurement, approved modification, certificate, or payment of money, nor acceptance of any part or whole of the work, nor any extension of time, nor any possession by the District or its agents, shall operate as a waiver of any provision of this contract or of any power reserved therein to the District, or any right to damage thereunder; nor shall any breach of the contract be held to be a waiver of any prior or subsequent breach. All remedies shall be taken and construed as cumulative.

12-10 Effect of Extension of Time. The granting of any extension of time on account of delays which in the judgement of the District are avoidable delays shall in no way operate as a waiver on the part of the District of its rights under the contract.

12-11 Progress Schedule and Prices of Delivered Materials. Immediately after execution and delivery of the contract, and before commencing work, the Contractor shall deliver to the Engineer a construction progress schedule in a form satisfactory to the Engineer, showing the proposed dates of commencement and completion of each of the various subdivisions of work required under the contract. The Contractor shall also furnish a complete list of prices of materials delivered to the job site which may be needed for the monthly itemized estimates.

12-12 Time of Completion. Upon written notification to the Contractor by the Engineer, the Contractor shall promptly begin the work under the contract and all portions of the project delineated in the plans and specifications. The work shall be begun and so prosecuted that it shall be completed and ready for full use within the number of working days specified in the Special Provisions, the first day of which shall be the date of the Engineer's "Notice to the Contractor to Proceed".

A "working day" is hereby defined as any day, except Saturdays, Sundays, and legal holidays, and days on which the Contractor is specifically required by the Special Provisions to suspend construction operations, and except days on which the Contractor is prevented by inclement weather or conditions resulting immediately therefrom adverse to the current controlling operation or operations, as determined by the Engineer, from proceeding with at least seventy-five per cent (75%) of the normal labor and equipment force engaged on such operation or operations for at least five (5) hours toward completion of such operation or operations.

PART C - DISTRICT CONTRACT REQUIREMENTS

Determination of each non-working day, except Saturdays, Sundays and legal holidays and days on which the Contractor is specifically required by the Special Provisions to suspend construction operations, shall be made by the Engineer. The Engineer will furnish the Contractor a weekly statement showing the number of working days charged to the Contractor for the proceeding week, the number of working days expended to date, and the number of working days remaining to complete the contract.

12-13 Avoidable Delays. Avoidable delays in the prosecution or completion of the work shall include all delays which might have been avoided by the exercise of care, prudence, foresight, and diligence on the part of the Contractor.

Delays in the prosecution of parts of the work, which may in themselves be unavoidable but do not necessarily prevent or delay the prosecution of other parts of the work nor the completion of the whole work within the time herein specified; reasonable loss of time resulting from the necessity of submitting plans to the Engineer for approval and from the making of surveys, measurements, and inspections; and such interruptions as may occur in the prosecution of the work on account of the reasonable interference of other contractors employed by the District, which do not necessarily prevent the completion of the whole of the work within the time herein specified; will be considered by the District as avoidable delays within the meaning of the contract.

12-14 Unavoidable Delays. Unavoidable delays in the prosecution or completion of the work under the contract shall include all delays which may result, through causes beyond the control of the Contractor and which he could not have provided against by the exercise of care, prudence, foresight, and dilligence. Orders issued by the District changing the amount of work to be done, the quantity of material to be furnished or the manner in which the work is to be prosecuted, and unforeseen delays in the completion of the work of other contractors under the contract with the District will be considered unavoidable delays, so far as they necessarily interfere with the Contractor's completion of the whole of the work.

12-15 Notice of Delays. Whenever the Contractor foresees any delay in the prosecution of the work, and in any event, immediately upon the occurrence of any delay which the Contractor regards as an unavoidable delay, he shall notify the Engineer in writing of the probability of the occurrence of such delay and its cause, in order that the Engineer may take immediate steps to prevent, if possible, the occurrence or continuance of the delay, or, if this cannot be done, may determine whether the delay is to be considered avoidable or unavoidable, how long it continues, and to what extent the prosecution and completion of the work are to be delayed thereby.

After the completion of any part or the whole of the work, the Engineer, in estimating the amount due the Contractor, will assume that any and all delays which have occurred in its prosecution and completion have been avoidable delays except such delays as shall have been called to the attention of the Engineer at the time of their occurrence and found by him to have been unavoidable. The Contractor will make no claim that any delay

not called to the attention of the Engineer at the time of its occurrence has been an unavoidable delay.

12-16 Extension of Time.

A. Avoidable Delays. In case the work called for under the contract is not finished and completed in all parts and requirements within the time specified, including such extra time as may have been allowed for unavoidable delays, the District Board shall have the right to grant a further extension of time to the Contractor, as may seem best to serve the interests of the District in which to complete the contract. During such extension of time, the Contractor shall be charged for engineering and inspection services as provided herein in Paragraph 13-07, but shall not be charged liquidated damages as provided herein in Paragraph 13-08.

B. Unavoidable Delays. For delays which the Engineer considers to be unavoidable, the Contractor shall, pursuant to his application, be allowed an extension of time beyond the time set forth in the Special Provisions, proportional to such delay or delays, in which to complete the contract. During such extension of time, neither extra compensation for engineering and inspection as provided in Paragraph 13-07, nor liquidated damages as provided in Paragraph 13-08, shall be charged to the Contractor.

12-17 Saturday, Sunday, Holiday and Night Work. No work shall be done between the hours of 6:00 P.M. and 7:00 A.M., nor on Saturdays, Sundays, or legal Holidays except such work as is necessary for the proper care and protection of work already performed, or except in case of an emergency, and in any case only with the permission of the Engineer.

It is understood, however, that night or Saturday work may be established as a regular procedure by the Contractor if he first obtains the written permission of the Engineer, and that such permission may be revoked at any time by the Engineer if the Contractor fails to maintain at night or on Saturday adequate force and equipment for reasonable prosecution and to justify inspection of the work.

12-18 Hours of Labor. The Contractor shall forfeit as penalty to the District, twenty-five dollars ($25.00) for each workman employed in the execution of the contract by him or by any subcontractor, for each calendar day during which any workman is required or permitted to labor more than eight (8) hours in any one calendar day and forty (40) hours in any one calendar week, in violation of the provisions of Article 3, Chapter 1, Part 7, Division 2 (commencing with Section 1810) of the Labor Code of the State of California and all amendments thereto.

12-19 (Deleted).

PART C - DISTRICT CONTRACT REQUIREMENTS

12-20 Apprentices. Attention is directed to the provisions in Sections 1777.5 (Chapter 1411, Statutes of 1968) and 1777.6 of the Labor Code concerning the employment of apprentices by the Contractor or any subcontractor under him.

Section 1777.5, as amended, requires the Contractor or subcontractor employing tradesmen in any apprenticeable occupation to apply to the joint apprenticeship committee nearest the site of the public works project and which administers the apprenticeship program in that trade for a certificate of approval. The certificate will also fix the ratio of apprentices to journeymen that will be used in the performance of the contract. The ratio of apprentices to journeyment in such cases shall not be less than one to five except:

A. When unemployment in the area coverage by the joint apprenticeship committee has exceeded an average of 15 percent (15%) in the ninety (90) days prior to the request for certificate, or

B. When the number of apprentices in training in the area exceeds a ratio of one to five, or

C. When the trade can show that it is replacing at least 1/30 of its membership through apprenticeship training on an annual basis statewide or locally, or

D. When the assignment of an apprentice to any work performed under contract with the District would create a condition which would jeopardize his life or the life, safety, or property of fellow employees or the public at large or if the specific task to which the apprentice is to be assigned is of such a nature that training cannot be provided by a journeyman, or

E. When the Contractor provides evidence that he employs registered apprentices on all of his contracts on an annual average of not less than one apprentice to eight journeymen.

The Contractor is required to make contributions to funds established for the administration of apprenticeship programs if he employs registered apprentices or journeymen in any apprenticeable trade on such contracts and if other Contractors on the public works site are making such contributions.

The Contractor and any subcontractor under him shall comply with the requirements of Sections 1777.5 and 1777.6 in the employment of apprentices.

Information relative to apprenticeship standards, wage schedules, and other requirements may be obtained from the Director of Industrial Relations, ex-officio the Administrator of Apprenticeship, San Francisco, California, or from the Division of Apprenticeship Standards and its branch offices.

12-21 Labor Discrimination. Attention is directed to Section 1735 of the Labor Code of the State of California, which reads as follows:

> "No discrimination shall be made in the employment of persons upon public works because of the race, color, national origin or ancestry, or religion of such persons and every contractor for public works violating this section is subject to all the penalties imposed for a violation of this chapter."

PART C - DISTRICT CONTRACT REQUIREMENTS

12-22 Right of Contractor to Stop Work. Under the following conditions, the Contractor shall have the right, if he so desires, to stop the work and terminate the contract upon ten (10) days written notice to the Engineer, and recover from the District payment for all work actually performed and for all satisfactory materials actually delivered to the site of the work for permanent incorporation therein, all as may be shown by the estimate of the Engineer:

A. If the work be stopped under an order of any Court or other competent public authority for a period of three (3) months through no act or fault of the Contractor or of anyone employed by him.

B. If the Engineer fails to issue the monthly certificate for payment in accordance with the terms of this contract.

C. If the District fails to pay the Contractor within sixty (60) days after it shall have become due, as provided by the terms of the contract, any sums certified by the Engineer or awarded by the District.

All provided that if such action to terminate the contract be not instituted by the Contractor within ten (10) days after the alleged existence of such condition and if written notice of such action be not at that time delivered to the District and the Engineer, then such rights shall lapse until another occasion arises according to this section.

12-23 Termination of Contract. If the work provided for under the contract shall be abandoned or if the contract shall be sublet or assigned without the consent of the District or if at any time the Engineer shall be of the opinion that the conditions specified as to the rate of progress are not being fulfilled, or that the work or any part thereof is unnecessarily delayed, or that the Contractor is willfully violating any of the conditions or provisions of the contract, or is executing the same in bad faith, the District shall notify the Contractor to fulfill the conditions of the contract, and should the Contractor fail to begin compliance with said notice within five (5) days the District may, at its discretion, notify the Contractor to discontinue all work under the contract or any part thereof, and thereupon the Contractor shall discontinue work and the District may by Contract, or otherwise, at its discretion, complete the work or such part thereof, and may take possession of the work and use therein such materials, machinery, implements and tools of every description as shall be found upon the work or provide whatever is needed for the completion of the work and charge the expense thereof to the Contractor.

In order to meet the expenses so incurred, the District is hereby authorized by the Contractor to draw a warrant in the name of the Contractor and in favor of those persons, firms, or corporations doing the work or providing the materials or labor therefor, against the fund or appropriation set aside for the purpose of the contract, and when a warrant is so drawn it shall be conclusive upon the Contractor, and shall be in all intents and purposes the same as drawn by the Contractor in person. When any of the said demands have been audited and paid, the amount of the same shall be deducted from the fund or appropriation set aside for the purposes of the contract being so terminated. The Contractor shall immediately,

upon due notice from the Engineer so to do, remove from the premises all materials and personal property belonging to him which have not already been used in the construction of the work, or which are not in place in the work, and he shall forfeit all sums due him under the contract, and both he and his sureties shall be liable on his bond for all damages caused the District by reason of his failure to complete the contract.

Neither the extension of time, for any reason, beyond the date fixed for the completion of this work, nor the doing and acceptance of any part of the work called for by the terms of the contract, subsequent to the said date, shall be deemed to be a waiver by the District of the right to abrogate, annul, or terminate the contract for abandonment or other cause as provided above.

12-24 Temporary Suspension of Work. The Engineer shall have the authority to suspend the work or any part thereof for such period as he may deem necessary, due to unsuitable weather, or such other conditions as are considered to be unfavorable for its prosecution. Such temporary suspension of work will be considered justification for time extensions to the contract in an amount equal to the period of suspension.

In the event a suspension of work is ordered as provided in this section, the Contractor, at his expense, shall do all work necessary to provide a safe, smooth, an unobstructed passageway through the construction area for use by public pedestrian and vehicular traffic, during the period of suspension. Should the Contractor fail to perform the work as specified, the District may perform such work and the cost thereof will be charged against the Contractor and will be deducted from monies due or to become due him under the contract.

SECTION 13 MEASUREMENT AND PAYMENT

13-01 Measurement of Quantities. Measurements of the completed work shall be in accordance with, and by instruments and devices calibrated to, United States Standard Measures, and the units of measurement for payment, and the limits thereof, shall be as shown on the plans or specified in the Special Provisions, or, in the absence thereof, as set forth in these specifications.

In determining quantities, all lengths and areas shall be based on horizontal measurements, unless otherwise specified.

Material paid for by the ton shall be weighed on platform scales furnished by the Contractor, or on public scales at the expense of the Contractor. A ton shall consist of two thousand (2,000) pounds avoirdupois.

When material is to be measured and paid for on a volume basis and it would be impracticable to determine the volume, or when requested by the Contractor in writing and approved by the Engineer in writing, the material will be weighed and converted to volume measurement for payment purposes. Factors for conversion from weight measurement to volume measurement will

be weighed and converted to volume measurement for payment purposes. Factors for conversion from weight measurement to volume measurement will be determined by the Engineer and shall be agreed to by the Contractor before such method of measurement of pay quantities will be adopted.

Full compensation for all expense involved in conforming in the above requirements for measuring and weighing materials shall be considered as included in the unit prices paid for the materials being measured or weighed and no additional allowance will be made therefor.

Quantities of material wasted or disposed of in a manner not called for under the contract; or rejected loads of material, including material rejected after it has been placed by reason of the failure of the Contractor to conform to the provisions of the contract; or material not unloaded from the transporting vehicle; or material placed outside the lines indicated on the plans or given by the Engineer; or material remaining on hand after completion of the work; will not be paid for and such quantities will be deducted from the final total quantities. No compensation will be allowed for hauling rejected material.

13-02 Certification by Engineer. All payments under the contract shall be made upon the presentation of certificates in writing from the Engineer based upon the unit prices set forth in the Contractor's accepted proposal and shall show that the work covered by the payments has been done and the payments are therefor due in accordance with the contract. Certificates of the Engineer as to quantity of work shall be final and conclusive.

13-03 Progress Estimates and Payments. The Engineer shall, within the first ten (10) days of each month, make an estimate of the quantity and value of the materials accepted and work performed prior to the end of the preceeding calendar month.

The first estimate shall be of the value of work done and of materials proposed and suitable for permanent incorporation in the work delivered and suitably and safely stored at the site of the work since the Contractor shall have begun the performance of this contract, and every subsequent estimate, except the final estimate, shall be of the value of the work done and materials delivered and suitably stored at the site of the work since the last preceeding estimate was made; provided, however, that should the Contractor fail to adhere to the program of completion fixed in this contract, the Engineer shall deduct from the next and all subsequent estimates the full calculated accruing amount of the liquidated damages to the date of said estimate, until such time as the compliance with the program has been restored; and provided, further, that no estimate shall be required to be made, when, in the judgement of the Engineer, the total value of the work done and material incorporated into the work under this contract since the last preceeding estimate amounts to less than two thousand dollars ($2,000); and provided, also, that materials so delivered and estimated shall not be removed from the site of the work prior to its completion, without the written consent of the Engineer.

The estimates shall be approved by the Engineer and after approval, the District shall pay or cause to be paid to the Contractor in the manner

provided by law, an amount equal to ninety percent (90%) of the estimated value of the work performed and of the value of materials furnished and delivered and unused, such materials to be those which are proposed and suitable for permanent incorporation in the work.

13-04 Final Estimate and Payment. The Engineer shall, as soon as practicable after the final acceptance of the work done under the contract, make a final estimate of the amount of work done thereunder and the value thereof.

Such final estimate shall be approved by the District, and after approval, the District shall pay or cause to be paid to the Contractor, in the manner provided by law, the entire sum so found to be due hereunder, after deducting therefrom all previous payments and such other lawful amounts as the terms of this contract prescribe.

In no case will final payment be made in less than thirty-five (35) days after the completion of the work and its acceptance by the District.

13-05 Extra Work and Work Omitted. Whenever corrections, alterations, or modifications of the work under the contract are ordered by the Engineer and increase the amount of work to be done, such added work shall be known as extra work, and when such corrections, alterations, or modifications decrease the amount of work to be done, such subtracted work shall be known as work omitted.

When the Contractor considers that any changes ordered involve extra work, he shall immediately notify the Engineer in writing and subsequently keep him informed as to when and where alleged extra work is to be performed and shall make claim for compensation therefor each month not later than the first day of the month following that in which the work claimed to be extra work was performed, and he shall submit a daily complete statement of materials used and expenses incurred on account of extra work performed showing allocation of all materials and expenses.

All such claims shall state the date of the Engineer's written order and the date of approval by the District authorizing the work on account of which claim is made.

Unless such notification is made in writing and unless complete statements of materials used and expenses incurred on account of such alleged extra work are furnished as above required, the Contractor shall not be entitled to payment on account of such alleged extra work and any future claims for compensation for such alleged extra work shall be invalidated.

When changes decrease the amount of work to be done, they shall not constitute a claim for damages on account of anticipated profits on the work that may be terminated.

13-06 Compensation for Extra Work and Work Omitted. Whenever corrections, additions or modifications in the work under the contract change the amount of work to be done or the amount of compensation due the Contractor, and such changes have been ordered in writing by the Engineer

and approved by the District, then a price may be agreed upon, or, failing such an agreement in price, an amount equal to the sum of the following five items shall be used as the full and proper compensation therefor; and such amounts shall be added to or subtracted from, as the case may be, the price fixed by the terms of the contract for the part of the work affected.

A. The necessary reasonable cost to the Contractor of the material required for the work as furnished by the Contractor and delivered by him at the site of the work.

B. The necessary cost to the Contractor of the labor (including foremen devoting their exclusive attention to the work in question), required to incorporate all of said material into the work and to finish the work in accordance with directions.

C. The necessary reasonable cost to the Contractor of equipment used for the work. For the use of equipment owned by the Contractor, the cost thereof shall be based on the current prices prevailing in the locality, which shall have been previously determined and agreed upon in writing by the Engineer and by the Contractor.

D. The cost of Workers' Compensation insurance premiums, State Unemployment and Federal Social Security payments on the labor included in item B above.

E. Fifteen percent (15%) of the sums of items A, B, C, and D, which shall be considered as covering all other expenses and profits, when the extra work is performed by the Contractor's forces. When extra work is performed by a bonified and approved subcontractor, the fifteen percent (15%) mark-up shall be limited to the subcontractor's actual costs, and the Contractor shall be entitled to a mark-up of not more than five percent (5%) on the performing subcontractor's actual costs. No mark-up will be allowed for any intermediary subcontractor between the performing subcontractor and the Contractor.

In order that a proper estimate may be made by the Engineer of the net cost of labor and materials entering into extra work, in accordance with the procedure just stated, the Contractor shall furnish daily an itemized statement of materials and labor supplied, together with the cost of such material and the wages paid, and shall furnish vouchers for quantities and prices of such labor, material, or work. In case the Contractor fails to comply with the above provisions, he shall have no claim for compensation against the District.

This method of determining the price of work shall not apply to the performance of any work which is required or reasonably implied to be performed or furnished under the contract.

13-07 Compensation to the District for Extension of Time. In case the work called for under the contract is not completed within the time limits stipulated in the Special Provisions, the District shall have the right, as provided hereinabove, to extend the time of completion thereof. If the time limit be so extended, the District shall have the right to charge to the Contractor and to deduct from the final payment for the work the actual cost to the District of engineering, inspection, superintendence, and other overhead expenses which accrue during the period of such extension, except that the cost of final surveys and preparation of final estimate and the costs accruing by reason of unavoidable delays shall not be included in such charges.

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13-08 Liquidated Damages for Delay. It is agreed by the parties to the contract that in case all the work called for under the contract in all parts and requirements is not finished or completed within the number of working days as set forth in the Special Provisions, damage will be sustained by the District, and it is and will be impracticable and extremely difficult to ascertain and determine the actual damage which the District will sustain in the event of and by reason of such delay; and it is therefor agreed that the Contractor will pay to the District, unless otherwise provided in the Special Provisions, the sum of fifty dollars ($50.00) per day for each and every calendar day's delay in finishing the work in excess of the number of working days prescribed; and the Contractor agrees to pay such liquidated damages herein provided for, and further agrees that the District may deduct the amount thereof from any monies due or that may become due the Contractor under the contract.

13-09 Copeland (Anti-Kickback) Act. The regulations of the Secretary of Labor applicable to Contractors and Subcontractors (29 CFR, Part 3), made pursuant to the Copeland Act, as amended, (40 U.S.C. 276c) and to aid in the performance of the Anti-Kickback Act (18 U.S.C. 874) are made a part of the contract by reference. The Contractor will comply with these regulations and any amendments or modifications thereof and the Contractor will be responsible for the submission of affidavits required of subcontractors thereunder. The foregoing shall apply except as the Secretary of Labor may specifically provide for reasonable limitations, variations, tolerances, and exemptions.

PART D - GENERAL CONSTRUCTION REQUIREMENTS

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PART D - GENERAL CONSTRUCTION REQUIREMENTS

SECTION 14 CONTROL OF WORK

14-01 Authority of Engineer. All work done under the contract shall be done in a workmanlike manner and shall be performed to the reasonable satisfaction of the Engineer, who shall have general supervision of all work included hereunder. To prevent disputes and litigation, the Engineer shall in all cases determine the amount, quality, acceptability, and fitness of the several kinds of work and materials which are to be paid for under the contract; shall decide all questions relative to the true construction, meaning, and intent of the specifications and drawings; shall decide all questions which may arise relative to the classifications and measurements of quantities and materials and the fulfillment of this contract; and shall have the power to reject or condemn all work or material which does not conform to the terms of the contract. His estimate and decisions in all matters shall be a condition precedent to an appeal to the District Board, or the right of the Contractor to receive, demand, or claim any money or other compensation under the agreement and a condition precedent to any liability on the part of the District to the Contractor on account of the contract.

Should the 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 Engineer may, at his option, make or cause to be made the necessary repairs or replacements or perform the necessary work, and the Contractor shall pay to the District the cost of such work plus fifteen percent (15%) for District administration. Any such action by the Engineer shall not relieve the Contractor and his 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.

14-02 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 Engineer, except by his 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 shall be accessible to the Engineer 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 Engineer, 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 Engineer before any work

involving these plans is performed.

It is expressly understood that approval by the Engineer of the Contractor's working drawings does not relieve the Contractor of any responsibility for accuracy of dimensions and details, or for mutual agreement 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 Engineer 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 Engineer has no objection to the Contractor using, upon his own full responsibility, the plan or method proposed.

14-03 Suggestions to Contractor. Any plan or method for work suggested by the Engineer 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 the Engineer and the District shall assume no responsibility therefor.

14-04 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. 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 Engineer and authorized in writing.

14-05 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 Engineer 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 Engineer and his decision thereon shall be final.

14-06 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 or foreman who shall receive and obey all instructions or orders given by the Engineer, 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.

14-07 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 Engineer, the Contractor shall discharge any person who commits trespass or is, in the opinion of the Engineer, incompetent, unfaithful, intemperate, disorderly, or uses threatening or obusive 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.

14-08 Construction Utilities. The Contractor shall be responsible for providing, for and in behalf of his work under the contract, all necessary utilities, such as special connections to water supply, telephones, power lines, fences, roads, watchmen, suitable storage places, etc.

14-09 Lines and Grades. When the Contractor requires stakes or marks, he shall notify the Job Engineer of his requirements a reasonable length of time 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 Job Engineer shall be carefully preserved by the Contractor. If any such stakes and marks, necessary to complete construction are destroyed or damaged by reason of the Contractor's operation, all costs incurred by the Job Engineer in replacing or restoring such stakes and marks, may be deducted from any monies due or to become due the Contractor.

All lines and grades will be given by the Job Engineer, but the Contractor, without special compensation, shall provide such materials and give such assistance as may be required to fully protect and preserve all the marks given. The Contractor shall keep the Job Engineer informed twenty four (24) hours in advance of the times and places in which he intends to do work in order that the lines and grades may be furnished and necessary measurements made, with the minimum of inconvenience to the Job Engineer or of delay to the Contractor.

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 Engineer.

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 any such discrepancy exists, it must be reported to the Engineer. If such discrepancy is not reported to the Engineer, the Contractor shall be responsible for any error in the finished work.

PART D - GENERAL CONSTRUCTION REQUIREMENTS

14-10 Proof of Compliance With Specifications and Drawings. In order that the Engineer 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 Engineer properly authenticated documents or other satisfactory proofs as to his compliance with such requirements.

14-11 Errors and Omissions. If the Contractor, in the course of the work, finds any 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 Engineer, in writing, and the Engineer shall promptly verify the same. Any work done after such discovery, until authorized, will be done at the Contractor's risk.

14-12 Inspection. The Engineer and his 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 Engineer 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 Engineer's instructions, laws, ordinances, or any public authority require any work to be specifically tested or approved, the Contractor shall give the Engineer timely notice of its readiness for inspection, and if the inspection is by another authority than the Engineer, of the date fixed for such inspection. Inspections by the Engineer shall be promptly made, and where practicable at the sources of supply. If any work should be covered up without approval or consent of the Engineer, it must, if required by the Engineer, 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 Engineer and accepted or estimated for payment.

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

14-13 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 Engineer (see Section 14-23). 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.

PART D - GENERAL CONSTRUCTION REQUIREMENTS

14-14 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., are given in Section 12.

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 hours when the work is not in progress. As provided in Section 17-02, 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 Engineer notice of the time when he will start work or resume work when suspended. Notice 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 Engineer to make the necessary assignment of his 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 Engineer shall determine that the work is not proceeding in accordance with plans and these specifications, or any applicable rules and regulations, the Engineer may order the cessation of further work until the work proceeds in compliance with such requirements. All delays in the work occassioned 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 Engineer, 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 Engineer 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.

14-15 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 and no compensation shall be allowed him for such remedial work, removal or replacement. Any work done beyond the lines and grades shown on the plans or established by the Engineer, 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 expense. Upon failure on the part of the Contractor to comply promptly with any order of the Engineer made under the provisions of this article, the Engineer shall have the authority to cause defective work to be remedied, or removed and replaced, and unauthorized work to be removed and to deduct the costs from any monies due or to become due the Contractor.

14-16 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.

14-17 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.

14-18 Removal or Replacement of Work Done Without Lines, Grades or Levels. Any work done without lines, levels, or grades being given by the Job Engineer or without the supervision of a District Inspector, may be ordered replaced at the Contractor's sole expense, except when such work is specifically authorized by the Engineer.

14-19 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 Engineer 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 Engineer 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.

14-20 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 or efficiency will be effected by any unfavorable conditions shall be constructed while these conditions obtain, unless by special means or precautions approved by the Engineer, the Contractor shall be able to overcome them.

14-21 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 Engineer prior to any encroachment.

PART D - GENERAL CONSTRUCTION REQUIREMENTS

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 Engineer. Unless otherwise provided in the Special Provisions or permitted by the Engineer, 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 by the Contractor to the satisfaction of the Engineer. 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 Engineer.

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.

14-22 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 Engineer; also to make such alterations or deviations, additions to, or omissions from the plans and specifications, as may be determined during the progress of the work to be necessary and advisable for the proper completion thereof. Upon written order of the Engineer, the Contractor shall proceed with the work as increased, decreased or altered.

14-23 Cleaning Up. The Contractor shall confine his apparatus, storage of materials, and construction operations to such limits as may be directed by the Engineer, and shall not allow the site of the work to become litered with trash and waste material, but shall maintain the same in a neat and orderly condition throughout the construction period. The Engineer 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.

14-24 Final Inspection. When the work contemplated by the contract, permit or agreement has been completed, the Engineer 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.

PART D - GENERAL CONSTRUCTION REQUIREMENTS

SECTION 15 CONTROL OF MATERIAL

15-01 Source of Supply and Quality of Materials. Prior to commencement of any work, the Contractor shall submit to the Engineer, a list of the suppliers or sources of all materials to be incorporated in the work. This list shall be approved by the Engineer before any of the materials are delivered to the job site.

Only new materials conforming to the requirements of these specifications and approved by the Engineer shall be used in the work. 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 Engineer 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.

15-02 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 materials 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.

15-03 Drawings, Samples and Tests. As soon as possible after execution of the contract or issuance of the permit, the Contractor shall submit to the Engineer, 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 Engineer 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 Engineer. When requested by the Engineer, 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 Engineer in accordance with recognized standard practice. No material shall be used in the work unless or until it has been approved by the Engineer. Samples will be secured and tested whenever necessary to determine the quality of the material.

15-04 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.

15-05 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.

15-06 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.

15-07 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 Engineer, 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.

15-08 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 Engineer. No rejected material, the defects of which have been subsequently corrected, shall be used until approval in writing has been given by the Engineer. Upon failure on the part of the Contractor to comply promptly with any order of the Engineer made under the provisions of this section, the Engineer 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.

15-09 Trade Names and Alternatives. For convenience and designation on the plans or in the specifications, 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 Engineer.

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 own expense, all information necessary or related thereto as required by the Engineer. The Engineer shall be the sole judge as to the comparative quality and suitability of alternate equipment or articles of materials and his 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.

15-10 Certificates of Compliance. The Engineer 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 Engineer.

15-11 Salvage of Existing Materials. Unless otherwise indicated in the Special Provisions or permitted by the Engineer, all old castings for manholes, rodding inlets, 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, 500 Davidson Street, Novato, California.

SECTION 16 LEGAL RELATIONS AND RESPONSIBILITY

16-01 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, the District Engineer, and all of its and his 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 Engineer in writing.

16-02 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.

16-03 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.

16-04 Public Convenience. 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. Where existing roads are not available for use as detours, 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. Spillage resulting from hauling operations along or across the traveled way shall be removed immediately at the Contractor's expense.

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.

Right is reserved to municipal corporations, county authorities, and to water, gas, telephone, telegraph, 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 but 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 side of the traveled way is ready for use by traffic. The roadbed shall be sprinkled with water, if necessary, to prevent dust nusiance.

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.

Bridges of approved construction shall be installed and maintained across the trench at all cross walks, intersections, and at such other points where, in the opinion of the Engineer, traffic conditions make it advisable.

In order to expedite the passage of public traffic through or around the work and where ordered by the Engineer, the Contractor shall install signs, lights, flares, barricades, and shall furnish a pilot car and driver and other facilities for the sole convenience and direction of public traffic. Also where directed by the Engineer, he shall provide and station competent flagmen whose sole duty shall consist of directing the movement of public traffic through or around the work. See Section 16-05 for flagmen's clothing and equipment.

PART D - GENERAL CONSTRUCTION REQUIREMENTS

In addition to the requirements herein specified for furnishing facilities and flagmen 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 as may be designated by the Engineer.

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 allowances will be made therefor.

16-05 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.

All roads must be kept open for public travel at all times unless specific written permission to close or restrict the use of a particular street is given by the District Engineer and by the Division of Highways or the Public Works Director of Marin County or by the Public Works Director of the City of Novato. 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 flagmen 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. Flagmen and guards while on duty shall be equipped with red wearing apparel and a red flag or paddle-type signal which shall be kept clean and in good repair. Signs, flags, lights, and other warning and safety devices shall conform to the requirements set forth in the current "Manual of Warning Signs, Lights, and Other Devices For Use in Performance of Work Upon Highways", issued by the State Department of Public Works.

Should the Contractor appear to be neglectful or negligent in furnishing warning and protective measures, the Engineer 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 Engineer 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 applicances 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.

16-06 Use of Explosives. When the use of explosives is necessary for the prosecution of the sewer 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.

16-07 Preservation of Property. Attention is directed to Section 17 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.

Trees and shrubbery adjacent to the sewer trench, pole lines, fences, signs, survey markers and monuments, buildings and structures, conduits, pipe lines under or above ground, sewer and water lines, all highway facilities and any other improvements or facilities within or adjacent to the sewer work shall be protected from injury or damage, and if ordered by the Engineer, the Contractor shall provide and install suitable safeguards, approved by the Engineer, to protect such objects from injury or damage. The Contractor shall not remove trees or shrubs adjacent to the sewer trench line without authorization from the Engineer. Serious injuries to trees shall be avoided. No major roots or branches crossing the trench shall be cut if, in the opinion of the Engineer, such cutting would seriously injure or imperil the safety of the tree or trench. All limbs, roots or branches which are cut or broken shall be trimmed and painted with the proper seal. If any object is injured or damaged by reason of the Contractor's operations, it shall be replaced or restored, at the Contractor's expense, to a condition equal to its condition at the time the Contractor entered upon the work, or to a condition as required by the specifications accompanying the contract, if any such objects are a part of the work being performed under the contract.

PART D - GENERAL CONSTRUCTION REQUIREMENTS

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 strengthen such roads and structures, where necessary. The Contractor will be held responsible for any and all injury or damage to such roads and structures caused by reason of his operations.

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 prices paid for the various contract items of work and no additional compensation will be allowed therefor.

16-08 Responsibility for Damage. The District or any of its officers or employees, or the Engineer shall not be answerable or accountable in any manner, for any loss or damage that may happen to the work or any part thereof; or for any of the materials or other things used or employed in performing the work; or for injury to any person or persons either workmen or the public; for damage to property from any cause which might have been prevented by the Contractor, or his workmen, or anyone employed by him; against all of which injuries or damages to persons and property the Contractor having control over such work must properly guard. The Contractor shall be responsible for any liability imposed by law upon the District, its officers, employees, or the Engineer 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 contract 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, its officers and employees and Engineer 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 disposition has been made of such suits or claims for damages aforesaid.

The Contractor shall be responsible for any liability imposed by law or for any damage to any person or property and shall indemnify, defend, and save harmless any county, city or district, its officers and employees connected with the work, within the limits of which county, city or district the work is being performed hereunder, all in the same manner and to the same extent as provided above for the protection of the District, its officers and employees, and the Engineer, except that no retention of money due the Contractor under and by virute of the contract will be made by the District pending disposition of suits or claims for damages brought against the said county, city or district.

16-09 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 an orderly condition throughout the construction period.

16-10 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; and 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 Engineer.

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 time.

16-11 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 the Federal Government or the public enemy.

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 Engineer. Where necessary to protect the work from damage, the Contractor shall, at his own expense, provide suitable drainage and erect temporary structures.

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

16-12 Acceptance of Work. When the Engineer has made the final inspection as provided in Section 14-24, 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. In the case of work done under District permit, approved "as-built" drawings as required under Section 6-04 shall be submitted prior to acceptance of the work by the District.

16-13 Guaranty of Work. Unless more stringent requirements are otherwise specified in the Special Provisions (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.

16-14 Personal Liability. Neither the District Board, the 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.

PART D - GENERAL CONSTRUCTION REQUIREMENTS

16-15 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 Job Engineer 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 Job Engineer 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.

16-16 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 Engineer, 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.

SECTION 17 - UTILITIES, OBSTRUCTIONS AND CONCRETE REMOVAL

17-01 Preservation of Property. Attention is directed to Sections 16-07 and 16-08, "Preservation of Property", and "Responsibility for Damage" 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.

17-02 Utility Facilities. A particular effort has been made to locate and indicate on the plans all aboveground and/or underground utilities and/or other facilities which may conflict with, cross or lie close to the work. While the locations shown are believed to be reasonably correct, neither the Job Engineer nor the District can guarantee the accuracy or adequacy of this information.

The Contractor shall, before proceeding with the work, confer with all agencies and utilities which have or may have aboveground and/or underground facilities in the vicinity of the work. The purpose of the conference shall be to notify said agencies and utilities of the proposed construction schedule and to locate and/or verify the locations of all facilities, including house connections in the area of the work. 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 other 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 25-02), unless otherwise approved by the Engineer.

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.

17-03 Removal of Obstructions. The Contractor shall remove, or cause to be removed, at his expense, 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 Engineer first being obtained, and suitable mutually agreeable arrangements made by the Contractor and the Engineer for the replacement of such improvements. In addition, a permit from the City 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 Engineer, 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 Engineer. 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 14-20, "Easement Construction", for additional requirements for removal and replacement of obstructions within easements.

Tree limbs overhanging the line of the work and in danger of being damaged by the Contractor's operations shall be trimmed and sealed by the Contractor in accordance with recognized standards for such work. The Contractor shall also remove other tree limbs under the direction of the Engineer, so that the tree will present a balanced appearance. 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.

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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 Engineer.

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

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 compensation will be allowed therefor.

17-04 Treatment of Tree Roots. No tree root shall be unnecessarily cut in excavating or trenching operations. Major roots encountered in the course of excavation shall be exposed but not severed, and they shall be wrapped in burlap as a protective measure while exposed. All other roots (1" in diameter and larger) that are severed in the course of excavation shall be neatly trimmed at the edge of the excavation or trench and shall be painted with a heavy coat of an approved tree seal as directed by the Engineer.

17-05 Removal of Concrete or Masonry Construction. At locations described in the Special Provisions, or shown on the plans or where directed by the Engineer, portions of existing concrete pavement, curbs, gutters, sidewalks, foundations, and other concrete or mortared structures shall be removed to the lines and elevations specified or shown on the plans or ordered by the Engineer. In addition, all concrete structures or objects not shown or noted on 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 at his expense.

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 19-04C). 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 Engineer. 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 Engineer, 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 Engineer.

PART D - GENERAL CONSTRUCTION REQUIREMENTS

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 compensation will be allowed therefor.

17-06 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. Unless otherwise specified in the Special Provisions, the Contractor shall obtain and pay for all necessary permits, licenses, bonds, and fees required for the crossing and give all notices necessary and incident to the work.

SECTION 18 - REFERENCE TO STATE STANDARD SPECIFICATIONS

All work shall be done in conformance with applicable provisions of the latest edition of the Standard Specifications of the State of California, Department of Public Works, Division of Highways, except as modified in these Standard Specifications and in the Special Provisions. Where the terms "State" or "Engineer" are used in the State Standard Specifications, they shall be considered as meaning the "District" or "Engineer" as defined herein. In case of a conflict between these specifications and the State Standard Specifications, these specifications will apply.

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SECTION 19 EARTHWORK

19-01 Description. Earthwork shall consist of performing all operations necessary to excavate earth, rock and/or other materials from the trench or adjacent thereto when shown on the plans or ordered by the Engineer; to excavate all material, of whatever nature, necessary for the construction of foundations for structures, sewers, and drainage facilities; to construct embankments; to place backfill around structures, sewers, and drainage facilities, and over sewers, culverts, and drainage pipes; to backfill ditches, holes, pits and other depressions within the work area; to construct temporary and permanent trench surfacing; to remove unsuitable material and replace with suitable material; to construct earth protection dikes.

Whenever a relative compaction requirement or sand equivalent value is specified under this section, or in the Special Provisions in connection with earthwork, the tests shall be made in accordance with the test methods in use by the laboratory of the State Division of Highways.

19-02 Trench Excavation and Backfill.

A. Excavation - Trench excavation shall include the removal of all materials or obstructions of any nature, the installation and removal of all sheeting and bracing, and the control of water necessary to construct the work as shown on the plans. Excavation for sewers shall be made only after pipe and other necessary materials are delivered on the site of the work. After such delivery, trench excavation shall proceed as rapidly as possible and the pipe installed and the trench backfilled without undue delay. The Engineer shall have the authority to limit the amount of trench to be opened or left open at any one time. In public street areas, excavation and pipe laying shall be coordinated to the end that a minimum of interference with public traffic will result.

In public street areas, excavation and pipe laying shall be coordinated so that the trench at the end of each day shall not be excavated for more than 100 feet in advance of pipe laying, nor left unfilled for more than 100 feet where the pipe has been laid. For periods of work suspension over two (2) days, trenches shall be either completely backfilled, barricaded, or fenced, as directed by the Engineer.

Where trenching occurs in paved areas, the pavement shall be blade cut or scored and broken ahead of the trenching operations, and shall be saw cut (using a concrete saw) to a neat edge after backfilling and prior to paving. The proper tools and equipment shall be used in marking and breaking so that the pavement will be cut accurately and on neat lines parallel to the trench. Any pavement damaged outside these lines shall be re-cut and restored at the expense of the Contractor.

Trenching may be accomplished by use of trenching machines, except where their use will result in damage to existing facilities. Trenching for all pipes shall, unless otherwise specified, be open cut to the lines and grades shown on the plans except those sections specifically indicated on the plans or designated by the Engineer to be tunneled to protect existing trees or structures.

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Trenches shall be excavated at least three (3) inches below the barrel of the pipe to be installed and the bottom refilled with approved bedding material (see Section 20-03A).

Attention is directed to Section 17-04, "Treatment of Tree Roots", for requirements in connection with tree roots encountered during excavation operations.

Permits for blasting shall be secured by the Contractor from the proper authorities. Excessive blasting will not be permitted and any material outside the authorized cross section which may be shattered or loosened by blasting shall be removed at the Contractor's expense. The Engineer shall have authority to require the Contractor to discontinue any method of blasting which leads to overshooting or is dangerous to the public or destructive to property or to natural features. The hours of blasting shall be approved by the Engineer. The cost of any necessary drilling and blasting shall be considered as included in the price paid per linear foot of sewer installed and no additional allowance will be made therefor.

B. Trench Width - The maximum allowable width of trench measured at the top of the pipe shall be the outside diameter of the pipe exclusive of bells and collars, plus eighteen (18) inches. The minimum allowable width of trench shall be the outside pipe diameter plus twelve (12) inches. Where shoring is required, the width of the trench shall be increased only by the thickness of the sheathing.

Trenches shall be excavated with full depth vertical sides where possible. Minimum vertical trench shall be from pipe flowline to a point two (2) feet above the top of pipe. Whenever the maximum allowable trench width is exceeded for any reason, the Contractor will be required, at his expense, to install special pipe, and/or concrete encasement, and/or special backfill as directed by the Engineer.

C. Trench Bracing - Excavations shall be adequately shored and braced so that the earth will not slide, move or settle and so that all existing improvements of any kind will be fully protected from damage. Attention is directed to the "Trench Construction Safety Orders" of the California State Industrial Accident Commission which the Contractor is required by law to obey, and which are adopted by reference as part of these specifications. For District contract work involving an estimated expenditure in excess of twenty-five thousand dollars ($25,000) for the excavation of any trench or trenches, see Section 12-05 of these specifications for additional requirements.

The Contractor shall furnish, install, and maintain such sheet piling, timbering, lagging, and bracing, as necessary to support the sides of the trench. The protection of adjacent structures from movement of the ground and the elimination of the element of danger to life, property, or to existing improvements is the intent of this requirement. Additional supports requested by the Engineer shall in no way relieve the Contractor of his responsibility for the sufficiency of his precautions.

All such piling, timbering, lagging, and bracing shall, unless otherwise required by the Engineer, be removed during backfilling in such a manner

as to prevent any movement to the ground or damage to the piping or other structures. When the Engineer requires that sheet piling, lagging, and bracing shall be left in place, such materials shall be cut off where designated and the upper part withdrawn.

Material in a natural position outside the planned excavation slopes, which is unstable in the opinion of the Engineer and constitutes a potential slide, and material which has already come into the excavation, shall be removed to the lines designated by the Engineer.

D. Control of Water - The Contractor shall remove all water which may accumulate in the excavation during the progress of the work so that all work can be done in a dry trench. Trenches or other excavations shall be kept free from water while the pipe or structures are being installed, while concrete is setting, and until backfill has progressed to a sufficient height to anchor the work against possible flotation or leakage. Water shall be disposed of in such a manner as to cause no injury to public or private property or be a menance to the public health. The Contractor shall at all times have on hand sufficient pumping equipment and machinery in good working condition for all ordinary emergencies and shall have available at all times competent mechanics for the operation of all pumping equipment.

E. Disposal of Excess Excavated Material - Excavated material to be used for backfill shall be laid along side of the trench and kept trimmed up so as to cause as little inconvenience as possible to public travel and the normal use of adjacent properties. Free access must be provided to all fire hydrants, water gates, meters, and private drives. Gutters or other drainage ways shall be kept clear unless other provisions are made for handling drainage.

All material excavated in streets, roadways, and rights of way, which is determined unsuitable for use as backfill or in excess of the amount required for backfilling, shall be removed immediately and disposed of in a manner satisfactory to the Engineer.

F. Unsuitable Material - In advance of placing sewer pipe, existing material within the area where such pipe is to be placed, which in the opinion of the Engineer is unsuitable as a foundation for the pipe, including but not limited to vegetable matter, garbage, and junk piles, either on the surface or buried, shall be removed and disposed of in accordance with the provisions of these specifications.

In rock excavation or a mixture of rock and earth excavation, such material shall be loosened and broken up for the full width of the trench so that no ribs, rocks, or solid projections will be within six (6) inches of the sewer pipe. The material thus broken up shall be removed and disposed

of and the resulting space refilled with approved bedding material.

When unsuitable material is removed and disposed of and the resulting space refilled with approved material as specified, the approved material shall be placed and compacted in layers in accordance with the applicable requirements hereinafter specified.

G. Pipe Bedding - All sewers shall be bedded in an approved bedding materail from a level twelve (12) inches above the barrel of the pipe to a point three (3) inches below the barrel of the pipe (see Standard Drawing SD 16). The bedding material shall be placed uniformly on each side of the pipe to prevent displacement. All bedding materials shall be compacted to a minimum of ninety percent (90%) relative compaction, and materials shall be carefully handled to prevent intrusion of foreign materials.

Bedding material for main and lateral sewers shall be an approved gravel, sand, or rock material, free from vegetable matter and other deleterious substances, graded so that it will compact readily to form a firm, stable base when compacted. It shall have a minimum sand equivalent value of thirty (30), and particle size and gradation shall fall within the following approximate limits.

Sieve Size	Percentage Passing Sieve
1 - inch	100
No. 4	50 - 70
No. 200	15 maximum

Unless otherwise specified by the Engineer, bedding material for building sewers shall be select material excavated from the trench, clear of any organic matter, and free from large clods or rocks. If trench excavated material is determined to be unsuitable for bedding by the Engineer, a bedding material similar to that specified above for main and lateral sewers shall be used.

H. Intermediate Backfill - Intermediate backfill is considered to be all material placed in the trench between the pipe bedding and the trench surfacing replacement. Intermediate backfill in public streets and highways shall conform to the requirements of the agency maintaining such streets and highways (i.e. the City, County or State Division of Highways, etc.), but in no case will the requirements be less than those specified herein. All backfill materials shall be placed and consolidated in such a manner as to permanently prevent damage to the sewer, roadbed, road surfacing, and private property, or inconvenience to the public.

In the case of sewer work done under permit within new subdivisions, the installation and compaction of intermediate backfill shall be in accordance with the recommendations and specifications of the Developer's Soils Engineer, as approved by the District Engineer. If, for some reason, a soils report is not prepared which makes such recommendations and specifications, the minimum trench backfill requirements shall be those specified herein.

1. Material - Intermediate backfill material shall consist of any imported or trench excavated material, free from vegetable matter and other deleterious substances, and shall contain no concrete, stones or clods larger than four (4) inches in diameter. The backfill material shall contain sufficient fines so

that all voids will be filled when compacted, and shall be so constituted that the compaction requirements specified herein can be met.

2. Compaction - All intermediate backfill shall be compacted in such a manner as to obtain ninety percent (90%) relative compaction. Backfill material shall be placed in layers not exceeding eight (8) inches in loose depth and thoroughly compacted by tamping, rolling or otherwise to obtain the specified compaction.

Compaction of intermediate backfill below the top three (3) feet may be obtained by jetting when this method has been specifically approved by the Engineer and, if within a street or highway area, by the agency maintaining such street or highway. In any event, jetting may only be used if the trench excavated material is sandy or granular and of such character that it will be self-draining when compacted, or if the Contractor elects to import sandy or granular material of such character, and when the Engineer determines that the adjacent ground and any adjacent foundation material will not soften or be otherwise damaged by the applied water and no damage from hydrostatic pressure will result to any nearby structure. When permitted, jetting shall be accomplished by introducing water into the backfill by means of a jet pipe. The jet pipe shall not be less than 1-1/2 inches in diameter and shall be of sufficient length to reach at least one (1) foot below the layer of backfill being compacted. The source of water for jetting shall be a pressure hydrant or a water tank with a minimum pressure of forty (40) pounds per square inch. All "bridges" in a backfill shall be completely broken down during the jetting process. Proceeding upgrade, jetting shall be accomplished by rapidly lowering and slowly raising the outlet end of the jet pipe through the entire depth of the layer being compacted at staggered points along the trench as necessary to insure that the backfill takes full possible subsidence while water is being introduced into it through the jet pipe. When this method of consolidation is to be used, the backfill shall be placed in lifts or steps not exceeding three (3) feet in height and then jetted prior to placement of each succeeding lift. When necessary, the above jetting method shall be supplemented by the use of vibratory or other compaction equipment in order to obtain the required compaction. Jetting of the upper three (3) feet below finished grade will not be permitted.

If and when rounded or open-graded aggregates, such as pea gravel, are permitted and used for intermediate backfill, and determination of relative compaction is therefor impracticable, the backfill material shall be placed in lifts not exceeding one and one-half (1 - 1/2) feet in height, and each lift shall be vibrated with a concrete vibrator, or by other means acceptable to the Engineer, prior to the placement of additional lifts.

I. Measurement and Payment - Unless otherwise provided in the bid proposal and/or the Special Provisions, full compensation for performing all work and furnishing all materials to complete the trench excavation and backfill, including surfacing removal and replacement, trenching, tunneling, replacement of unsuitable or slide material, blas shoring, disposal of excavated material, backfilling, and compaction shall be considered as included in the prices paid for the various contract items of work in place and no additional compensation will be allowed therefor.

PART E - TECHNICAL CONSTRUCTION REQUIREMENTS

19-03 Temporary Paving. Temporary paving shall consist of a minimum one (1) inch layer of premixed asphalt paving ("cutback"). Unless otherwise permitted by the Engineer, temporary paving shall be placed over all trenches to receive Type D permanent surfacing replacement (see Section 19-04) within twenty-four (24) hours after backfilling, and the required base shall be installed and compacted prior to placing temporary paving. The temporary paving shall be maintained level with adjacent pavement in a safe and usable condition until permanent paving is installed. The Engineer may also require that temporary paving be placed at locations where necessary to accommodate traffic.

19-04 Permanent Surfacing Replacement. All areas in which the surface is removed, broken or damaged, or in which the ground has caved in or settled due to the installation of the improvements, shall be resurfaced and brought to the original grade and crown section by the Contractor.

Unless otherwise permitted by the Engineer, in those instances where temporary paving is required as provided in Section 19-03, the final trench pavement shall be installed no sooner than twenty (20) calendar days and no later than forty (40) calendar days after backfilling. For all other types of permanent surfacing replacement specified below, the final trench pavement shall be completed no later than five (5) working days after backfilling.

A. Public Streets - Permanent surfacing replacement in public streets and highways shall conform to the requirements of the agency maintaining such streets and highways, but in no case shall the replacement consist of less than that specified herein. Surfacing replacement within public streets or highways shall conform to one of Types A through F as shown in the Standard Drawings. Unless otherwise indicated on the plans or in the Special Provisions, the type of surface replacement shall be as follows:

Description of Area to be Surfaced	Type (See Std. Drawings)
Within existing paved areas of public streets (asphaltic pavement over untreated base material)	D
Within existing paved areas of public streets (asphaltic pavement over concrete base, and/or cement-treated base, and/or lime-treated base)	
-- Transverse trenches	E
-- Longitudinal trenches	F
Within public street right of way but outside existing paved areas	B

PART E - TECHNICAL CONSTRUCTION REQUIREMENTS

B. Areas Other than Public Streets - Paved or surfaced areas other than public streets shall be restored by replacement of identical pavement and base when practicable. Portland cement concrete pavement shall be replaced in kind, and color shall be matched. Asphaltic pavements shall be replaced with an equal or greater thickness of Asphalt Concrete Surfacing, but in no case will less than two (2) inches be applied over trench areas. Base material will be replaced with a minimum of eight (8) inches of Aggregate Base.

Trenches in unpaved areas of private streets shall be surfaced with a minimum of eight (8) inches of Aggregate Base.

Trenches in unimproved areas within easements shall be backfilled to finished grade with intermediate backfill (see Type A surface replacement in Standard Drawings), except that all trenches in landscaped or cultivated areas shall have the top twelve (12) inches backfilled with top soil.

C. Concrete Surfaces - All concrete curbs, gutters, aprons, patios, driveways and sidewalks which are broken, cracked or damaged by the installation of the improvements shall be reconstructed by and at the expense of the Contractor, of the same kind of material and of the same dimensions as the original work, with the minimum requirements that the concrete shall be Class A and the minimum thickness for concrete slabs, etc., shall be four (4) inches. 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. All work shall match the appearance of the existing improvements as nearly as practicable. Lamp black or other pigments may be added to the concrete to obtain the necessary result.

D. Landscaped or Cultivated Areas - All trenches in landscaped or cultivated areas shall have the top twelve (12) inches backfilled with top soil. The top soil shall consist of fertile, friable soil of loamy character conforming to the requirements of Section 20-2.01 of the State Standard Specifications. Where practicable the Contractor may use top soil taken from the excavation. After installation, the top soil and any adjacent unimproved land which has been compacted by the operations of the Contractor shall be thoroughly scarified and the surface cleared of all large clods, stones or debris.

19-05 Bores, Tunnels and Encasement Pipe. For sewer lines within or crossing utility, railroad or highway rights of way requiring tunnels, bores, encasement pipe, and/or special sewer pipe, the encasement pipe and/or special sewer pipe shall extend the entire length of the sewer within the particular right of way, unless otherwise approved by the Engineer.

A. Bores - Where an encasement pipe or sewer pipe is installed in a bored hole, whether wet or dry, the hole shall be bored by use of a machine which will cut a true circular bore to the required line and grade. Bored tunnels shall be no more than two (2) inches larger in diameter than the maximum outside diameter of the encasement pipe or sewer pipe to be placed therein. Main or side sewer pipes installed in tunnels or bores without encasement pipes shall be cast iron (Class 23 or better), unless otherwise specified in the Special Provisions or directed by the Engineer.

After the main or side sewer pipe is secured in place, the space around the pipe shall be completely filled with sand or grout as directed by the Engineer.

B. Tunnels - Where tunnels without encasement pipes are required or permitted, they may be drilled with approved equipment which will cut a true circle on grade to a diameter not greater than two (2) inches larger than the greatest diameter of the sewer pipe, or they may be excavated by standard tunnel methods using shoring, lagging, and adequate support, where necessary.

C. Encasement Pipe - When designated on the plans, permit, or by the Engineer in writing, approved encasement pipe shall be placed in a bored hole under the area to be crossed. The encasement pipe shall be corrugated or plain metal and shall be of the length, diameter and thickness specified on the plans or in the Special Provisions and shall be thoroughly galvanized, free from cracks and imperfections and asphalt dipped. Galvanizing shall consist of not less than two (2) ounces of prime zinc spelter per square foot (2 surfaces), uniformly distributed over the sheets. Corrugated metal pipe shall conform to the requirements of AASHO-M36 for galvanized corrugated metal pipe. Plain metal pipe shall conform to the requirements of AWWA C201 or AWWA C202 for steel water pipe, butt welded. Corrugated and plain metal encasement pipes shall conform to the thickness given in the following table:

Protective Casings

Inside Diameter inches	Corrugated Metal gage	Smooth Steel Thickness inches
18	14	1/4
21	12	1/4
24	12	1/4
30	10	5/16
36	10	5/16
48	8	not
54	8	per-
60	8	mitted

The encasement pipe shall be installed by jacking or tunneling in such a manner as not to interfere with the utility, railroad track, street or highway being crossed. Sufficient jacking capacity shall be provided in advance to insure successful completion of the operation. Guide rails shall be accurately set to the line and grade so that the pipe, while being jacked, will be guided along the prescribed line and grade. A rigid backstop shall be erected to withstand the full thrust of the jacks during the process of installing the pipe. Jacks and bearing frame with necessary blocking shall be provided of sufficient strength and number to propel the pipe forward as excavation progresses ahead of the forward end of the pipe.

If the encasement pipe is installed by tunneling, the space around the casing shall be completely filled with clean sand or grout as directed by the Engineer.

After the casing has been installed, two (2) redwood skids of appropriate cross-sectional dimensions, running the full length of each pipe section, shall be strapped securely to each section of sewer pipe and each section shall then be pushed or pulled into the encasement pipe after jointing. Extra care shall be taken to insure proper pipe jointing since a misplaced rubber joint ring would be extremely difficult to correct once the pipe has entered the casing. Appropriately sized redwood blocks shall also be secured at suitable intervals to each piece of sewer pipe to prevent the possibility of the pipe floating within the casing. Exact details of installation, including all redwood skid and block sizing and spacing shall be submitted by the Contractor for specific approval of the District Engineer well in advance of starting this work.

After the pipeline has been cleaned and tested in accordance with Section 20-04, the space between the pipe and the casing, at both ends of the casing, shall be plugged with brick and mortar in accordance with accepted construction practices. Unless otherwise indicated on the plans or in the Special Provisions, the space between the sewer pipe and encasement pipe shall be filled with sand or grout, as directed by the District Engineer.

D. Measurement and Payment - Tunnels, bore sections and encasement pipes as shown on the plans and as specified herein shall be measured horizontally.

Full compensation for all boring or tunneling work required to install a sewer pipe without an encasement pipe shall be considered as included in the prices paid for the sewer pipe being installed and no additional compensation will be allowed therefor.

When included in the bid proposal, the price per linear foot of encasement pipe shall include all excavation, jacking, boring, tunneling, casing pipe, encased sewer pipe, concrete, grouting, sand fill, trench backfill, surfacing replacement, and all labor, materials and equipment necessary to produce a complete and finished job in accordance with the plans and specifications.

When the bid proposal does not include a contract pay item for encasement pipe, full compensation for all work involved shall be considered as included in the prices paid for the sewer pipe being installed and no additional compensation will be allowed therefor.

19-06 Structure Excavation and Backfill. Structure excavation shall consist of the removal, to the lines designated on the plans or specified or ordered by the Engineer, of all material of whatever nature necessary for the construction of foundations and other structures; and other excavations specifically designated on the plans or in these specifications or in the Special Provisions as structure excavation.

Structure backfill shall consist of placing and compacting, to the lines designated on the plans or specified or ordered by the Engineer, backfill material around structures; and other backfill specifically designated on the plans or in these specifications or in the Special Provisions as structure backfill.

PART E - TECHNICAL CONSTRUCTION REQUIREMENTS

Structure excavation and backfill shall include the furnishing of all equipment and the construction or installation of all cofferdams and other facilities which may be necessary to perform the excavations and place and compact the backfill, and the subsequent removal of such facilities except where they are required or permitted by the plans or specifications to remain in place.

A. Excavation - All excavation for structures shall be done to the dimensions and levels indicated on the plans or specified herein. Excavation shall be made to such width outside the lines of the structure as may be required for proper working methods, the erection of forms, and the protection of the work. Care shall be taken to preserve the foundation surfaces shown on the plans in an undisturbed condition. If the Contractor excavates or disturbs the foundation surfaces shown on the plans or specified herein without written authorization of the Engineer, he shall replace such foundations with compacted, approved gravel foundation fill or other material approved by the Engineer in a manner which will show by test an equal bearing quality with the undisturbed foundation material.

The Contractor shall, where necessary, protect excavations from caving by installing suitable shoring. Any damage resulting from the failure to provide shoring or similar protective measures shall be repaired by the Contractor at his own expense. All shoring shall be removed prior to the placing of concrete and/or backfill material, unless otherwise specifically authorized by the Engineer.

The excavation shall be kept free of water while construction work is in progress and any water encountered during the process of excavation shall be controlled to the satisfaction of the Engineer.

The Contractor shall notify the Engineer when excavation for a structure is complete and no forms, reinforcing steel, concrete, pipe, or backfill material shall be placed until the excavation has been approved by the Engineer.

PART E - TECHNICAL CONSTRUCTION REQUIREMENTS

B. Use of Explosives - If the use of explosives is necessary for the prosecution of the work, the Contractor shall use the utmost care not to endanger life or property. Whenever directed, the number and size of the charges shall be reduced. All explosives shall be stored in accordance with the provisions of Division XI of the Health and Safety Code of the State of California. Attention is directed to any local ordinances or regulations and permits involving the use and storage of explosives. It shall be the sole responsibility of the Contractor to secure any required permits for the use and storage of explosives.

Blasting mats shall be used at all times in areas where flying rock might damage any building or other installation. All traffic shall be stopped at a safe distance from any blasting operation and all persons shall be removed from the area prior to blasting.

All blasting operations shall be under the direct supervision of a single responsible individual designated by the Contractor to the Engineer as the "Powder Foreman".

The priming of all explosive charges shall be with electric detonators of sufficient size as to assure efficient and complete detonation of the explosive charge. All charges consisting of more than one hole shall be wired as either series or series-parallel. Straight parallel hookups will not be permitted. The Contractor shall provide a source of power adequate for detonation of the explosive charges consistent with the accepted standard practices involving electric detonation of explosives.

Excessive blasting will not be permitted and the Engineer shall have the authority to require the Contractor to discontinue any method of blasting

which leads to overshooting or is dangerous to the public or destructive to property or to natural features. Any material outside the authorized cross section which may be shattered or loosened because of blasting shall be removed and replaced at the Contractor's expense. Particular care shall be exercised by the Contractor to prevent damage to adjacent pipe lines, structures, or other improvements, and any damage so caused shall be repaired at the Contractor's expense to the satisfaction of the Engineer.

C. Cofferdams - Cofferdams for foundation construction shall be carried well below the bottom of the footings and shall be well braced and as water tight as practicable. The interior dimensions of cofferdams shall be such as to provide sufficient clearance for construction forms and, when no seal is placed, to permit pumping outside the forms.

In the judgement of the Contractor, if the clearance provided on the plans between the outside of the footing and any pile or interior wall or surface is not sufficient to permit the expenditious driving of piles or building of forms, he may provide such necessary clearances by constructing the cofferdams sufficiently large to provide such clearance as he may deem necessary. It shall be considered and is agreed that any such enlargement in excess of the outside dimensions of the footing as designed is for the sole purpose of expediting the work of the Contractor and quantities of such excavation and backfill will not be included in the quantities to be paid for.

Cofferdams which are tilted or moved out of position by any cause whatsoever during the process of sinking, shall be righted or enlarged so as to provide the necessary clearance and proper location and such work shall be at the sole expense of the Contractor.

In tidal waters or in streams at a time of probable flood, cofferdam walls shall be vented at low water elevation to insure full hydrostatic head both inside and outside of the cofferdam during the period of pouring and setting of seals.

No shoring will be permitted in cofferdams which will induce stress, shock, or vibration in the permanent structure.

When permitted by the Engineer, cross struts or bracing may extend through foundation concrete. Such struts or bracing below low water will be permitted to remain in place. Struts or bracing above low water shall be removed and the volume displaced filled with concrete of the same mix as that specified for the surrounding concrete.

For substructure work, the Contractor shall submit drawings showing his proposed method of cofferdam construction and other details left open to his choice or not fully shown on the plans. The type and clearance of cofferdams, insofar as such details affect the character of the finished work, will be subject to the approval of the Engineer, but the other details of design will be left to the Contractor, who will be responsible for the successful construction of the work.

After the completion of the substructure, the cofferdams with all sheeting and bracing shall be removed to the level of the stream bed, or ground

water table, by the Contractor, at his own expense, and such removal shall be performed in such a manner as not to disturb or mar the finished concrete or masonry.

D. Foundation Treatment - When footing concrete or masonry is to rest upon rock, the rock shall be fully uncovered and the surface thereof shall be removed to a depth sufficient to expose sound rock. The rock shall be roughly leveled off or cut to approximate horizontal and vertical steps, and shall be roughened. The over cut of the rock shall be filled with concrete as a part of the structure, or, upon specific approval of the Engineer, may be filled with compacted sand or gravel.

When piles are to be used, the Contractor, at his own expense, will be permitted to excavate a sufficient distance below the bottom of the footing as shown on the plans to take care of swell due to driving piles. After the piles are driven, if it is found that the ground has risen above the planned grade, the Contractor shall remove such surplus material at his own expense. After the piles are driven, if it is found that the surface of the ground is below the planned grade, the Contractor shall backfill, at his own expense, to the planned grade with material approved by the Engineer.

E. Disposal of Excess Excavated Material - All materials to be removed during the course of excavation in excess of that needed for backfill, or deemed by the Engineer as being unsuitable for backfill, shall be hauled off the job site by the Contractor and disposed of at his expense.

F. Inspection - In order to determine the character of the foundation material, the Contractor shall, if ordered by the Engineer, dig test pits, and make test borings and foundation bearing tests.

Whenever any structure excavation is completed to the grade of the bottom of the footing shown on the plans, or set forth in the Special Provisions, or ordered by the Engineer, the Contractor shall notify the Engineer, who will make an inspection of the elevation and character of the foundation. No footing concrete or masonry shall be placed in a footing until the Engineer has inspected and approved the elevation and character of the foundation for the footing.

G. Backfill - Structure backfilling operations shall conform to the requirements of this section, and any requirements specified in the Special Provisions.

Material for use as structure backfill shall consist of any excavated or imported material, free from vegetable matter and other deleterious substances, and shall not contain concrete, stones or clods larger than six (6) inches in greatest dimension. The backfill material shall contain sufficient fines so that all voids will be filled when compacted, and shall be so constituted that the compaction requirements specified herein can be met. Only materials specifically approved by the Engineer shall be used for structure backfill.

The Contractor shall make his own arrangements for obtaining structure backfill material and all costs involved therewith shall be considered as included in the contract price paid for structure excavation, or for the

structure being constructed.

Structure backfill shall not be placed until the structure footings or other portions of the structure or facilities to be below ground line have been inspected by the Engineer and approved for backfilling. No backfill material shall be deposited against outside walls of concrete structures until the concrete has developed the strength of 2,500 pounds per square inch in compression as determined by test samples cured under conditions similar to those prevailing at the site and tested in accordance with standard methods.

Backfill materials shall be placed in uniform horizontal layers not exceeding eight (8) inches in loose thickness before compaction and shall be brought up uniformly on all sides of the structure or improvement in order to avoid bending or distortional stresses. Each layer of backfill shall be moistened as necessary and thoroughly tamped, rolled or otherwise compacted until the relative compaction is not less than ninety percent (90%) Upon specific approval of the Engineer, compaction of granular backfill material may be obtained by jetting. When approved, jetting shall be accomplished in a manner specified by the Engineer and similar to that specified in Section 19-02H for intermediate trench backfill. Jetting of the upper three (3) feet below finish grade will not be permitted.

H. Measurement - Quantities of earthwork to be paid for as structure excavation and structure backfill shall be the volumes computed in accordance with the following provisions.

The limits for payment of structure excavation shall be those shown on the plans or specified or ordered by the Engineer, and in the case of excavation for foundations of structures, no deduction in pay quantities will be made where the Contractor does not elect to excavate material which is outside the limits of the actual structure but within the limits shown on the plans or specified or ordered by the Engineer.

Unless otherwise shown on the plans or specified, the lower limit for payment of structure excavation for foundations of structures, shall be the bottom of the completed footing.

If it is necessary or advisable, in the opinion of the Engineer, to increase the depth of structure excavation below the depth shown on the plans, the material removed to a depth of four (4) feet below said depth will be paid for at the contract price for structure excavation. The removal of material from depths greater than four (4) feet below said depth will be paid for as extra work, or at the option of the Contractor, the material removed will be paid for at the contract price for structure excavation.

No compensation will be made for the removal and disposal of material which may come into an excavation from outside the designated limits or for the removal and disposal of swell material resulting from the driving of piles in an excavation or for furnishing and placing backfill material in an excavation that is below the designated grade, and such quantities will not be included in the quantities of structure excavation and backfill to be paid for.

PART E - TECHNICAL CONSTRUCTION REQUIREMENTS

The upper limit for payment of structure excavation shall be the original ground surface as it existed prior to the start of construction operations with the following exception. Where it is required that the structure excavation be made in new embankment, the upper limit shall be the planes of the new embankment at the elevation shown on the plans or specified for construction in advance of performing the required structure excavation.

I. Payment - The contract price paid for structure excavation and backfill, when included in the bid proposal, shall include full compensation for furnishing all labor, materials, tools and equipment, and doing all the work involved in making the excavations and disposing of the resulting excavated material as specified, including the furnishing and installation or construction of all cofferdams and other facilities necessary to the excavation operations and their subsequent removal if required, and shall include full compensation for furnishing all labor, materials, tools and equipment, and doing all the work involved in furnishing, placing and compacting the structure backfill material in place as specified.

Full compensation for placing and compacting surplus structure excavation in embankments or otherwise disposing of the material as specified in the Special Provisions or as directed by the Engineer, shall be considered as included in the contract price paid for excavating the material.

When the bid proposal does not include a contract pay item for structure excavation and backfill, full compensation for furnishing all work involved shall be considered as included in the lump sum price paid for the structure being constructed and no additional compensation will be allowed therefor.

19-07 Embankment Construction. Embankment construction shall consist of the construction of fills, including the preparation of the ground areas upon which they are to rest; the construction of earth dikes for site protection; the placing and compacting of approved material within areas where unsuitable fill foundation material has been removed; and the placing and compacting of embankment material in holes, pits and other depressions within the work area.

A. General Requirements - The relative compaction of the natural ground area upon which embankments are to be constructed, for a depth of not less than two (2) feet below finished grade, shall not be less than ninety percent (90%).

When necessary to conform to the above compaction requirements, the natural ground shall be excavated and the excavated material or other material designated by the Engineer backfilled in the excavated area. The backfill material shall be placed in layers not exceeding eight (8) inches in loose thickness before compaction and each layer shall be compacted to a relative compaction of not less than ninety percent (90%).

When embankments are to be made and compacted on hillsides, or where new fill is to be compacted against existing embankments, the slopes of the original hillside, old or new fill, shall be cut into as the work is brought up in layers. Material thus cut out shall be recompacted along with the new

fill at the Contractor's expense.

Whenever selection is possible, embankment material having a sand equivalent value of less than ten (10) shall be deposited in the lower portions of embankments and no such material shall be placed within two (2) feet of planned finished grade.

When the embankment material consists of large rocky material, or hard lumps such as hardpan or cemented gravel which cannot be broken readily, such material shall be well distributed throughout the embankment, and sufficient earth or other fine material shall be placed around the large material as it is deposited so as to fill the interstices and produce a dense compact embankment.

B. Compacting - Embankments shall be constructed in compacted layers of uniform thickness and each layer shall be compacted by means of approved compacting equipment with the following two exceptions:

(1) Sidehill fills, where the width, including bench cuts for bonding existing in new embankments, is too narrow to accommodate compacting equipment, may be placed by end dumping until the width of the embankment, including benching, becomes great enough to permit the use of compacting equipment, after which the remainder of the embankment shall be placed in layers and compacted as specified.

(2) Where embankments are to be constructed across low swampy ground which will not support the weight of trucks or other hauling equipment, the lower part of the fill may be constructed by dumping successive vehicle loads in a uniformily distributed layer of a thickness not greater than that necessary to support the vehicle while placing subsequent layers, after which the remainder of the embankment shall be constructed in layers and compacted as specified.

At the time of compaction, the moisture content of embankment materials shall be such that the relative compaction specified may be obtained with the compacting equipment being used. Embankment material which contains less than the required moisture content shall be watered as necessary, and the water may be added to the material at the excavation site. Compaction of embankment material which contains excessive moisture shall not be commenced until material has been allowed to dry to such an extent that the relative compactions specified may be produced with the compacting equipment being used. At all times it shall be the responsibility of the Contractor to employ such means as may be necessary to secure a uniform moisture content throughout the material being compacted. Full compensation for any additional work involved in drying embankment material to the required moisture content shall be considered as included in the contract price paid for excavating the material and/or constructing the embankment and no additional allowance will be made therefor.

Embankments shall be maintained to the grade and cross section shown on the plans until the acceptance of the contract and the Contractor shall be responsible for the stability of all constructed embankments and shall replace any portions which have become displaced or damaged.

PART E - TECHNICAL CONSTRUCTION REQUIREMENTS

C. Payment - Full compensation for furnishing all labor, materials, tools and equipment, and doing all the work involved in constructing embankments as specified; including the drying of embankment material; including the construction of earth dikes; including the placing and compacting of approved material within areas where unsuitable fill foundation material has been removed; and including the placing and compacting of embankment material in holes, pits and other depressions; shall be considered as included in the contract price paid for excavating or furnishing the material used and no additional compensation will be made therefor.

SECTION 20 SEWER PIPE LINES

20-01 Description. Sewer pipe lines shall be installed as shown on the plans and in accordance with the following provisions, the Special Provisions, and as directed by the Engineer.

20-02 Materials.

A. Pipe - All pipe shall be of the size, materials, and strength classifications shown on the plans or specified herein. The use of new pipe, pipe products and/or pipe specifications shall be determined by the Engineer and authorized in writing. A current list of all District approved pipes for use in constructing building sewers is on file at the District office and shall hereinafter be referred to as "Approved Building Sewer Pipe Materials List".

All pipe sizes refer to inside diameter of pipe (including any pipe lining) and no pipe shall be more than one-eighth (1/8) inch smaller than its designated size.

All pipe and pipe joints between structures shall be of the same type, design, and size unless otherwise specified or permitted by the Engineer.

The Contractor shall submit, at his own expense, shop and material details of all special pipe for approval of the Engineer before the pipe shall be manufactured or used on the work. All pipes and fittings shall be marked with the trade or brand name of the manufacturer and inventory identification marks.

1. Vitrified Clay Pipe and Fittings - Vitrified clay pipe and fittings shall be new, first quality pipe and shall conform to ASTM C-700, as it applies to extra strength clay pipe and fittings, unglazed, and pipe fittings shall be of a quality equal to the straight pipe.

2. Asbestos-Cement Pipe and Fittings - Asbestos-cement pipe and fittings for gravity sewers shall conform to ASTM C-428 Type II and, unless otherwise indicated on the plans, in the Special Provisions, or directed by the Engineer, shall be Class 2400.

Asbestos-cement pipe and fittings for force mains shall conform to ASTM C-296 Type II and, unless otherwise indicated on the plans, in the Special Provisions or directed by the Engineer shall be Class 100.

PART E - TECHNICAL CONSTRUCTION REQUIREMENTS

Asbestos-cement pipe and fittings for side sewer construction shall conform to ASTM C-644.

All fittings and pipe appurtenances shall be those recommended by the manufacturer and approved by the Engineer.

3. Cast Iron Pipe and Fittings - Cast Iron pipe and fittings shall conform to ASA A21.6 or A21.8 and, unless otherwise indicated on the plans, in the Special Provisions, or directed by the Engineer, shall be Class 22. The pipe shall be bituminous coated outside and cement lined inside, conforming to the requirements of ASA A21.4.

Joints shall be either the mechanical or "push-on" type, conforming to the requirements of ASA A21.11. Fittings shall conform to ASA A21.10, with a minimum pressure rating of 250 pounds per square inch.

Flexible and transition couplings shall be cast iron and shall have stainless steel nuts and bolts, as manufactured by Smith-Blair, Inc., or approved equivalent.

Cast iron pipe and fittings for side sewers shall be new, first quality pipe, and shall conform to the specifications by the United States Department of Commerce standard for service weight cast iron soil pipe and fittings, Commercial Standard CS 188 or by the Cast Iron Soil Pipe Institute Specifications 301-64T. All pipe fittings shall be of a quality equal to or better than the straight pipe.

4. PVC Pipe and Fittings - PVC (Poly Vinyl Chloride) pipe and fittings for gravity sewers shall conform to ASTM D-3034-73 and, unless otherwise indicated on the plans, in the Special Provisions or directed by the Engineer, shall be SDR-35. Joints shall be the "push-on" type or "Ring-Tite" as manufactured by Johns-Manville, or approved equivalent.

PVC pipe and fittings for force mains shall be pressure pipe conforming to ASTM D-2241 and, unless otherwise indicated on the plans, in the Special Provisions or directed by the Engineer, shall be 160 p.s.i. pipe - SDR 26.

All fittings and pipe appurtenances shall be those recommended by the manufacturer and approved by the Engineer.

5. Reinforced Plastic Mortar Pipe and Fittings - Reinforced plastic mortar pipe and fittings for gravity sewers shall conform to ASTM D-3262-73.

Reinforced plastic mortar pipe and fittings for force mains shall be pressure pipe conforming to Specification No. SP-28, dated August 1, 1973, published by Amoco Reinforced Plastics Company, Riverside, California, or approved equivalent. Unless otherwise indicated on the plans, in the Special Provisions or directed by the Engineer, the force main pipe shall be Class 100.

All fittings and pipe appurtenances shall be those recommended by the manufacturer and approved by the Engineer.

PART E - TECHNICAL CONSTRUCTION REQUIREMENTS

6. Reinforced Concrete Pipe - Reinforced concrete pipe shall conform to ASTM C-76 and, unless otherwise indicated on the plans, in the Special Provisions or directed by the Engineer, shall be Class III, designed for a head of at least twenty-five (25) feet, and the pipe shall be centrifugally cast. D Loadings will be noted on the plans, and joint design shall conform to AWWA C-302, Section 3.3 as modified herein:

a. The joint shall be the all concrete bell and spigot type, unless otherwise specified in the Special Provisions or permitted by the Engineer in writing.

b. The gasket shall be confined in a groove formed in the outside furface of the spigot end of the pipe.

c. The pipe shall be manufactured with Type II Cement.

7. Concrete Steel Cylinder Pipe - Concrete steel cylinder pipe shall be concrete lined and coated steel cylinder pipe, hereinafter referred to as CL & C Pipe, as specified below:

CL & C Pipe and fittings shall conform to Fed. Spec. SS-P-381a or SS-P-385a, except as modified below and in the Special Provisions. The total area of steel used for design purposes shall be the cross-sectional area of steel in the wall of the pipe cylinder. The cross-sectional area of the rod wrapping shall not be considered for design purposes. The minimum diameter of the reinforcing steel used for rod wrapping for all CL & C Pipe shall be 7/32-inches. Unless otherwise specified, the pipe shall be fabricated in maximum forty (40) foot lengths, except where shorter lengths are required to meet special conditions, with due allowance for jointing. The pipe shall be manufactured with Type II Cement lining and coating. Fittings for CL & C Pipe shall conform to the requirements of AWWA C-208.

The Contractor shall submit at his own expense, shop and material details of all CL & C Pipe and fittings for approval, before the pipe or fittings shall be manufactured or used on the work.

All pipe shall be clearly marked on each section of pipe, date of manufacture, type of cement lining and coating, and name or trade mark of the manufacturer.

a. Fabrication of CL & C Pipe for aboveground crossings shall be in accordance with the following table: (Based on maximum thirty (30) foot span).

	Minimum Basic Requirements				
Lined I.D. of Pipe, Inches*	6	8	10	12	14
Cylinder Gauge	10	10	7	7	7
Uniform Lining Thickness	1/2	1/2	1/2	3/4	3/4
Coating Thickness	One Inch				
Bar Reinforcement or Wire Reinforcement	Diameter greater than 7/32-inch and maximum clear space at 1-3/4 inches. Self-furring welded fabric of 2 by 4 inch No. 13 gauge steel wire.				

* Diameters of steel cylinders shall be such that lined pipe shall have an inside diameter of not less than the figure in the Table.

PART E - TECHNICAL CONSTRUCTION REQUIREMENTS

Jointing of pipes by butt welding in the field will be permitted at support points. The cement lining shall extend to the ends of the pipe. The cement coating shall be held back three (3) inches from each end of the pipe, unless otherwise specified. The ends of the pipe shall be clean of all concrete, grease, scale and dirt and ready for making field joints by welding. A protective shop coating shall be applied to the exposed metal portion of the pipe. Field replacement of coating at joints shall be to manufacturer's specifications or as directed by the Engineer.

b. Unless otherwise specified or shown on the plans, CL & C Pipe for use in siphon or other underground installations shall be fabricated in accordance with the minimum requirements listed above for aboveground corssings.

Special fittings shall be fabricated as shown on the plans or, if approved, to fit field conditions and shall have maximum deflections of fifteen (15) degrees at any one angle break. The distance between miters shall be three (3) pipe diameters unless otherwise shown on the plans or approved by the Engineer.

B. Joint Types and Materials - All pipe joint materials shall be as specified herein and the use of new or unapproved products or materials for joints shall be determined by the Engineer and authorized in writing. Care will be exercised in the intermixing of different shipments of materials to insure well-fitted joints. All rubber gaskets and/or couplings for pipe joints shall be purchased from or through the firms supplying the pipe.

The approved types of joint materials commonly used with the various pipes and fittings are as follows:

1. Vitrified Clay Pipe and Fitting Joints - Joints for vitrified clay pipe and fittings shall be the mechanical compression type conforming in all respects to the standards of the pipe manufacturer. Resilient material used for jointing shall conform to the specifications of ASTM C-425. Rubber couplings used to join plain end vitrified clay pipe shall conform to the material and performance requirements of ASTM C-594.

2. Asbestos-Cement Pipe and Fitting Joints - Couplings shall be asbestos-cement using rubber rings and shall conform in all respects to the standards of the pipe manufacturer. Rubber rings shall conform to the requirements of ASTM D-1869.

3. Cast Iron Pipe and Fitting Joints - Rubber gaskets used for jointing cast iron pipe shall conform to the requirements of Fed. Spec. WW-P-421c.

Lead joints will not be permitted without special approval. When permitted, hot lead used for jointing cast iron pipe shall conform to the requirements of ASTM B-29 for pig lead Grade III common. Before lead is poured, the joints shall be caulked with approved graded or twisted treated jute packing yarn of uniform quality.

4. PVC Pipe and Fitting Joints - Joints for PVC pipe and fittings shall be the "push-on" type or "Ring-Tite" as manufactured by Johns-Manville, or approved equivalent. Rubber rings shall conform to the requirements of ASTM D-1869.

PART E - TECHNICAL CONSTRUCTION REQUIREMENTS

5. Reinforced Plastic Mortar Pipe and Fitting Joints - Joints for reinforced plastic mortar pipe and fittings shall be the rubber ring "push-on" type as manufactured for "Techite" pipe by Amoco Reinforced Plastics Company, Riverside, California, or approved equivalent. Rubber rings shall conform to the requirements of ASTM D-1869.

6. Reinforced Concrete Pipe Joints - Rubber gaskets used for jointing reinforced concrete pipe with bell and spigot ends shall conform to Section 3.4 of AWWA C-302. Rubber gaskets conforming to ASTM C-361 require prior written approval of the Engineer. When the use of reinforced concrete pipe with double spigot ends is approved by the Engineer, joints shall have approved fiberglass reinforced collars, and rubber gaskets conforming to Section 3.4 of AWWA C-302.

7. Concrete Steel Cylinder Pipe Joints - Rubber gaskets used for jointing CL & C Pipe with bell and spigot ends shall conform with Fed. Spec. SS-P-381a, Class 150. Joints used for jointing plan end CL & C Pipe shall be either the "Dresser" type of approved style, or shall be butt welded, as shown on the plans or directed by the Engineer.

PART E - TECHNICAL CONSTRUCTION REQUIREMENTS

20-03 Installation.

A. Main or Trunk Sewer Pipe Laying - All sewer pipe shall be laid with the minimum of twelve (12) inches clearance from all other improvements and utilities, unless otherwise approved by the Engineer. All pipe shall be laid to conform to the prescribed line and grade as shown on the plans and each pipe length checked to the grade line. This shall be accomplished by means of a grade line from the grade stakes. This grade line shall be established before any pipe is laid in the trench.

As the work progresses, the interior of the sewer shall be cleared of all dirt and debris of every description. Where clearing after laying is difficult because of small pipe size, a suitable swab or squeegee shall be kept in the pipe and pulled forward past each joint immediately after jointing has been completed.

Unless otherwise approved by the Engineer, the sewer line shall be laid without break upgrade from the point of connection to existing sewer and with the bell end forward or upgrade. Pipe shall not be laid when the condition of the trench or the weather is unsuitable. When pipe laying is not in progress, the forward end of the pipe shall be kept effectively closed with an approved temporary plug.

The pipe shall be placed on a prepared subgrade of approved bedding material at least three (3) inches deep below the barrel of the pipe. The bedding material shall conform to the requirements of Section 19-02G. Each length of pipe shall have full bearing for its entire length and adequate bell holes shall be dug at each end of the pipe. Adjustments of pipe to line and grade shall be made by scraping away or filling in and tamping the bedding material under the body of the pipe. No wedging or blocking to support the pipe will be permitted.

Unsuitable foundation material shall be excavated and replaced with bedding material properly compacted. Over-excavated areas in the trench bottom shall be restored to grade with bedding material at the Contractor's expense. Further, when in the opinion of the Engineer, additional gravel or crushed rock is required to stabalize a soft, wet, or spongy foundation caused by the operations of the Contractor, such gravel or crushed rock shall be furnished at the Contractor's expense.

For curved sewers, the deflection in the joint between any two successive pipe sections shall not exceed eighty percent (80%) of the maximum deflection as recommended by the pipe manufacturer. Minimum two (2) foot pipe lengths may be supplied or pipe may be cut, if approved joint material is available, to install short radius curves and to conform with the joint deflection limitations.

Sewer pipes, branches, stubs, or other open ends which are not to be immediately connected, shall be plugged or capped with a standard watertight plug or cap, as approved by the Engineer for use in the particular installation. The plug or cap shall be placed on a standard end. Open pipe ends on which rodding inlets, flushing inlets, etc., are to be constructed shall be plugged at all times until the structure is completed and the cover in place.

PART E - TECHNICAL CONSTRUCTION REQUIREMENTS

All sewer line connections to manholes, trunk sewers, main sewers, or side sewers shall be left uncovered until after the inspection has been made. After approval of the connection, the trench shall be backfilled as specified.

If the sewer is to be laid in an area that is to be filled and the cover prior to filling is less than four (4) feet, the pipe shall not be laid until the area has been filled to a level of four (4) feet above the proposed pipe and compacted to ninety percent (90%) relative compaction, unless otherwise authorized by the Engineer.

The markings on reinforced concrete pipe indicating the minor axis of the eliptical reinforcement shall be placed in a vertical plane when the pipe is laid in place.

B. Force Main Pipe Installation and Testing - Force main pipe shall be laid in conformance with the requirements set forth herein for main and trunk sewer pipe, and to the following requirements.

Concrete thrust blocks shall be provided on all force main bends having a deflection angle of eleven (11) degrees or more, and at elbows, tees and valves. Thrust blocks shall have a sufficient bearing area to withstand the maximum force to be exerted. For cement lined and coated steel pipe, pipe joints may be welded one hundred (100) feet either side of the bend in lieu of providing a concrete thrust block.

Unless otherwise specified on the plans, in the Special Provisions or directed by the Engineer, all valves to be installed in force mains shall be iron body, bronze mounted, double-disc, parallel seat type gate valve with mechnical joint ends, and non-rising stem designed for 175 pounds per square inch working pressure, conforming to standard specifications of the American Water Works Association. Valves shall be equivalent in design, workmanship and functional characteristics to Series A-2380 as manufactured by the Mueller Company, San Francisco, California. Unless otherwise shown on the plans each valve shall correspond to the size of the run of pipe on which it is to be installed.

Force main valves shall be installed in accordance with North Marin County Water District's Standard Drawing No. A-3, except that materials for riser pipe and cover shall be equivalent to Brooks Products, Inc. Oakland, California, 8-3/4" diameter traffic box, 1-RT Series. The cover shall be marked with the word "sewer". An extension stem, valve wrench and all materials and equipment necessary for easy and proper valve operation shall be supplied.

Proper clearance shall be provided between the riser and the cover of the box so that traffic loads will not be transferred to the valve or pipe.

All force main pipes shall be thoroughly cleaned by flushing prior to testing in such a manner that no materials are allowed to enter the existing sewer system.

After installing the force main pipe and after the intermediate trench backfill has been placed and compacted as specified herein, all force mains

shall be tested for leakage as provided below. The program for testing shall fit the conditions as mutually determined by the Engineer and the Contractor. The Contractor shall furnish all labor, tools, equipment and water necessary to make the tests and to perform any work incidental thereto. Any leaks which may develop shall be repaired by and at the expense of the Contractor, and he shall, at his own expense, correct and repair any damage to the pipe and its appurtenances, or to any other structures, resulting from or caused by the tests.

A hydrostatic test of one hundred (100) pounds per square inch shall be applied for not less than two (2) hours, or for as long as may be necessary to check all joints and find any leaks which might develop. Force main pipe installations will not be accepted unless the leakage at one hundred (100) pounds per square inch is less than fifty (50) gallons per twenty-four (24) hours per mile per inch of pipe diameter.

C. Side Sewer Pipe Installation and Testing - All side sewer pipe shall be laid in conformance with the requirements set forth herein for main and trunk sewers and to the following requirements.

Unless otherwise directed by the Engineer, all four (4) inch diameter side sewers shall be tested by installing an approved test fitting and plug at or near the point of connection to the main sewer, or lateral sewer if existing, and filling the pipe with water after the pipe has been bedded and shaded. Any leaks discovered shall be repaired by the Contractor at his expense.

All side sewers six (6) inches in diameter and larger shall be tested and cleaned in the same manner as that specified herein for main sewers.

Test fittings shall be wye branches or tees of the same type, size and quality as that of the side sewer pipe, unless otherwise approved, and shall be installed where required. The branch of each test fitting shall be laid in an upright position. After the test is completed and the test plug has been removed, an approved water tight cap or stopper shall be placed in the branch of the test fitting as directed by the Engineer.

D. Pipe Jointing - All pipe jointing shall be accomplished by using the proper types of jointing materials as specified in Section 20-02B and in a manner conforming to the methods hereinafter specified and in accordance with the manufacturer's prescribed installation procedures.

1. Vitrified Clay Pipe Jointing - Vitrified clay pipe jointing shall be accomplished in accordance with the manufacturer's prescribed installation procedures

2. Asbestos-Cement Pipe Jointing - Asbestos-cement pipe jointing shall be accomplished in accordance with the manufacturer's prescribed installation procedures.

3. Cast Iron Pipe Jointing - Cast iron pipe jointing shall be accomplished by any one of the methods specified herein or as specified on the plans. Tyton or "push-on" joints shall be installed in accordance with the manufacturer's prescribed installation procedures. Standard mechanical

joints shall be assembled by placing the gland followed by the rubber gasket over the plain end of the pipe, which is then inserted into the socket of the preceding pipe. The gasket is then pushed into position so that it is evenly seated in the socket. The gland is then moved into position against the face of the gasket. Bolts are inserted and made finger-tight, then tightened with a rachet wrench.

Lead joints (not permitted without special approval) shall consist of a gasket of treated, twisted or braided jute or oakum which shall be caulked tightly into the socket so that the hot poured lead, after caulking, shall have a depth of at least three-fourths (3/4) of the socket depth. The socket shall be free from dirt, grease, and water, and the runner shall be firmly held in place before the lead is poured. The melting pot shall be kept near the joint to be poured and each joint shall be made at one pouring. Dross and slag shall not be allowed to accumulate in the melting pot or ladle. After the joints have cooled sufficiently, they shall be caulked by hand or by pneumatic machine to secure a tight joint without over stressing the iron of the socket.

4. PVC Pipe Jointing - PVC pipe jointing shall be accomplished in strict accordance with the manufacturer's prescribed installation procedures.

5. Reinforced Plastic Mortar Pipe Jointing - Reinforced plastic mortar pipe jointing shall be accomplished in strict accordance with the manufacturer's prescribed installation procedures.

6. Reinforced Concrete Pipe Jointing - Reinforced concrete pipe jointing shall be in accordance with the manufacturer's prescribed installation procedures except as modified herein. When double rubber gasket joints are used, the annular space left inside between abutting pipe sections shall be completely filled with Class II mortar and Class II grout shall be poured to completely encase the steel joint sleeve on the outside by an approved method.

7. Concrete Steel Cylinder Pipe Jointing - Concrete steel cylinder pipe jointing shall be in accordance with the manufacturer's prescribed installation procedures except as modified herein. When rubber gasket joints are used, Class I mortar shall be used to point the joint on the inside and Class I grout shall be used to completely fill the annular space left between abutting pipe sections on the outside.

When pipes are jointed by butt welding, it shall be accomplished as specified in accordance with the latest standards of the American Welding Society. When the welding is complete and approved by the Engineer, the exposed portions of the cylinders and joint shall be wrapped with eighteen (18) gauge stucco wire and then coated to thickness equal to or greater than the thickness of the coating on the pipe with Class I grout. The cement band shall be immediately coated with membrane curing material (Hunts Process white) applied under pressure with a spray nozzle at such a rate as to seal the surface completely.

8. Jointing of Dissimilar Pipes - Jointing of dissimilar pipes shall be accomplished with approved special couplings. The jointing of asbestos-cement, vitrified clay and cast iron pipe may be accomplished by using an approved Ceramicweld Coupling, Calder Coupling, Band Seal Coupling, or other special approved couplings.

E. Connections to Existing Sewerage Systems - The existing sewers are shown on the plans at the locations where new sewers are to be connected. It shall be the responsibility of the Contractor to determine the exact location and depth of the existing sewers prior to the installation of any sewer pipe. In the case of side sewer work, the Contractor shall also determine the elevation of the plumbing outlet at the building to be connected and decide whether the required grade and cover can be maintained between the outlet and the main sewer prior to construction of any portion of the side sewer. Where the connection is to be made in an existing manhole, the Contractor shall make the connection by breaking through the manhole wall, cutting the floor, installing the pipe, and forming a new channel, and repairing any damage to the structure. Where the connection is to be made by constructing a new manhole on an existing sewer, the connection and manhole shall conform to the details shown on the standard drawings.

1. Main Sewers - Connection of main sewers and trunk sewers shall only be made in manholes, or special manhole structures.

2. Side Sewers - Where wyes, tees and/or laterals were previously installed on the main sewer, the side sewer or building sewer shall be connected to the wye, tee or lateral as provided for the particular connection. Where a wye, tee, or lateral has not been installed at the point of desired connection, either a standard wye or tee fitting shall be "cut-in" to the main sewer using approved couplings and fittings of the same material as the main sewer, or a saddle connection shall be made in accordance with the Standard Drawings. The special fittings used to make a saddle connection to the particular size and type of main sewer shall be as indicated in the following table:

Main Sewer Type	Side Sewer Type	Saddle Fitting Type to be Used
V.C.	V.C.	V.C. collar wye or tee saddle.
V.C.	A.C. or C.I.	V.C. collar wye or tee saddle, with V.C. 1/8 bend and Band Seal connection to A.C. or C.I. side sewer.
A.C.	A.C.	Waterman wye or tee saddle.
A.C.	V.C. or C.I.	Waterman wye or tee saddle, with A.C. 1/8 bend and Band Seal connection to V.C. or C.I. side sewer.
C.I.	V.C., A.C. or C.I.	As directed by the Engineer
R.C.P.	V.C., A.C. or C.I.	See Standard Drawings.

PART E - TECHNICAL CONSTRUCTION REQUIREMENTS

a. V.C. Saddle Connection to V.C. Main - A V.C. collar wye or tee saddle with a skirt fabricated thereon, which will prevent the saddle from entering the main sewer pipe beyond the inside surface of the main, shall be used. An opening shall be cut in the barrel of the main sewer pipe and carefully trimmed to form a snug fit with the saddle fitting, and shall be positioned so that the saddle fitting will have an angle of forty-five (45) degrees with horizontal and pointing downgrade on the main sewer.

Excavation to permit a minimum of three (3) inches of concrete under the main and six (6) inches on the sides shall be made. The interior of the main sewer shall be cleaned thoroughly prior to installing the saddle fitting. The entire circumference shall be cleaned twelve (12) inches each way along the main sewer from the saddle. The saddle fitting shall then be installed and secured with struts and blocking in the required position and sufficient epoxy cement to smooth and encase the joint between the main sewer pipe and the saddle fitting shall be carefully applied. The epoxy cement used shall be Johns-Manville "Joint Master" or approved equivalent.

Care shall be taken that no fragments of pipe or epoxy cement are allowed to fall into the main sewer. Class A concrete shall then be placed in the excavated area around the pipe and shall entirely encase the saddle to the lip of the bell (see Standard Drawings). No pipe shall be connected to the saddle until after the installation has been inspected by the Engineer. No backfill shall be placed on the concrete saddle block within two (2) hours after pouring the block.

b. Waterman Fitting Connection to A.C. Main - The Waterman wye or tee saddle shall be connected to an A.C. main sewer using epoxy cement in the same manner as that specified above for V.C. saddles. The fittings shall not be bolted to the main sewer and if holes are provided they shall be completely filled with epoxy cement.

c. Connection of a Side Sewer Equal in Size to the Main - When the side sewer to be installed is equal in size to the main sewer, a standard wye branch or tee fitting of the same material as the main sewer pipe shall be installed in the main line and approved fittings used for the side sewer connection.

F. Special Jointing Requirements in Filled Ground - Where construction takes place in filled marsh land or bay mud areas, or any other areas which in the judgement of the Engineer are subject to possible subsidence or differential settlement, special pipe jointing will be required for pipe entering and leaving manholes or structures. When indicated on the plans, in the Special Provisions or directed by the Engineer, all sewer lines smaller than twelve (12) inches entering and leaving manholes or structures shall have two (2) approved flexible joints within four (4) feet of the manhole base or structure, with not less than twelve (12) inches between joints. All sewer lines twelve (12) through eighteen (18) inches shall have one (1) approved flexible joint within twelve (12) inches of the manhole base or structure.

20-04 Cleaning and Testing - Gravity Main and Trunk Sewers. After installation, all gravity and trunk sewers shall be tested and cleaned as herein specified, in the presence of the Engineer. The program for testing

and cleaning shall fit the conditions as mutually determined by the Engineer and the Contractor. The Contractor shall furnish all labor, tools, equipment and water necessary to make all tests, clean the lines and to perform any work incidental thereto. The Contractor shall take all necessary precautions to prevent any joints from drawing while the pipe lines or their appurtenances are being tested. He shall, at his own expense, correct any excess leakage and repair any damage to the pipe and its appurtenances or to any structures, resulting from or caused by these tests. Materials and methods used for any necessary repair work shall be specifically approved by the District Engineer.

The Contractor shall flush all sewer lines prior to testing and accumulated materials shall be removed at each manhole and no materials shall be allowed to enter the existing sewer system. A plug shall be installed and maintained by the Contractor in the line connecting to the existing system until all cleaning and testing is completed and the lines are approved for operation.

A. Testing - Each section of sewer line shall be tested as provided herein using either water or air at the option of the Contractor. However, in the event that the Contractor elects to test sewer sections using the air test method, each manhole shall be water tested using the procedure outlined below.

The infiltration test described below may be required by the Engineer in addition to either the water or air tests.

The tests shall not be undertaken prior to the placing and compaction of intermediate trench backfill, and they shall be completed and any leaks repaired prior to installation of aggregate base and paving. If a new street is being constructed involving the placement of cement treated or lime treated base, the testing and repair of all sewers shall be completed prior to the installation of such base.

1. Water Test - Each section of sewer shall be tested between successive manholes by closing the lower end of the sewer to be tested and the inlet sewer of the upper manhole with stoppers and filling the pipe and manhole with water to a point four (4) feet above the crown of the sewer in the upper manhole, or, if ground water is present, four (4) feet above the average adjacent ground water level. For the convenience of the Contractor, where grades are slight, two (2) or more sections between manholes may be tested at once. However, when testing more than one section, the allowable leakage for the total length shall be that computed for the shortest section of pipeline between manholes tested. Where grades are steep and excessive test heads would result by testing from one manhole to another, test fittings the full size of the main shall be installed at intermediate points so the maximum head on any section under test will not exceed twelve (12) feet. The lines shall be filled at least two (2) hours prior to testing and shall be tested at least one (1) hour maintaining the head specified above by measured additions of water. The sum of these additions shall be the leakage for the test period.

The allowable leakage shall be figured as two hundred (200) gallons per day per inch main sewer diameter per mile of main sewer being tested. Where the actual leakage exceeds the allowable, the Contractor shall discover the cause and remedy it before the sewer is accepted. If the leakage is less than the allowable and leaks are observed, such leaks shall be repaired at the Contractor's expense, as directed by the Engineer.

PART E - TECHNICAL CONSTRUCTION REQUIREMENTS

When the Contractor elects to test sewer sections using the air test method, each manhole shall be water tested by plugging all inlet and outlet pipes and filling the manhole with water for a period of at least two (2) hours. After that time the leakage shall be measured and, if any leakage exists, the Contractor shall discover the cause and remedy it before the sewer is accepted.

2. Air Test - Low pressure air tests for sewers between structures shall be accomplished by carefully placing test plugs at each end of the section of line to be tested. When all necessary test equipment is in place, a compressed air supply shall be attached to the air fitting on the equipment and the air pressure within the line increased to the test pressure. After the air supply is securely turned off or disconnected, there shall be a two (2) minute waiting period to allow stabilization of air within the sewer line before the actual test period begins. The test pressure shall be at least four (4) pounds per square inch at the beginning of the test.

The allowable leakage shall be determined by noting the elapsed time for the test pressure to drop from four (4) pounds per square inch to three (3) pounds per square inch. The elapsed time for this prescribed pressure drop shall not be less than the time shown on the Allowable Air Test Leakage Chart on Standard Drawing No. SD-19.

The maximum length of a sewer line that may be tested at one time shall be five hundred(500) feet. After completion of a test, the air pressure shall be released slowly through the valve, which is incorporated in the test equipment. Air test plugs shall not be removed until the air pressure is no longer measurable.

If ground water is known to be present, the beginning test pressure shall be increased as directed by the Engineer.

3. Infiltration Test - If in the construction of a sewer, excessive ground water is encountered,the tests for leakage described above may, at the discretion of the Engineer, be supplemented by the infiltration test described herein. Test sections shall be isolated and any pumping of ground water shall be discontinued for at least three (3) days and the ground water shall be allowed to rise to maximum level. The infiltration rate shall then be measured at the low end of the test section.

The infiltration rate shall not exceed one hundred (100) gallons per day per inch main sewer diameter per mile of main sewer being tested. No additional allowance shall be made for manholes or other structures. If the observed infiltration rate exceeds the allowed limit, the required repairs shall be made and the section shall be retested. Repairs and retesting shall be repeated until the observed infiltration falls within the allowed limit. Notwithstanding satisfactory passing of either the leakage tests or infiltration tests, where infiltration is later discovered in excess of the allowed limit before completion and acceptance of the sewer, the sewer shall be immediately uncovered where necessary and repairs made to reduce the infiltration rate within the allowed limit before the sewer is accepted. However, should the infiltration be less than the specified amount, the Contractor shall stop any individual leaks that may be observed when ordered to do so by the Engineer.

B. Cleaning - After gravity main and trunk sewers have been tested for leakage and after either temporary or permanent surfacing replacement has been installed, but prior to acceptance, they shall be tested for obstructions and cleaned by the sewer ball method. The cleaning operation shall consist of passing a rubber ball of the same diameter as the pipe through each line in the presence of the Engineer. The ball shall be a standard cleaning ball attached to a rope or cable and forced through the line by maintaining a head of water behind it. Debris shall be caught and removed from the downstream manhole on each section of line as it is cleaned. The cleaning shall be performed before any sewage is permitted to flow in the line and after paving operations are completed. The Contractor shall furnish all labor, tools, equipment and water necessary for the cleaning operation and he shall dispose of all wastes, including water, at his own expense.

20-05 Measurement and Payment. The final determination of the quantity of sewer pipe laid in accordance with the plans and specifications shall be by the following method of measurement. Sewer lines shall be measured horizontally along the center line of the sewer from the center of structure to the center of structure without deduction for structure, unless otherwise specified in the Special Provisions.

The price paid per linear foot for sewer pipe lines, in place, shall include full compensation for furnishing all labor, materials, tools, equipment and doing all work involved in furnishing and installing the sewer line complete in place as herein specified, including excavation, bedding, backfill, compaction, cleaning, testing, surface replacement, temporary and permanent paving, and any specified or required connections to existing sewers.

The unit price paid for rodding and/or flushing inlets shall include excavation, pipe, fittings, concrete, castings, backfill, surface replacement, temporary and permanent paving, and all labor, equipment and material necessary for completion of the rodding and/or flushing inlet in accordance with the plans and specifications.

SECTION 21 PORTLAND CEMENT CONCRETE AND MORTAR

21-01 Description. Portland cement concrete shall, unless otherwise specified, be composed of Type II portland cement, fine aggregate, coarse aggregate, and water, proportioned and mixed as herein specified (based on ninety-four (94) pound sacks).

CLASS A concrete shall contain five hundred sixty-four (564) pounds (six (6) sacks) of portland cement per cubic yard.

CLASS B concrete shall contain four hundred seventy (470) pounds (five (5) sacks) of portland cement per cubic yard.

CLASS C concrete shall contain three hundred seventy-six (376) pounds (four (4) sacks) of portland cement per cubic yard.

CLASS D concrete shall contain six hundred fifty-eight (658) pounds (seven (7) sacks) of portland cement per cubic yard.

The relative proportions of fine and coarse aggregate shall be changed as necessary to maintain constant the quantity of portland cement in each cubic yard of concrete. Portland Cement Concrete materials, mixing, handling and curing shall conform to the requirements of Section 90 of the State Standard Specifications.

Mortar shall be composed of Type II portland cement and sand conforming to the requirements set forth for the fine aggregate, proportioned and mixed as specified herein.

CLASS I mortar shall consist of one part by volume of cement to one part of sand.

CLASS II mortar shall consist of one part by volume of cement to two parts of sand.

CLASS III mortar shall be Class I mortar containing fifteen (15) percent Pozzolan of the calcined reactive siliceous type as a replacement.

CLASS IV mortar shall be Class I mortar containing twenty-five (25) percent Embeco as a sand replacement.

CLASS V mortar shall be Class II mortar to which may be added hydrated lime to the extent of eight (8) percent of the volume of cement for masonry bedding and ten (10) percent for masonry pointing. Hydrated lime shall be added to the mixture and not substituted for cement.

Grout shall be composed of mortar diluted with water to flow readily.

No mortar or grout shall be used later than thirty (30) minutes after the water has been introduced into the mix.

Unless otherwise permitted by the Engineer, mortar shall be mixed in an approved type of mixing machine in accordance with the applicable requirements of these specifications. Should hand mixing of the mortar be permitted by the Engineer, the sand, cement and lime shall be mixed dry in a tight box until the mixture assumes a uniform color, after which water shall be added as the mixing continues. Mortar shall be of such consistency that it can be easily handled and spread with a trowel.

21-02 Materials, Etc. Materials, equipment and plant, storage of aggregates, proportioning, machine mixing, hand mixing, admixtures, amount of water and slump test, cold weather work, and basis for payment shall conform to the requirements of Portland Cement Concrete, of the State Standard Specifications, unless modified in the Special Provisions.

Unless otherwise indicated on the plans, in the Special Provisions or directed by the Engineer, all Portland Cement Concrete shall be Class A

conforming to the grading requirements for one and one-half (1-1/2) inch maximum combined aggregate, and shall develop a minimum compressive strength of three thousand (3,000) pounds per square inch at twenty-eight (28) days.

SECTION 22 REINFORCEMENT

22-01 Description. Reinforcement shall conform to these specifications and be of the shape and dimensions shown on the plans, or specified in the Special Provisions.

22-02 Materials. The following specifications set forth the requirements for bar reinforcement, mesh reinforcement, and reinforcing wire.

A. Bar Reinforcement - Bar reinforcement shall be Deformed Billet-Steel Bars for Concrete Reinforcement conforming to the specifications of ASTM A-615 and, unless otherwise shown on the plans or specified in the Special Provisions, bars shall be either Grade 40 or Grade 60 at the option of the Contractor.

Reinforcing bars shall be placed in accordance with the size and spacing shown on the plans, regardless of the designation and grade of bars selected by the Contractor.

B. Mesh Reinforcement - Mesh reinforcement shall conform to the requirements of ASTM A-185. The gauge of the wire and the dimensions of the mesh will be specified in the Special Provisions or shown on the plans.

C. Reinforcing Wire and Plain Bars - Wire, but not including tie wire, used as reinforcement and plain bars used as spiral reinforcement in structures and concrete piles as shown on the plans, shall be, at the option of the Contractor, either cold drawn steel wire conforming to ASTM A-82 or hot-rolled plain or deformed bars conforming to the strength requirements of ASTM A-615, Grade 40 or 60. The wire gauge or bar size shall be as designated on the plans or specified in the Special Provisions. The gauge number and the equivalent diameter in inches shall conform to the table for reinforcing wire given in Section 52-1.10 of the State Standard Specifications.

22-03 Cleaning. Reinforcing steel, before being placed in the forms, shall be thoroughly cleaned of loose mill scale and rust, mortar, oil, dirt, and of coatings of any character that would destroy or reduce the bond.

22-04 Bending. Reinforcing steel shall conform accurately to the dimensions shown on the plans.

Bars shall not be bent or straightened in a manner that will injure the material. Bars with kinks or improper bends shall not be used.

Hooks shall conform to the manual of standard practice of the American Concrete Institute.

PART E - TECHNICAL CONSTRUCTION REQUIREMENTS

22-05 Placing. Reinforcing bars shall be accurately placed as shown on the plans and shall be firmly and securely held in position by wiring at intersections with No. 14 or No. 16 wire and by using concrete or metal chairs, spacers, metal hangers, supporting wires, and other approved devices of sufficient strength to resist crushing under full load. Such wires, chairs, and other supporting devices shall be furnished by and at the expense of the Contractor. Metal supports which extend to the surface of the concrete, except where shown on the plans, and wooden supports shall not be used. Placing bars on layers of fresh concrete as the work progresses and adjusting bars during the placing of concrete will not be permitted.

Bars shall be accurately spaced as shown on the plans. In no case shall the clear distance between parallel bars be less than two and one-half (2-1/2) diameters of the bar with a minimum of two (2) inches.

Unless otherwise specified, all reinforcement, other than stirrups or spacers, shall have a clear coverage of two (2) inches, measured from the surface of the concrete to the outside of the bar. Additional coverage shall be provided for reinforcement in the bottoms of footings, or where exposed to salt water or unusual corrosive or abrasive conditions, as shown on the plans.

Mesh reinforcement shall be rolled flat before placing concrete, unless otherwise shown on the plans. Mesh reinforcement shall be held firmly in place against vertical or transverse movement by means of devices satisfactory to the Engineer.

Tack welding on reinforcing bars will not be permitted without prior approval of the Engineer.

22-06 Splicing. Bars shall not be spliced except as shown on the plans, or approved by the Engineer. Splices of tensile reinforcement at points of maximum stress shall be avoided. Where approved, splices shall be made in conformance with the requirements of Section 52-1.08 of the State Standard Specifications.

22-07 Steel Lists and Drawings. Before delivering any reinforcing steel, the Contractor shall prepare a list of all reinforcing steel together with detail drawings showing the number and length and dimensioned bending diagrams of all steel bars and rods. These drawings shall be made by men experienced in this type of work, and shall be suitably titled and shall correspond in size with the contract plans.

The Contractor shall furnish the Engineer three sets of prints of the reinforcing steel drawings for the Engineer's inspection and approval. If the Engineer finds these prints satisfactory, he shall return one set marked with the Engineer's approval to the Contractor. If corrections are indicated, the Contractor may be required to correct and resubmit the drawings. Such approval is intended as additional precaution against errors, and shall not relieve the Contractor from responsibility for furnishing and placing steel according to the contract plans. Any expense incidental to the revision of reinforcing steel lists and drawings to make them comply with the design drawings shall be borne by the Contractor.

PART E - TECHNICAL CONSTRUCTION REQUIREMENTS

22-08 Inspection. No concrete shall be deposited until the Engineer has inspected the placing of the reinforcing steel and given permission to place concrete. Concrete placed in violation of this provision will be rejected.

22-09 Measurement and Payment. Quantities of bar reinforcing steel or other types of reinforcement as shown on the plans or as directed by the Engineer, shall be considered a part of reinforced concrete in place and will be paid for at the price of the structure in place or of reinforced concrete in place, whichever may apply.

SECTION 23 CONCRETE STRUCTURES

23-01 Description. Concrete manholes, expansion blocks, pedestal supports, walls, and all other types of concrete structures shall be constructed to the lines and grades given by the Engineer and in accordance with the designs shown on the Standard Drawings or plans; using therefor the classes of concrete designated on the plans or in the Special Provisions and specified in Section 21 of these specifications. Unless otherwise indicated on the plans or specified in the Special Provisions, Class A concrete shall be used, and the aggregate shall conform to the combined aggregate size designated as one and one-half (1-1/2) inches maximum.

23-02 Depth of Footings. The elevations of the bottoms of footings, as shown on the plans, shall be considered as approximate only and the Engineer may order, in writing, such changes in dimensions or elevations of footings as may be necessary to secure a satisfactory foundation. Coarse bedding material shall be placed as a foundation, to a minimum depth of nine (9) inches, under the entire footing of all concrete structures, except standard manholes.

23-03 Pumping. Pumping from the interior of any foundation enclosure shall be done in such manner as to preclude the possibility of any portion of the concrete materials being carried away. No pumping will be permitted during the placing of concrete, or for a period of at least twenty-four (24) hours thereafter, unless it be done from a suitable sump separated from the concrete work.

23-04 Forms. The forms shall be smooth, mortar-tight, true to the required lines and grade, and of sufficient strength to resist any appreciable amount of springing out of shape during the placing of the concrete. All dirt, chips, sawdust, and other foreign matter shall be thoroughly removed from forms before any concrete is deposited therein. Forms previously used shall be thoroughly cleaned of all dirt, mortar and foreign matter before being reused. Before concrete is poured in forms, all inside surfaces of the forms shall be thoroughly coated with an approved form oil. The form oil shall be of high penetrating qualities leaving no film on the surface of the forms that can adhere to or discolor the concrete and shall be applied before reinforcement is placed.

Struts, stays and braces, serving temporarily to hold the forms in correct shape and alignment, pending the placing of concrete at their

locations, shall be removed when the concrete placing has reached an elevation rendering their service unnecessary. These temporary members shall be entirely removed from the forms and not buried in the concrete. Holes shall be provided at the bottom of forms for cleaning purposes. These openings and holes shall be left open until just before the concrete is placed.

The falsework and forms supporting concrete beams, ribs, slabs, or other members subject to direct bending stress shall not be removed or released in less than twenty-one (21) days after the concrete has been placed, unless concrete test cylinders show a strength of not less than three (3,000) pounds per square inch in compression when cured under conditions similar to those affecting the structure. Side forms for beams, girders, columns, or other members of the structure wherein the forms do not resist dead load bending may be removed within a period of from two (2) to five (5) days, as permitted by the Engineer, provided that arrangements satisfactory to him are made for curing and protecting the concrete thus exposed. The required setting times specified herein shall be exclusive of any days when the temperature is below forty (40°) F. Approval of the Engineer shall be obtained before removing any forms, but the responsibility for the preserving of straight lines, true surfaces, and a satisfactory result, including the protection of surfaces and corners from damage or abrasion are the Contractor's responsibility.

Forms for all surfaces, which will not be completely enclosed or hidden below the permanent surface of the ground, or where plywood forms are not specified, shall be made of surfaced lumber or material which will provide a surface at least equally satisfactory. Form lumber shall be sound and free from loose knots or knots that will become loose during construction, or from other defects. Any lumber or material which becomes badly warped or checked prior to placing of the concrete may be rejected. No patented form system shall be used without prior approval of the Engineer.

All sharp edges shall be chamfered with one (1) inch by one (1) inch triangular fillets, unless otherwise directed by the Engineer. The triangular fillets or chamfer strips shall be milled or surfaced on all sides. Curved surfaces shall be formed of strips of matched lumber not over four (4) inches wide or of other material, such as plywood or metal, which has been approved by the Engineer.

Forms shall be of sufficient strength to carry the dead weight of the concrete as a liquid without appreciable deflection, and if any such deflection occurs, it shall be sufficient cause for the rejection of the work. Approved form clamps or bolts shall be used to fasten forms. The use of ties consisting of twisted wire loops to hold forms in position during the placing of concrete will not be permitted.

Bolts or form clamps shall be positive in action and shall be of sufficient strength and number to prevent spreading of the forms. They shall be of such type that they can be entirely removed or cutback one (1) inch below the finished surface of the concrete. All forms for the outside surfaces shall be constructed with stiff wales at right angles to the studs and all form clamps shall extend through and fasten such wales.

Forms for exposed surfaces, where plywood forms are shown on the plans or specified in the Special Provisions, shall be constructed of plywood or material which will produce a surface substantially equal to that which would result by the use of plywood forms.

No concrete shall be deposited in the forms until all work connected with constructing the forms and placing all reinforcing steel, ducts, anchorages, inserts, etc., has been completed for the unit to be poured and the Engineer has inspected said forms, reinforcing steel, ducts, anchorages, inserts, etc.

23-05 Falsework and Centering. When specified or requested, detailed plans of the falsework or centering shall be supplied to the Engineer, but in no case shall the Contractor be relieved of responsibility for results obtained by use of these plans.

All falsework or centering shall be designed and constructed to provide the necessary rigidity and to support the loads.

Falsework or centering shall be founded upon a solid footing safe against undermining and protected from softening.

23-06 Reinforcement. Reinforcement shall be furnished and placed as shown on the plans, and in accordance with the applicable provisions of these specifications and any requirements of the Special Provisions. All reinforcing shall be kept a minimum of two (2) inches clear of any exposed surface and a minimum of one (1) inch clear of all pipes or other objects piercing the structure.

23-07 Mixing Concrete. All concrete shall be mixed as specified in Section 21 of these specifications, and the proportions of aggregate, cement and water shall be as defined by the Engineer, who shall have authority to vary these proportions as necessary during the pour.

The amount of water to be used in mixing concrete for concrete structures shall be the least amount possible and yet sufficient to provide a workable mix for the particular part of the structure in which the concrete is to be placed. The mixer shall be of sufficient capacity to pour the largest continuous run specified, within an eight (8) hour working day.

23-08 Inserts. The Contractor shall, before placing concrete, make provision for all cored holes, hangers, anchors, conduits, and pipes to be placed in the concrete by other trades. He shall verify the locations and details of all such work and shall prevent the disturbance of such inserts during the placing of the concrete.

Where pipes, castings, or conduits are set in place or passed through the walls, floors, or roof of any concrete structure, the Contractor shall provide approved means for securing watertight connections. As indicated on the plans and where required, additional reinforcements shall be provided around openings for the accommodation of equipment specified hereinafter.

The Contractor shall set and hold in exact position in the forms until the concrete has been placed and set, all gate frames, sluice gates, thimbles,

or other metal parts that are to be embedded in the concrete or attached thereto. The Contractor shall also place in the forms and hold in position all anchor and other bolts necessary for the attachment of pipe and equipment.

23-09 Placing Concrete. All concrete or mortar shall be used while fresh and before it has taken an initial set. Retempering any partially hardened concrete with additional water will not be permitted.

Any concrete pour involving four (4) or more cubic yards shall be made only under the direct supervision and inspection of the Engineer.

Concrete, when mixed, shall be deposited immediately without segregation of its ingredients and shall be consolidated with internal vibrators in layers until it is thoroughly compacted, all voids are filled and free mortar appears on the surface. The concrete shall be placed as nearly as possible in its final position and the use of vibrators for extensive shifting of the mass of fresh concrete will not be permitted. Fresh concrete shall not be permitted to fall from a height greater than six (6) feet without the use of adjustable-length pipes or "elephant trunks".

Vibration shall be supplemented by such spading as is necessary to insure smooth surfaces and dense concrete along form surfaces and in corners and locations impossible to reach with vibrators. The concrete shall be completely worked around reinforcing steel and imbedded fixtures.

All concrete shall be compacted by means of high frequency internal vibrators of a type, size and design approved by the Engineer. They shall be capable of transmitting vibrations to the concrete at frequencies of not less than 4500 cycles per minute. The vibration shall be such as to visibly affect a mass of concrete of one (1) inch slump over a radius of at least eighteen (18) inches.

The Contractor shall provide one vibrator for each location where simultaneous placement of concrete takes place. There shall be not less than one vibrator in operation for every ten (10) cubic yards of concrete, or fraction thereof, placed per hour. In any event, there shall be not less than two (2) vibrators available in making any concrete placement.

The vibrators shall not be attached to or held against the forms or the reinforcing steel. The location, manner and duration of the application of the vibrators shall be such as to secure maximum consolidation of the concrete, freedom from voids and proper texture of exposed surfaces when the forms are removed. Fresh concrete shall be spread in horizontal layers insofar as practicable and the thickness of the layers shall not be greater than can be satisfactorily consolidated with the vibrators.

The use of approved external vibrators for compacting concrete will be permitted when the concrete is otherwise inaccessible for adequate compaction provided the forms are constructed sufficiently rigid to resist displacement or damage from external vibration.

The use of chutes in conveying or depositing concrete will be allowed only at the discretion of the Engineer, and wherever they are used, they

shall be of metal or metal lined and shall be laid at such inclination as will permit the flow of concrete of such consistency as is required. Where necessary in order to prevent separation, chutes shall be provided with baffle boards or a reversed section at the outlet.

Concrete, preferably, shall be deposited by beginning at the center of a span and working from the center toward the ends. Concrete in girders shall be deposited uniformly for the full length of the girder and brought up evenly in horizontal layers. Concrete in slab spans shall be placed in one continuous operation for each span unless otherwise permitted. Concrete in columns shall be placed in one continuous operation, unless otherwise directed. At least two (2) hours must elapse after concrete is deposited in the columns or walls before depositing in beams, girders, or slabs supported thereon.

A plan and schedule of pouring operations shall be submitted by the Contractor for approval by the Engineer before mixing and placement of any concrete begins. In general, no vertical joints will be permitted in the walls of any major tanks, and horizontal joints in tanks may be placed only where shown on the plans. Joints in columns shall be level and flush with the bottom of beams or of column heads.

Concrete shall not be mixed or placed while the atmospheric temperature is at, or within the preceding twenty-four (24) hours has been, below thirty-five degrees (35°) F., except with the written permission of the Engineer and only after taking such precautionary measures for the protection of the work for a period of seven (7) days after placing as the Engineer may direct.

23-10 Concrete Deposited Under Water. On excavating for the footings of proposed structures, if conditions render it impossible or inadvisable in the opinion of the Engineer to dewater the excavation before placing concrete, the Contractor shall deposit under water, by means of a tremie or bottom dump bucket, a layer of concrete of sufficient thickness to thoroughly seal the cofferdam. Concrete deposited in water shall be Class A with ten (10) percent extra cement added. The exact thickness will depend upon the hydrostatic head, but in no case shall the seal be less than eighteen (18) inches. This seal shall, in general, be allowed to remain in place for not less than five (5) days and preferably ten (10) days before dewatering so as to set sufficiently to withstand the hydrostatic pressure.

All portions of the structure for which concrete must be deposited under water shall be poured continously until completed. When such portions are completed, all scum, laitance, and sediment shall be removed before fresh concrete is deposited. Concrete shall not be placed in running water.

23-11 Construction Methods. The concrete in each integral part of the structure shall be placed continuously, and the Contractor will not be allowed to commence work on any such part unless his inspected and approved material is on hand, and his forces are sufficient to complete the part without interruption in the placing of the concrete.

Joints in the concrete due to stopping work are to be avoided as far as possible, except where indicated on the plans.

PART E - TECHNICAL CONSTRUCTION REQUIREMENTS

Where the concrete structures have been designed to withstand fluid pressures, the Contractor shall use every precaution to place concrete, provide construction joints and water seals, and install equipment within or attached to concrete so that the structure will be watertight. The Contractor shall be liable for, and shall repair to the satisfaction of the Engineer, any leaks or lack of watertightness caused by poor workmanship and/or defective materials used in building the reinforced concrete structures shown on the plans or specified.

If, in the judgement of the Engineer, pockets and surface blemishes are of such an extent or character as to materially affect the strength, durability, or appearance of the concrete structure, he may declare the concrete defective and require the entire removal and replacement of the defective part of the structure.

23-12 Waterstops. Waterstops shall be furnished and installed in accordance with the details shown on the plans and the Special Provisions, and in accordance with the requirements of Section 51-1.14 of the State Standard Specifications.

23-13 Bonding. Construction joints shall be made only where located on the plans or shown in the pouring schedule, unless otherwise approved by the Engineer. In case of emergency, construction joints shall be placed as directed by the Engineer.

When it is necessary to make a joint because of an emergency, reinforcing steel shall be placed across the joint as directed by the Engineer.

After the pour has been completed to the construction joint and before the concrete has taken a permanent set, the entire surface of the joint shall be thoroughly cleaned of surface laitance and clean aggregate shall be exposed by wire brushing, sandblasting, or air and water pressure jets. Before depositing new concrete on or against hardened concrete, the forms shall be retightened. The surface of the hardened concrete shall be roughened, cleaned and wet as required by the Engineer. To aid in development of bond at the juncture of the hardened and newly deposited concrete, the cleaned and wet surfaces shall first be thoroughly covered with a coating of cement grout against which the new concrete shall be placed before the grout has attained its initial set.

Construction joints shall be mechanically bonded by means of keys cast into the surfaces in contact. Keys shall be formed by bevelled strips or boards placed at right angles to the direction of shear. Except where otherwise specified, keys shall be at least one and one-half (1-1/2) inches in depth over at least twenty-five percent (25%) of the area of the section.

Where existing concrete and new concrete are to be joined, holes shall be drilled in the existing concrete and bar reinforcing steel dowels grouted in place as shown on the plans. The holes shall be filled with grout before placing the dowels.

23-14 Curing. With certain exceptions described below, all newly placed concrete shall be kept wet by the continuous application of water for the first seven (7) days after the concrete has been placed. Water for

use in curing concrete shall conform to the requirements for water for use in the manufacture of concrete.

Concrete surfaces where only ordinary surface finish is to be applied as a final finish and on which a uniform color is not required, may be cured by the pigmented sealing compound method. Surfaces to be cured by the pigmented sealing compound method shall be kept moist or wet until the sealing compound is applied, and it shall not be applied until all patching or surface finishing has been completed.

23-15 Manholes. All manholes shall conform to ASTM C-478, except that Type II modified portland cement shall be used. Manholes shall be watertight structures and shall have metallic steps from top to bottom (see Section 24-06). The design, the specifications, and the name of the manufacturer shall be submitted to the Engineer for approval prior to the purchase of any precast manhole units. Refer to the Standard Drawings.

A. Manhole Channels - Where sewer lines pass through manholes, construction shall conform to the applicable Standard Drawings. Pipe shall be used as a form for the channel if the proper positioning of the flexible joints can be maintained. Whether pipe or channel forms are used, after the manhole base concrete has taken a set, the channel shall be carefully shaped and mortared to obtain a smooth channel. All channels shall be checked with the proper template.

B. Manhole Throat - The maximum depth of the manhole throat shall be eighteen (18) inches, measured from the top of the manhole cover to the lower extremity of the throat at the top of the cone section.

PART E - TECHNICAL CONSTRUCTION REQUIREMENTS

C. Precast Manhole Construction - An approved form ring conforming to the dimensions of the precast barrel section joint shall be used to form a joint groove in the manhole base prior to setting the first barrel section. All joint surfaces of precast sections and the manhole base shall be thoroughly clean prior to setting precast sections. These various sections shall be set in preformed plastic sealing gaskets conforming to Fed. Spec. SS-S-00210. Installation of gaskets shall conform to the following procedures:

1. Apply one coat of primer to clean, dry joint surface (both tongue and groove) and allow to dry. Remove the paper wrapper from one side only of the two-piece wrapper on the gasket. The outside paper will protect the gasket and assure against stretching. Before setting the manhole section in the trench, attach the plastic gasket strips end to end to the tongue or groove of each joint, forming a continuous gasket around the entire circumference of the manhole joint.

2. Handling of barrel sections after the plastic gasket has been affixed shall be carefully controlled to avoid bumping the gasket and thus displacing it or covering it with dirt or other foreign materials. Any gaskets so disturbed shall be removed and replaced if damaged and repositioned if displaced.

3. Care shall be taken to properly align the manhole section with the previously set section before it is lowered into position.

4. During cold, wet weather, pass direct heat over the concrete joint surface lightly until ice, frost and moisture are removed and surface to be primed is dry and warm immediately before application of primer. Direct heat shall also be passed over plastic gasket strips immediately prior to attaching them to joint surfaces and immediately prior to installation of tongue into groove.

D. Adjusting or Repairing Manholes - All workmanship and materials shall conform to these Standard Specifications and to the Standard Drawings of the District. In the case of existing brick or cast-in-place concrete manholes, repair or adjustment in kind or with precast elements may be permitted upon approval of the Engineer. Existing standard undamaged frames and covers may be reinstalled unless otherwise directed by the Engineer. Cast iron extension rings may be used for adjusting manhole covers to grade where the completed manhole throat will not exceed eighteen (18) inches in depth. Where the completed manhole throat will exceed eighteen (18) inches, adjustment shall be made by removing the upper portion of the manhole down to the first barrel section. Precast concrete barrel and cone sections shall be used to reconstruct the upper portion of the manhole in accordance with the Standard Drawings. Before any work is started on adjusting or repairing a manhole, the channels in the base shall be covered with plywood or a similar material and then the entire base covered with a heavy piece of canvas temporary debris cover. This temporary debris cover shall be kept in place during all work, and upon completion, picked up containing all debris. The canvas and the plywood shall be carefully removed from the manhole allowing no debris to fall or to remain in the manhole.

23-16 Other Standard Structures. All other standard structures to be made of concrete shall be constructed in accordance with this section and as detailed in the Standard Drawings.

23-17 Temporary Covers and Plugs For Structures. Temporary steel covers of approved design shall be temporarily used during construction in subdivisions or other areas where final grades for unfinished roadbeds have not been determined, or where approved or ordered by the Engineer.

A temporary debris cover, as described in Section 23-15D, shall be placed over the base of any existing manhole prior to beginning any adjustment or repair work.

Temporary plugs of burlap or similar approved material shall be tightly packed into the open end of the sewer line while adjusting or repairing rodding inlets, pressure reliefs, or other similar structures.

23-18 Surface Finishes. The following specifications set forth the requirements for the classes of surface finish, which shall be applied to the various parts of concrete structures.

Unless otherwise specified on the plans, in the Special Provisions, or directed by the Engineer, the wearing surfaces of concrete steps and concrete walkways, together with the top surfaces of all floors of structures and slabs shall be given a monolithic finish. All surfaces to be finished shall be thoroughly worked and brought to a uniform steel trowel finish. In addition, where directed by the Engineer, stair treads, landings, walkways or floors shall be given a brush or broom finish. All floor surfaces shall be marked off in squares of appropriate size as directed by the Engineer.

A. Ordinary Surface Finish - Ordinary Surface Finish shall be applied to all concrete surfaces either as a final finish or preparatory to a higher class finish. On surfaces which are to be buried underground and are in contact with the ground or specified backfill, the removal of fins and form marks and the rubbing of mortared surfaces to a uniform color will not be required. Unless otherwise specified, Ordinary Surface Finish shall be considered as a final finish.

During the pouring of concrete, care shall be taken that the methods of compaction used will result in a surface of even texture free from voids, water or air pockets, and that the coarse aggregate is forced away from the forms in order to leave a mortar surface. Spades or broad-tined forks shall be provided and used if and as required by the Engineer to produce the desired results.

Immediately after the forms have been removed, all form bolts shall be removed to a depth of at least one (1) inch below the surface of the concrete. All holes and depressions caused by the removal or setting back of such form bolts shall be cleaned and filled with a Class II mortar of

matching color. Care shall be exercised to obtain a perfect bond with the concrete. All fins caused by form joints, and other projections shall be removed and all pockets cleaned and filled. Cement mortar for filling pockets shall be treated as specified for bolt holes. In the judgement of the Engineer, if rock pockets are of such an extent or character as to affect the strength of the structure materially or to endanger the life of the steel reinforcement, he may declare the concrete defective and require the removal and replacement of that portion of the structure affected.

Holes or depressions in surfaces which are to receive Class 1 Surface Finish shall be cleaned and filled with mortar at least seven (7) days prior to starting Class 1 Surface Finish. Exposed mortar shall be wetted with water at intervals during the day for two (2) consecutive days after placing. After the mortar has thoroughly hardened, the surface shall be rubbed with carborundum as required to match the texture and color of the adjacent concrete.

B. Class 1 Surface Finish - The application of Class 1 Surface Finish shall result in obtaining smooth, even surfaces of uniform texture and appearance, free of unsightly bulges, depressions and other imperfections. The degree of care in building forms and character of materials used in form work will be a contributing factor in the amount of additional finishing required to produce smooth even surfaces of uniform texture and appearance, free of unsightly bulges, depressions and other imperfections, and the Engineer shall be the sole judge in this respect.

Unless otherwise indicated on the plans or in the Special Provisions, all exposed interior and exterior concrete surfaces of all treatment plant and pumping station structures shall be given a Class 1 Surface Finish as a final finish.

After completion of the Ordinary Surface Finish, areas which do not exhibit the required smooth, even surface of uniform texture and appearance shall be sanded with power sanders or other approved abrasive means until smooth, even surfaces of uniform texture and appearance are obtained. The use of power carborundum stones or disks will be required to remove bulges and other imperfections. Class 1 Surface Finish shall not be applied until a uniform appearance can be obtained.

23-19 Waterproofing. When called for on the plans or in the Special Provisions, waterproofing of the type specified shall be installed in accordance with the requirements of Section 54 of the State Standard Specifications.

23-20 Measurement and Payment. Quantities of concrete used in structures shall, unless otherwise specified in the Special Provisions, be included as part of the complete structure, and the price paid for the structure in place shall include all concrete complete in place. Quantities of concrete used in work such as Concrete Jackets or Concrete Encasements shall be measured by the linear foot in place, or in special cases by the cubic yard. Where concrete is to be measured by the cubic yard, truck tags for individual loads indicating where and how used must be delivered to the Engineer each day.

PART E - TECHNICAL CONSTRUCTION REQUIREMENTS

Full compensation for drilling holes and furnishing and placing cement grout for grouting steel dowels in existing structures that are to be extended, and full compensation for furnishing and placing expansion joint filler, including all incidental work in connection therewith, shall be considered as included in the unit price or prices paid for the various contract items of work and no additional compensation will be made therefor.

Full compensation for furnishing all materials and doing all the work in connection with installing drains and rock backing where specified, shall be considered as included in the prices paid for the various items of work and no additional allowance will be made therefor.

The unit price for manholes and drop manholes shall include excavation, concrete forms, reinforcing steel, castings, precast concrete items, construction of inverts, backfill, surface replacement, temporary and permanent paving, and all labor, equipment and material necessary for completion of the structure in accordance with the plans and specifications.

SECTION 24 CASTINGS AND METAL FABRICATIONS

24-01 Description. Castings and metal fabrications shall be constructed in accordance with the details shown on the plans, Standard Drawings and as hereinafter specified. The Contractor shall install or erect the metal work, remove the temporary construction, including the removal of the old structure or structures if specified, in accordance with the plans, these specifications and the Special Provisions.

24-02 Materials. The various materials shall conform to the requirements of the specifications of the ASTM as listed in the following tabulation with certain modifications and additions as specified later in this section.

MATERIAL	ASTM DESIGNATION
Structural steel	A-36
Structural silicon steel	A-94
Structural nickel steel	A-8
Low alloy structural steel for welding	A-242
Structural steel for welding	A-373
High-strength structural rivet steel	A-502
Bolts and nuts	A-307
Black steel pipe (std. wt. seamless)	A-120
Carbon steel for forgings	A-235, Class C1
Alloy steel for forgings	A-237, Class A
Cast steel	A-27, Grade 65-35
Cast iron	A-48, Class 30
Malleable iron castings	A-47, Grade No. 32510
Bronze castings	B-22, Class C
Aluminum Alloy GS11A-T6	B-209
Stainless steel forgings	A-473

PART E - TECHNICAL CONSTRUCTION REQUIREMENTS

Materials used in the manufacture of corrugated metal pipes shall conform to AASHO Designation: M-36.

Where the Contractor has been granted permission to substitute rolled stock for forgings, the rolled stock shall meet the physical and chemical requirements for forged steel.

24-03 Castings. To insure good annealing and machining properties in steel castings, the steel used shall contain not less than 0.60 percent of manganese and not less than 0.20 percent of silicon.

All castings shall be sound and free from shrinkage cracks, blow holes, and other defects. All fins and burnt sand must be removed. Excessive porosity and spongy surfaces will constitute causes for rejection. The Engineer shall be final judge as to whether the defects present are sufficient to cause rejection.

No welding or patching of defects in castings will be permitted unless authorized by the Engineer. Any such welding or patching done without the Engineer's consent shall be cause for rejection.

All castings shall be true to the form and dimensions shown on the plans. After inspection and prior to shipping, all machined surfaces shall be coated with a blue rust inhibitive lacquer, or other approved material which can be easily removed, unless otherwise specified.

The dimensions of the finished casting shall not be less than the specified dimensions. Castings shall not be more than seven and one-half (7-1/2) percent overweight. Large castings shall be suspended and hammered over their entire area. No cracks, flaws, or other defects shall appear after such hammering.

24-04 Cast Iron Frames and Covers. Castings shall conform to the shape and dimensions shown on the Standard Drawings.

The cover and its seat in the frame shall be machined so that the cover will sit evenly and firmly in the frame.

Cast iron frames and covers shall be dipped or painted with asphalt which will form a tough, tenancious, non-scaling coating which does not have a tendency to become brittle when cold or sticky when hot.

24-05 Fillets. Steel, gray iron, malleable iron, and bronze castings shall be provided with adequate continuous fillets cast in place in all re-entrant angles. The radius of curvature of the exposed surface of a fillet shall define the size of the fillet.

The size of the fillets shall not be less than one-half (1/2) of the thickness of the thinnest adjoined member nor less than one-half (1/2) inch.

24-06 Manhole Steps. Manhole steps shall be fabricated from wrought iron bar and shall be hotdip galvanized after fabrication. See Standard Drawings for step dimensions and locations.

PART E - TECHNICAL CONSTRUCTION REQUIREMENTS

24-07 Metal Railings. Metal railings shall be of standard one and one-half (1-1/2") G.I. pipe, as detailed on the plans. They shall be neatly welded and finished and securely anchored in place in their designated locations. Pin connections shall be used wherever possible. A minimum of field welds shall be made. All steel railings shall be galvanized after fabrication.

The Contractor shall provide suitable chains with eyes welded to the end post of rail at one end and with snap catch and eye at the other end, at entrance to floor openings and wells within and adjacent to the structure. Chains and eyes shall be galvanized.

24-08 Straightening Material. If straightening is necessary, it shall be done by methods approved by the Engineer. Sharp kinks and bends may be cause for rejection of the material.

If straightening is necessary in the field, only methods approved by the Engineer shall be used.

Following the straightening of a bend or buckle, the surface of the metal shall be carefully inspected for evidence of fracture.

24-09 Match Marking and Finish. Connecting parts assembled in the shop for the purpose of reaming holes in field connections shall be match-marked, and a diagram showing such marks shall be furnished to the Engineer. Portions of the work exposed to view shall be finished neatly. Shearing and chipping shall be done carefully and accurately.

24-10 Bolts. Bolted connections shall be used unless otherwise shown on the plans or in the Special Provisions. Where bolted connections are required, the bolts shall be galvanized bolts or turned bolts, as specified. Bolts shall have hexagonal heads and nuts and shall be of such length that they will extend entirely through the nut but not more than one-quarter (1/4) inch beyond. Bolts in tension shall have two (2) nuts.

Unfinished bolts in shear shall have not more than one thread within the grip. The diameter of the unfinished bolt shall not be more than one thirty-second (1/32) inch smaller than the diameter of the hole.

The threads of turned bolts shall be entirely outside the grip. Approved nut locks or flat washers one-quarter (1/4) inch thick shall be furnished, as specified. The holes for turned bolts shall be reamed and the bolts shall be finished to provide a driving fit.

24-11 Finished Members. Finished members shall be true to line and free from twists, bends, and open joints.

24-12 Web Plates. In girders having no cover plates and not to be encased in concrete, the top edge of the web plate shall not extend above the backs of the flange angles and shall not be more than one-eighth (1/8) inch below at any point.

24-13 Eye Bars. Eye bars shall be straight, true to size, and free from twists, folds in the neck and head, and other defects. The heads

shall be made by upsetting and rolling or forging, and not by welding. The form of the heads will be determined by the dies in use at the work where the eye bars are made, if they are satisfactory to the Engineer. The thickness of the head and neck shall not overrun more than one-sixteenth (1/16) inch.

All eye bars that are to be placed side by side in any one group in the structure shall be bored so accurately that upon being placed together, pins one thrity-second (1/32) inch less in diameter than the pin holes will pass through the holes at both ends at the same time without driving.

24-14 Screw Threads. Screw threads shall make close fits in the nuts and shall be American National Form.

24-15 Bearings and Anchorage. During construction, the anchor bolts shall be placed within pipe sleeves as shown on the plans or as directed by the Engineer. The concrete bearing plates shall be set level and properly supported in exact position until fixed with portland cement grout. The grout, consisting of one part by volume of portland cement and two parts of clean sand, shall be forced under the plates so as to completely fill the pipe sleeves and to give a uniform and even bearing for the plates.

24-16 Cutting With Torch. The use of a cutting torch is permissible if the metal being cut is not carrying stress during the operations. The radius of re-entrant flame cut fillets shall be as large as possible, but never less than one (1) inch. To determine the net area of members so cut, one-eighth (1/8) inch shall be deducted from the flame cut edges. Stresses shall not be transmitted through a flame cut surface.

When cutting with a torch, cuts shall be true to line with a maximum deviation of one-sixteenth (1/16) inch. All burned edges shall be finished by grinding or chipping.

The use of the burning torch will be permitted on ends that form compression connections, providing a minimum of one-quarter (1/4) inch of metal is left to be removed by machining.

24-17 Welding. All welding shall be done by qualified welders in accordance with the requirements of the American Welding Society. Proposed operators may be examined at the site of the work and upon satisfactory completion of test welds, designated by the Engineer, may be permitted to perform welding operations on the project. All welding operators shall be subject to examination for requalification, at any time during the progress of the work.

Welding electrodes shall comply with the requirements of the ASTM Designation: A-233, except they shall be uniformly and heavily coated (not washed) and shall be of such nature that the coating will not chip or peel while being used with the maximum amperage specified by the manufacturer.

In welding metal which is to be galvanized, bare electrodes shall be used unless otherwise specified.

PART E - TECHNICAL CONSTRUCTION REQUIREMENTS

24-18 Galvanizing. When galvanizing is specified for structural steel shapes, manhole steps, plates and bars and their products, it shall be performed by the hotdip process after fabrication into the largest practical sections. The galvanizing shall conform to the requirements of the ASTM Designation: A-123. Fabrication shall include all operations such as shearing, punching, forming, bending, welding, riveting, etc. When it is necessary to straighten any sections after galvanizing, such work shall be performed without damage to the spelter coating.

Small structural steel or cast steel articles, such bolts, nuts, washers and similar articles that are to be galvanized, shall be galvanized after fabrication in accordance with the requirements of the ASTM Designation: A-153.

Galvanized surfaces that are abraded or damaged at any time after the application of the zinc coating shall be repaired by thoroughly wire brushing the damaged areas and removing all loose and cracked coating, after which the cleaned areas shall be painted with 2 coats of paint, high zinc dust content, conforming to the requirements of Fed. Spec. MIL-P-21035.

24-19 Painting. All iron and steel surfaces shall be cleaned and painted in accordance with the requirements of Section 26 of these specifications.

24-20 Removal of Old Fabrications and Falsework. The Contractor shall dismantle old structures which, unless otherwise provided in the Special Provisions, shall be the property of the District and the Contractor shall deliver the materials to the District. If a structure is to be re-erected, it shall be dismantled without unnecessary damage and the parts match marked and carefully piled.

The Contractor shall dismantle the falsework, and remove all debris and refuse resulting from his work leaving the premises in good condition.

24-21 Plant. The Contractor shall provide the falsework and all tools, machinery, and appliances necessary for the expeditious handling of the work. All falsework shall be designed and constructed to support the loads which will be applied.

Workmanship and finish shall be equal to the best general practice in modern shops.

24-22 Methods and Equipment. Before starting work, the Contractor shall inform the Engineer fully as to the method of erection or installation he proposes to follow, and the amount and character of equipment he proposes to use, which shall be subject to the approval of the Engineer. The approval of the Engineer shall not be considered as relieving the Contractor of the responsibility for the safety of his method or equipment or from carrying out the work in full accordance with the plans and specifications.

24-23 Inspection. All castings and fabrications shall be inspected and approved prior to installation.

PART E - TECHNICAL CONSTRUCTION REQUIREMENTS

The acceptance of any material or finished members by the Inspector shall not be a bar to their subsequent rejection, if found defective. Rejected material shall be replaced promptly or made good by the Contractor.

24-24 Payment. Unless otherwise specified, full compensation for furnishing all materials and doing all work in connection with castings and metal fabrications and other work covered by this Section shall be considered as included in the prices paid for the various items of work and no additional compensation will be allowed therefor.

SECTION 25 ABANDONMENT OF LINES AND STRUCTURES

25-01 Abandonment of Sewer Lines. Sewer lines to be abandoned shall be securely closed at all pipe openings by a watertight plug of concrete, or brick and cement mortar, not less than two (2) feet thick.

25-02 Structures to be Abandoned. Structures to be abandoned shall have all openings, inlets and outlets sealed off as set forth for sewer lines and the structure shall be removed to a point three (3) feet below the proposed street grade or ground surface and filled with intermediate backfill material, if structure is in State, City or County roadway right of way, or filled with earth and compacted if structure is outside of State, City or County roadway right of way.

25-03 Salvaged Materials. Salvaged metal castings such as frames and covers and other metal appurtenances, unless otherwise specified, shall be delivered to the District yard, 500 Davidson Street, Novato.

25-04 Payment. The price paid for abandonment, when included in the bid proposal, shall include full compensation for furnishing all labor and materials, including tools and equipment, and doing all work involved in complete abandonment of lines and/or structures as specified.

When the bid proposal does not include a contract pay item for abandonment, full compensation for all work involved shall be considered as included in the prices paid for the various contract items of work and no additional compensation will be allowed therefor.

SECTION 26 PAINTING

26-01 Description. Painting shall include the furnishing of all plant, labor, equipment, appliances, and material and the performing of all operations in connection with the preparation of surfaces, application of all paint or other materials and the manufacture of paints, paint materials and miscellaneous materials incidental thereto. Surfaces to be painted shall receive the treatment and the number of coats prescribed herein, or as detailed on the plans or in the Special Provisions. Paint colors shall be those specified and approved by the Engineer.

PART E - TECHNICAL CONSTRUCTION REQUIREMENTS

26-02 Standard Products. All materials, supplies and articles furnished shall, wherever practicable, be the standard product of a recognized, reputable manufacturer. The standard products of manufacturers other than those specified will be accepted when it is proved to the satisfaction of the Engineer that all paint materials comply fully with the specifications

26-03 Preparation of Surfaces. All surfaces to be painted shall be thoroughly cleaned before applying paint or surface treatments.

Clean cloths and clean fluids shall be used in solvent cleaning to avoid leaving a thin film of greasy residue. Cleaning and painting shall be so programmed that dust or spray from the cleaning process will not fall on wet, newly painted surfaces. Hardware, and similar accessories shall be removed or suitably masked during preparation and painting operations, or shall otherwise be satisfactorily protected.

In all cases the recommendations of the paint manufacturer shall be rigidly followed in the preparation of surfaces prior to painting.

After the Contractor has completed the job of preparing all surfaces to be painted, the surfaces shall be inspected and approved by the Engineer prior to the application of any paint.

A. Metal Surfaces - All metal surfaces to be painted shall be completely clean and free of all oil, grease, dirt, rust, loose mill scale, old weathered paint, and other foreign substances. The removal of oil and grease shall, in general, be accomplished by sandblasting. Minor amounts of grease and oil contaminants will be tolerated on the surface, prior to sandblasting, provided that the abrasive is not reclaimed and reused. All metal surfaces to be painted with coal tar epoxy must be cleaned by sandblasting. All galvanized metal shall be thoroughly washed with neutralizing solution prior to painting.

B. Concrete Surfaces - All concrete surfaces to be painted shall be completely clean and free of all oil, grease, dirt, etc., and shall be completely wire brushed to remove any loose concrete or paint and all cracks shall be patched to the satisfaction of the Engineer. All concrete surfaces to be painted, with the exception of those surfaces to receive a coal tar derivative product shall be properly neutralized with an appropriate wash in accordance with the recommendations of the paint manufacturer. Surfaces to be painted with coal tar epoxy shall be sandblasted to remove the smooth surface mortar in accordance with the recommendations of the paint manufacturer.

26-04 Paint Application.

A. Workmanship - All work shall be done in strict accordance with the instructions of the paint manufacturer and in a workmanlike manner so that the finished surfaces will be free from runs, drops, ridges, waves, laps and unnecessary brush marks. All coats shall be applied in such manner as to produce an even film of uniform thickness completely coating all corners and crevices. All painting shall be done by thoroughly experienced workmen. Care shall be exercised during spraying to hold the nozzle

sufficiently close to the surfaces being painted to avoid excessive evaporation of the volatile constituents and loss of materials into the air, or the bridging over of crevices and corners. Spray equipment shall be equipped with mechanical agitators, pressure gauges, and pressure regulators. Nozzles shall be of proper size. Floors, roofs, and other adjacent areas and installations shall be satisfactorily protected by drop cloths or other precautionary measures. All overspray shall be removed by approved method or the affected surface repainted.

The Engineer shall be notified when each coat has been applied and is ready for inspection. Until each coat has been inspected and approved by the Engineer, no succeeding coats shall be applied.

B. Atmospheric Conditions - Except as specified or required for certain water-thinned paints, paints shall be applied only to surfaces that are thoroughly dry and only under such combination of humidity and temperatures of the atmosphere and surfaces to be painted as will cause evaporation rather than condensation. In no case shall any paint at all be applied during rainy, misty weather or to surfaces upon which there is frost or moisture condensation, without suitable protection as approved by the Engineer. Where painting is permitted during damp weather, or when the temperature is at or below 50°F, the surfaces shall be heated to prevent moisture condensation thereon. Bare metal surfaces, except those which may be warped by heat, may be dehydrated by flame-heating devices immediately prior to paint application. While any painting is being done, the temperature of the surfaces to be painted and of atmosphere in contact therewith, shall be maintained at or above 50°F, except where paints are being used which dry solely by evaporation, in which case the temperature of the air and surface may be 35°F or as approved by the Engineer. All paint when applied shall be approximately the same temperature as that of the surface on which it is applied.

C. Protection of Painted Surfaces - Where protection is provided for paint surfaces, such protection shall be preserved in place until the paint film has properly dried, and the removal of the protection is authorized. Items which have been painted shall not be handled, worked on or otherwise distrubed until the paint coat is completely dry and hard. After delivery at the site, all shop coated metalwork shall be repainted or retouched from time to time with specified paint, whenever in the opinion of the Engineer, it becomes necessary to maintain the integrity of the film.

26-05 Coating Systems.

Coating System Designation	Paint Specification
A	One (1) coat of Porter "284 Versa Prime", or approved equal, followed by two (2) coats of Porter "I.A.-24 Gloss" enamel, or approved equal. Completed surfaces shall have a dry mil thickness of at least 5. Primer and enamel may be brushed or sprayed, except where spraying of enamel is required by the Engineer. On galvanized metal, use Porter "45 Galvaprep" prior to application of primer. On all other nonferrous metals, use Porter "V.C.-17 Wash Primer", or approved equal.

Coating System Designation	Paint Specification
B	Two (2) coats of Porter "200 Masonry" paint, or approved equal. Both coats must be brushed. Application shall be not more than 1 gallon for each 200 square feet.
C	Two (2) coats of Porter "200 C.R.-11 High Build" paint, or approved equal, followed by one (1) coat of Porter "C.R.-11 High Build" masonry paint semi-gloss, or approved equal. First coat must be brushed, the second and third coats shall be sprayed. Application shall be at not more than 1 gallon for each 200 square feet.
D	Two (2) coats of Porter "Tarset C-200E", or approved equal. Completed surfaces shall have a dry mil thickness of at least 16. May be brushed or sprayed. First coat to be applied same day as surface preparation and second coat within 5 to 24 hours of first coat.
E	One (1) coat of Porter "284 Versa Prime", or approved equal, followed by two (2) coats of Porter "Tarmastic 103", or approved equal. Completed surfaces shall have a dry mil thicknes of at least 20. On galvanized metal, use Porter "45 Galvaprep" prior to application of primer. On all other non-ferrous metals, use Porter "V.C.-17 Wash Primer", or approved equal.

26-06 Painting Schedule. Various items shall be painted in accordance with the painting schedule given below. Coating systems refer to those listed in Section 26-05 above.

Item Description	Coating System Designation
All exposed interior and exterior metal-work, machinery, pipe, valves and fittings, bolts, nuts, hangers, clamps, etc.	A

PART E - TECHNICAL CONSTRUCTION REQUIREMENTS

Item Description	Coating System Designation
All exposed exterior concrete surfaces such as pump station and structure walls, etc.	B
All interior concrete surfaces such as pump station and structure walls and ceilings, etc. (not floors).	C
All metalwork submerged or exposed to moisture or sewage such as weirs, gates, pipework, etc.	D
All submerged concrete surfaces such as pump station wet wells, etc. (not std. manholes).	D
Miscellaneous iron and steel surfaces in underground pipeline installations such as welded connections, valves, "Dresser" couplings, etc.	E
Underground surfaces of steel structures and access tubes used for pump stations, etc.	D

26-07 Cleanup. Upon completion of his work, the painting contractor shall remove his surplus materials. All paint spills shall be removed and the entire premises shall be free from rubbish, debris, etc., caused by his work. He shall present the work clean and free from blemish so that it is acceptable in every way. All glass shall be cleaned of paint spots and polished, and the job made ready for occupancy.

26-08 Payment. Full compensation for furnishing all labor, materials, tools and equipment and doing all the work involved in painting, including all incidental work connected therewith, shall be included in the prices paid for the various contract items of work and no additional allowance will be made therefor.

SECTION 27 AGGREGATE BASE

27-01 Aggregate Base. Aggregate base shall consist of mineral aggregate, furnished and placed on prepared subbase or as backfill in conformity with the lines, grades and dimensions shown on the plans, Standard Drawings or Special Provisions, or as directed by the Engineer.

Materials, subgrade preparation, compaction and measurement shall conform to the requirements of Section 26, Aggregate Bases, of the State Standard Specifications.

Aggregate base shall be Class 2, conforming to the grading specified for one and one-half (1-1/2) inch maximum aggregate.

Unless otherwise stated in the Special Provisions, compensation for furnishing all materials, including water for compaction and maintenance,

labor, tools and equipment, and doing all work involved in placing aggregate base shall be included in other contract items of work, and no additional allowance will be made therefor.

SECTION 28 BITUMINOUS SEALS

28-01 Seal Coats. Seal coats shall consist of an application or applications of bituminous binder and a cover of screenings or an application of bituminous binder without screenings, applied to pavement, prepared base, or surfacing in accordance with the requirements of Section 37, Bituminous Seals (Seal Coats), of the State Standard Specifications.

Immediately before applying the bituminious binder for seal coats, the surface to be sealed shall be cleaned of all dirt and loose material.

Unless otherwise indicated on the plans, in the Special Provisions or directed by the Engineer, the seal coat type shall be a "Fine Seal Coat". Bituminous binder shall be RS-1 or SS-1 emulsified asphalt conforming to the provisions of Section 94 of the State Standard Specifications. It shall be uniformly applied at the rate of approximately 0.10 gallon per square yard. Sand used for sealing shall be clean river sand free from all organic matter and other deleterious substances. It shall meet all the requirements for Portland Cement Concrete fine aggregate as specified in Section 90-3.03 of the State Standard Specifications. Sand shall be spread uniformly and in sufficient quantity that no bleeding of the binder may be seen.

Should the Special Provisions specify a fog seal it shall be SS-1 emulsified asphalt conforming to the provisions of Section 94 of the State Standard Specifications. It shall be diluted with water by approximately, but not more than fifty (50) percent. The mixture shall be applied uniformly at a rate of 0.10 gallon per square yard.

Unless otherwise specified in the Special Provisions and bid proposal, full compensation for furnishing all labor, materials, tools and equipment and doing all the work involved in applying the seal coat and all incidental work connected therewith, shall be included in the prices paid for the various contract items of work and no additional compensation will be allowed therefor.

SECTION 29 ASPHALT CONCRETE SURFACING

29-01 Description. This work shall consist of furnishing and applying prime coat and tack coat; furnishing, spreading, and compacting asphalt concrete; furnishing and applying seal coats; and performing all incidental work as specified.

29-02 Penetration Treatment (Prime Coat). Whenever asphalt concrete surfacing is to be placed on a base which has not previously been paved, the base shall be treated with a prime coat conforming to the following provisions.

Immediately in advance of applying the prime coat the surface of the base shall be cleaned of all dirt and loose material.

The liquid asphalt to be used shall be MC-70 or MC-250 conforming to the provisions of Sections 92 and 93 of the State Standard Specifications, unless otherwise directed by the Engineer. It shall be spread uniformly over the area to be paved at a rate of approximately 0.25 gallon per square yard. Excess liquid asphalt which has failed to penetrate the base shall be covered with fine sand. All loose sand shall be removed from the treated areas before placing any surfacing material thereon. Liquid asphalt shall not be applied when the atmospheric temperature is below 50°F. The prime coat shall be applied at least 24 hours in advance of paving.

Immediately in advance of placing asphalt concrete surfacing, additional prime coats shall be applied, as directed by the Engineer, to areas where the prime coat has been damaged.

29-03 Paint Binder (Tack Coat). Whenever asphalt concrete is to be placed over or against existing asphalt surfacing or concrete, the surface on or against which it is to be placed shall be treated with a tack coat conforming to the requirements specified herein. The application of a tack coat on newly placed asphalt concrete prior to placing another layer on top may be deleted only with the permission of the Engineer.

Immediately in advance of applying the tack coat, the surface to be covered shall be cleaned of all dirt and loose material. The emulsified asphalt to be used shall be RS-1, SS-1, SS-1H, SS-K or SS-KH, conforming to the provisions of Sections 92 and 94 of the State Standard Specifications. It shall be spread uniformly over the area to be paved at a rate of 0.10 gallon per square yard. Emulsified asphalt shall not be applied when the atmospheric temperature is below 40°F.

29-04 Asphalt Concrete Materials and Installation. Asphalt concrete surfacing shall consist of a mixture of mineral aggregate and bituminous binder, mixed, spread and compacted in accordance with the requirements of Section 39, Asphalt Concrete, of the State Standard Specifications.

Unless otherwise specified by the Engineer, asphalt concrete shall be Type "B"; bituminous binder for permanent paving shall be paving asphalt having a penetration of 85-100; bituminous binder for temporary paving shall be liquid asphalt, Grades MC-3 or MC-4; and the combined mineral aggregate shall conform to the grading specified for one half (1/2) inch maximum aggregate.

29-05 Seal Coat. Unless otherwise specified in the Special Provisions, all asphalt concrete surfacing shall be sealed with a sand seal coat as specified in Section 28.

29-06 Payment. Unless otherwise specified in the Special Provisions and bid proposal, full compensation for furnishing all materials, labor, tools and equipment, and doing all work involved in placing asphalt concrete surfacing, including preparing subgrade, placing prime coat and tack coat, and placing seal coat shall be included in the prices paid for the various contract items of work and no additional compensation will be allowed therefor.

PART F - STANDARD DRAWINGS

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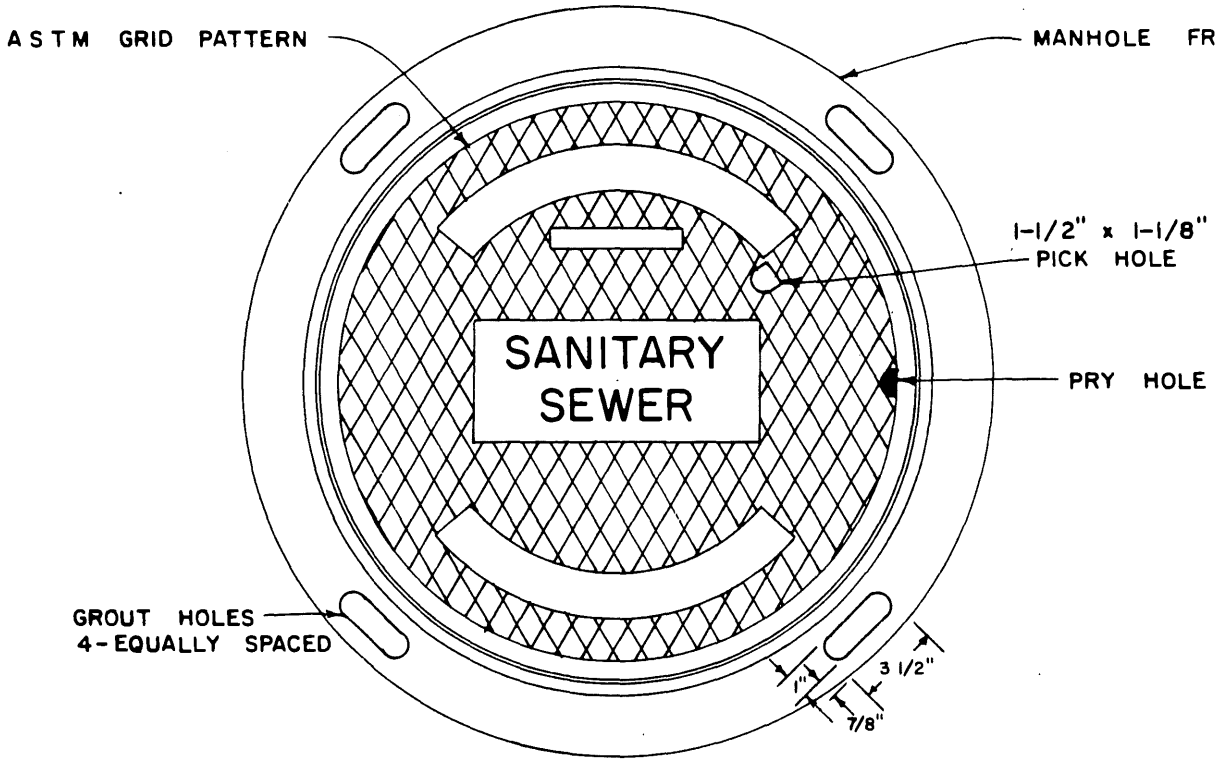
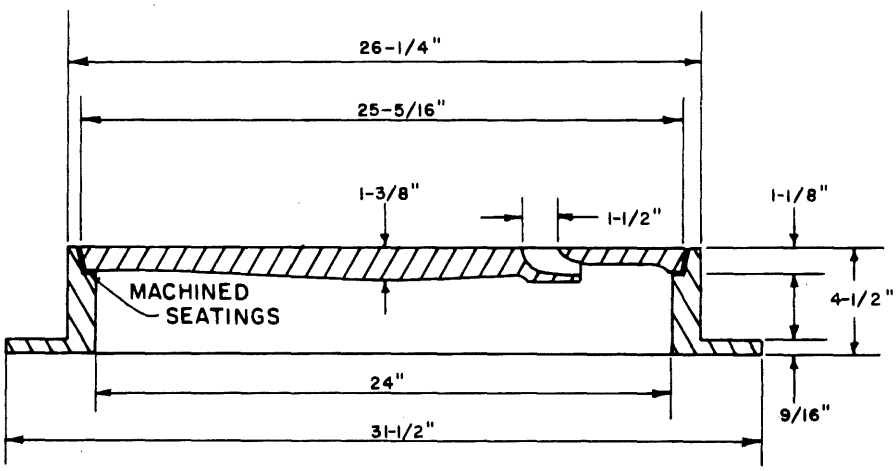


PLAN



SECTION THRU FRAME AND COVER

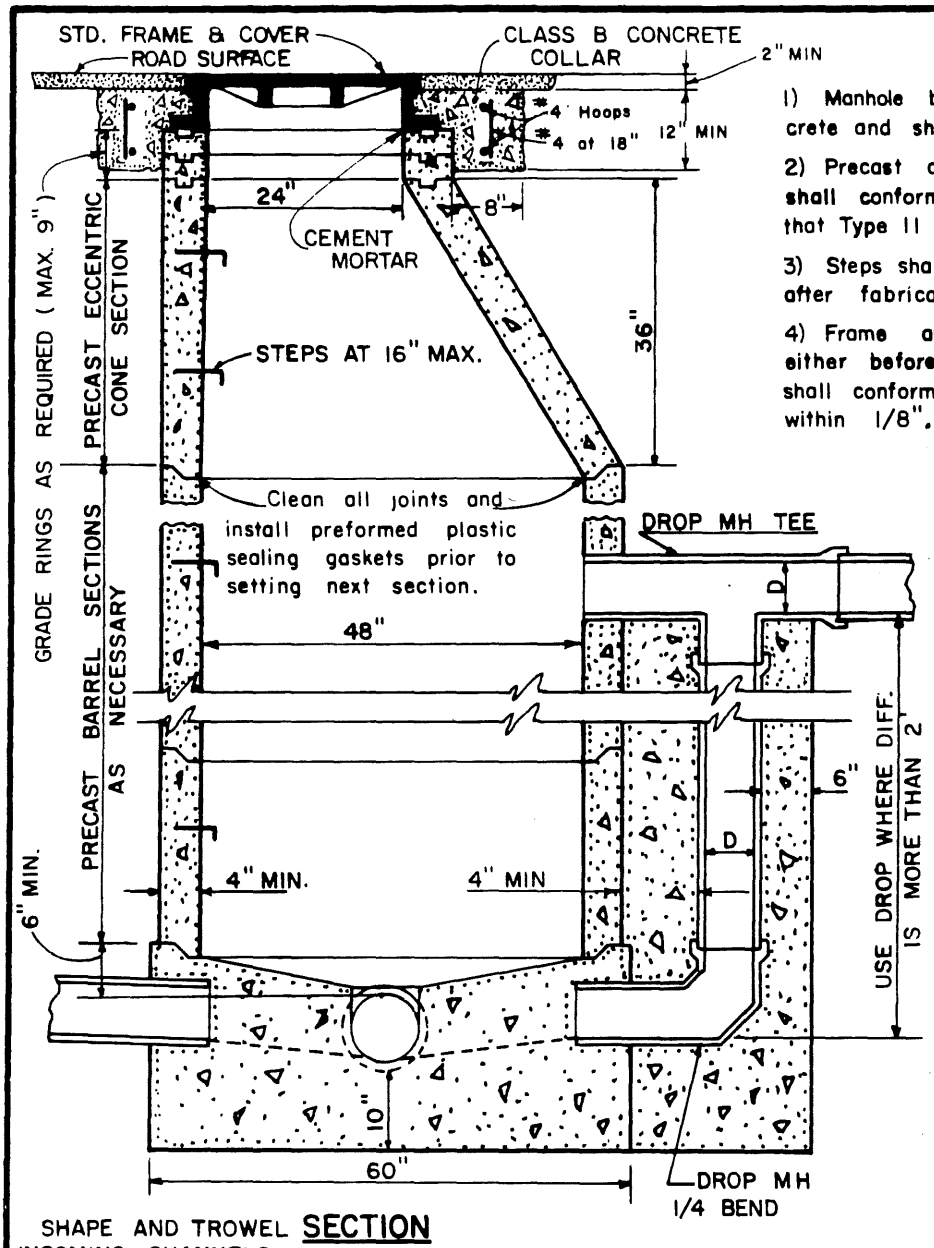
NOTES:

1) Manhole Frame and Cover shall be as manufactured by Phoenix Iron Works, Oakland, No P-1090 or approved equivalent.

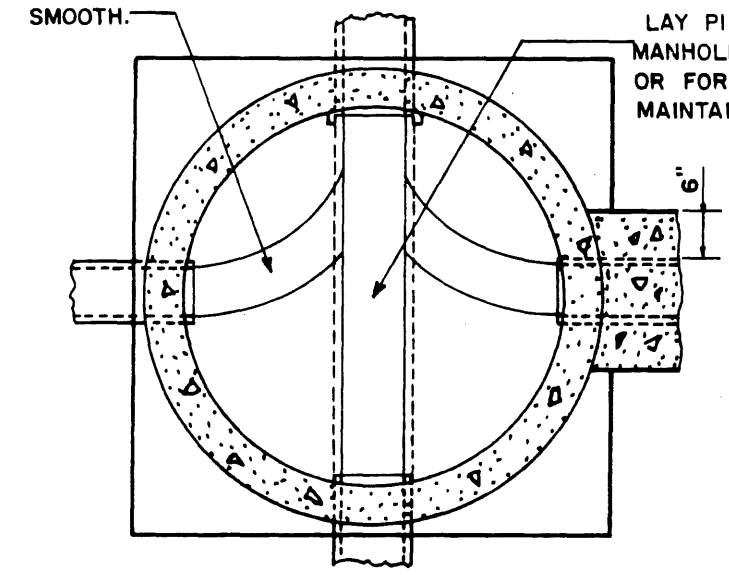
2) For manholes located in sidewalk areas use Phoenix No P-1067 Frame and Cover or approved equivalent.

3) Minimum weight of frame is 138 lbs. Minimum weight of cover is 130 lbs.

NOVATO SANITARY DISTRICT Sanitary District No. 6 MARIN COUNTY, CALIFORNIA		
STANDARD MANHOLE FRAME AND COVER		
DRAWN BY RLB	APPROVED BY: MANAGER-ENGINEER	DRAWING NO. SDI
DATE: 4-1-75		



SECTION



PLAN OF BOTTOM

NOTES

1) Manhole base shall be Class A (6-sack) concrete and shall be poured against undisturbed soil.

2) Precast concrete cone, barrel and grade rings shall conform to A.S.T.M. Spec. C-478, except that Type II Modified portland cement shall be used.

3) Steps shall be 3/4" steel rod, galvanized after fabrication.

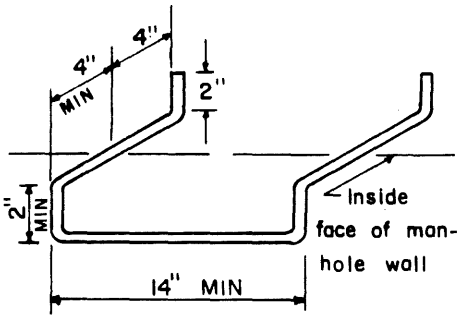
4) Frame and cover may be adjusted to grade either before or after paving, but final grade shall conform to adjacent finish pavement grade within 1/8".

5) Eccentric cone section shall be positioned as directed by the District Engineer.

6) Where frame and cover is set after paving, the concrete collar shall be brought to finish grade and the exposed concrete surface shall be colored with SS-1 paving oil before the concrete has set.

7) Recess in manhole base shall be formed with an approved metal forming ring to receive precast manhole joint. Preformed plastic seal gasket shall be installed before placing first barrel section.

8) Reinforcing steel shown in collar need be installed only when manhole is located outside paved areas. In these locations the top surface of the collar shall be brought to finish grade and outside edge shall be formed to circular shape.



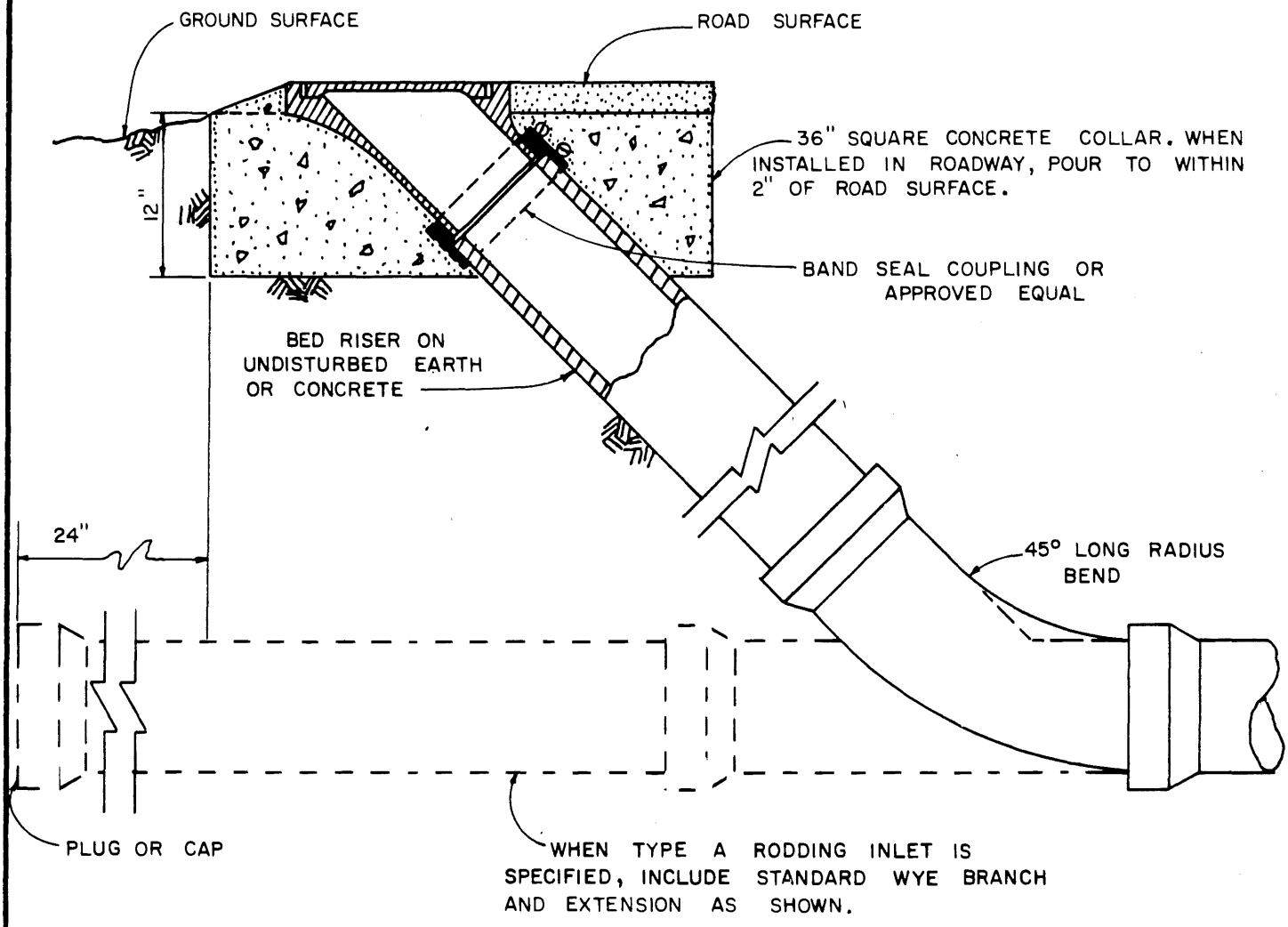
STEP DETAIL

⚠	Revised Note 7, Added Note 8	4-1-75

NOVATO SANITARY DISTRICT
Sanitary District No. 6
MARIN COUNTY, CALIFORNIA

STANDARD SEWER MANHOLE

DRAWN: RLB	APPROVED BY:	DWG. NO.
DATE: 5-24-68	Manager - Engineer	SD2



NOTES:

1) Frame and cover shall be Phoenix No. 7103 or approved equal.

2) Concrete shall be Class A (6-sack mix).

3) Backfill shall not be placed until pipe installation has been inspected and approved.

4) Frame and cover may be adjusted to grade either before or after paving, but final grade shall conform to adjacent finished pavement grade within 1/8".

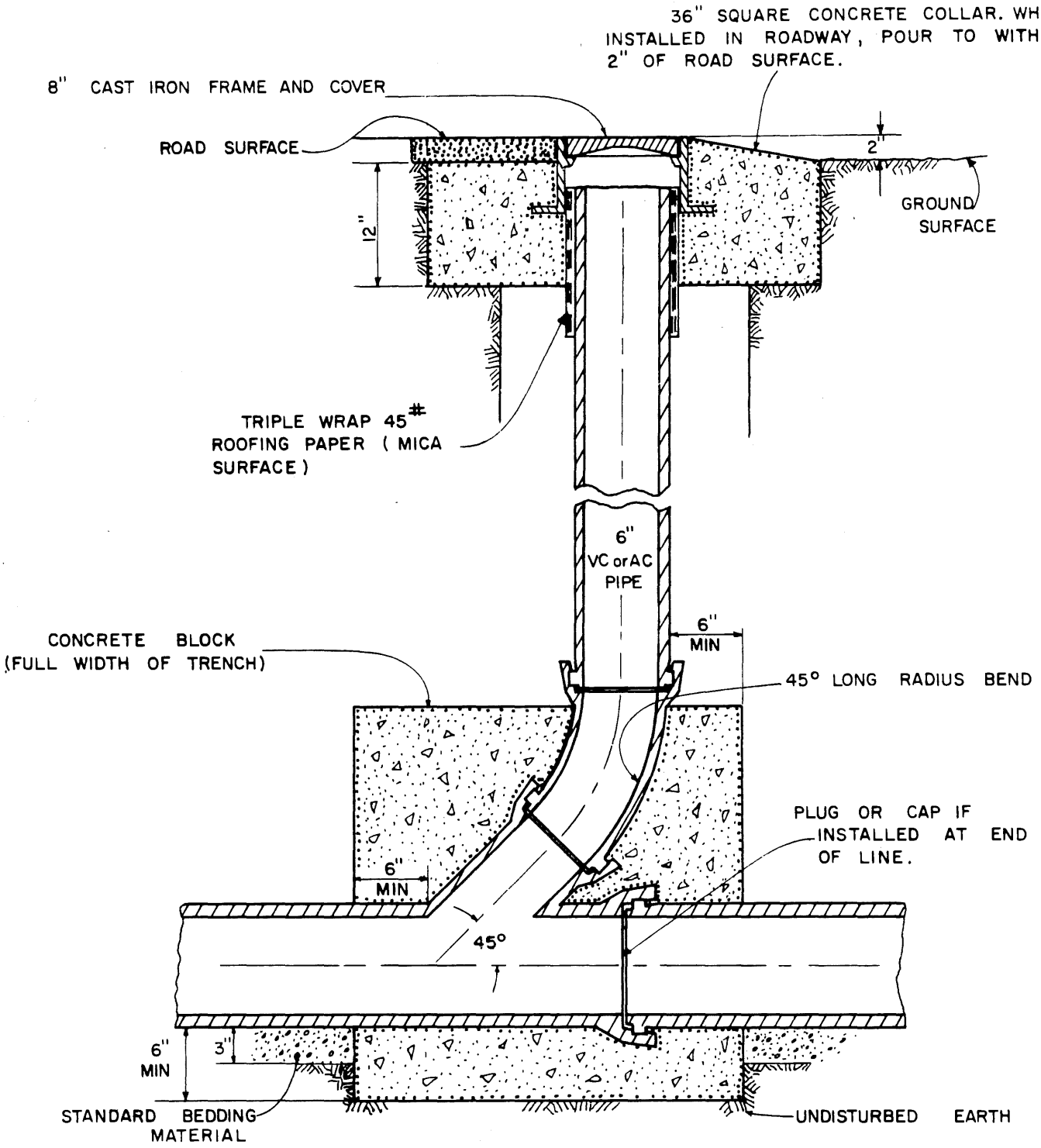
5) Type A Rodding Inlet shall be installed when shown on plans or as required by the District Engineer.

1	Changed Frame & Cover — Phoenix	4-1-75

NOVATO SANITARY DISTRICT
Sanitary District No. 6
MARIN COUNTY, CALIFORNIA

STANDARD 6 INCH RODDING INLET

DRAWN: RLB	APPROVED BY: Manager - Engineer	DWG. NO. SD3
DATE: 5-28-68		



NOTES:

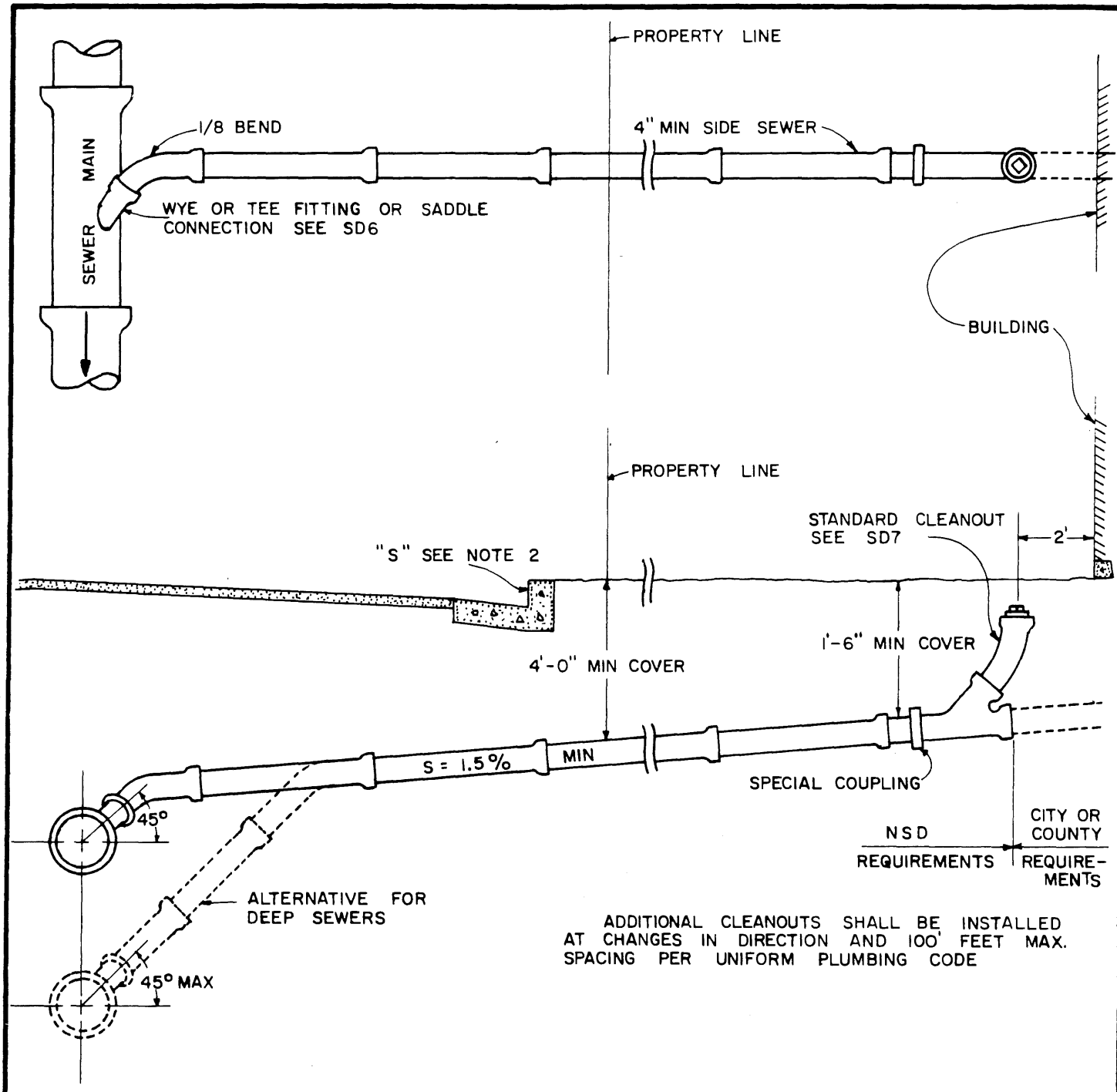
1. Frame and cover shall be Phoenix No. 2501 or approved equal.
2. Concrete shall be Class A (6-sack mix).
3. Backfill shall not be placed until pipe installation has been inspected and approved.
4. Frame and cover may be adjusted to grade either before or after paving, but final grade shall conform to adjacent finish pavement grade within 1/8".

1	Changed Frame & Cover – Phoenix	4-1-75

NOVATO SANITARY DISTRICT
Sanitary District No. 6
MARIN COUNTY, CALIFORNIA

STANDARD 6 INCH FLUSHING INLET

DRAWN: RLB	APPROVED BY:	DWG. NO.
DATE: 7-12-68	Manager - Engineer	SD4



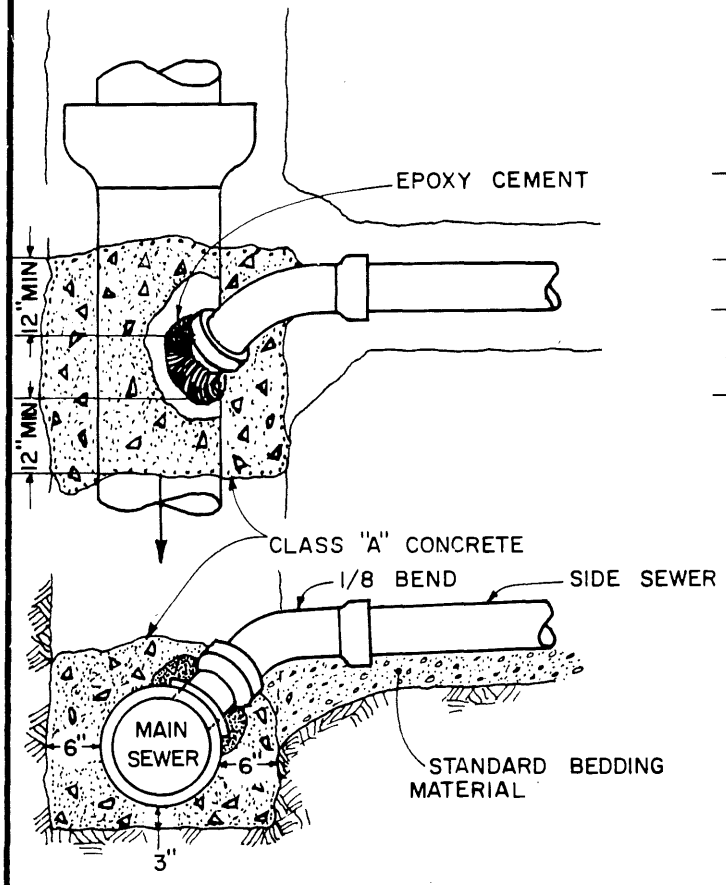
NOTES:

1. When a lateral sewer is installed in advanced of the building sewer, it shall be terminated at or near the property line. The end of the lateral shall be marked with a 2" x 2" redwood stake from the top of pipe to a point 6" below the finished ground surface.
2. Where concrete curbs and gutters exist or are to be part of an improvement, each side sewer shall be permanently located by imprinting or chiseling an "S" (3" size) in the face of the curb vertically above the sewer pipe.
3. Backfill shall not be placed until pipe installation has been inspected and approved.

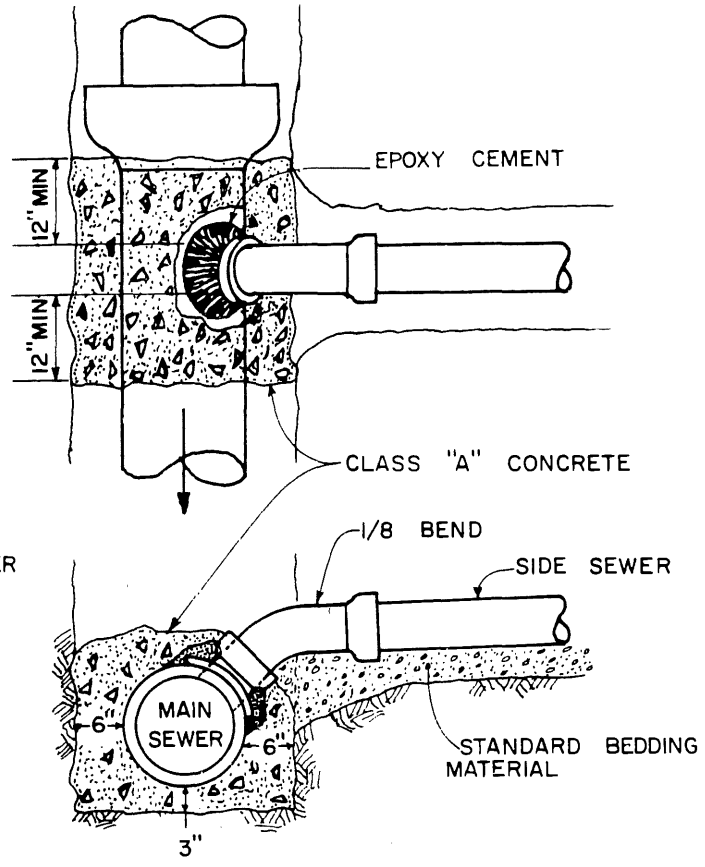
NOVATO SANITARY DISTRICT
Sanitary District No. 6
MARIN COUNTY, CALIFORNIA

TYPICAL SIDE SEWER DETAILS

DRAWN: RLB	APPROVED BY: Manager - Engineer	DWG. NO. SD5
DATE: 11-15-68		



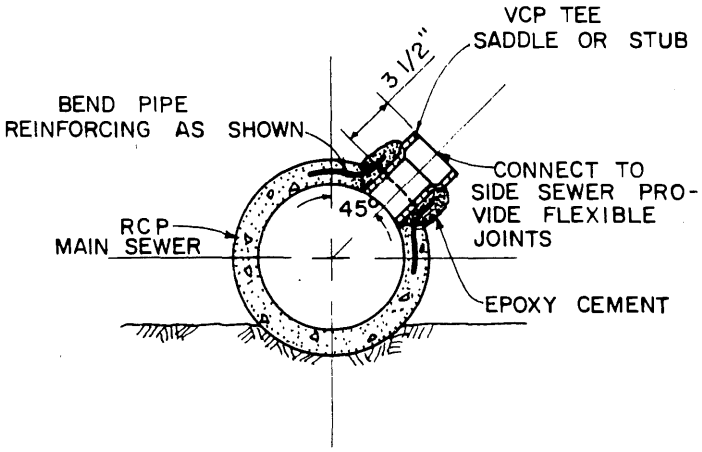
COLLAR WYE SADDLE



COLLAR TEE SADDLE

NOTES:

1. For further details on saddle connections, see Section 20-03E of the Standard Specifications.
2. The epoxy cement used shall be Johns-Manville "Joint Master" or approved equivalent.
3. No pipe shall be connected to the saddle fitting until the installation has been inspected and approved by the District Inspector.
4. When side and main sewers are equal in diameter, a standard wye branch (same type as main sewer) shall be installed in the main sewer.
5. Saddle connections shall be made only by licensed contractors.



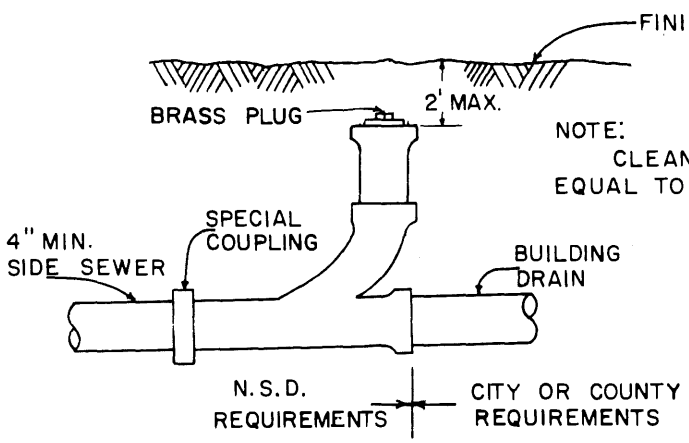
CONNECTION TO R.C.P.

NOVATO SANITARY DISTRICT
Sanitary District No. 6
MARIN COUNTY, CALIFORNIA

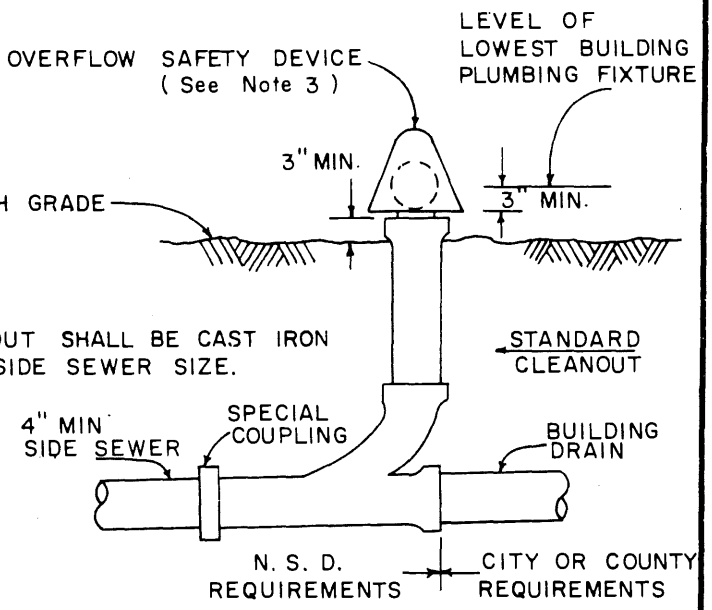
SADDLE CONNECTION DETAILS

DRAWN: RLB	APPROVED BY: Manager - Engineer	DWG. NO. SD6
DATE: 11-26-68		

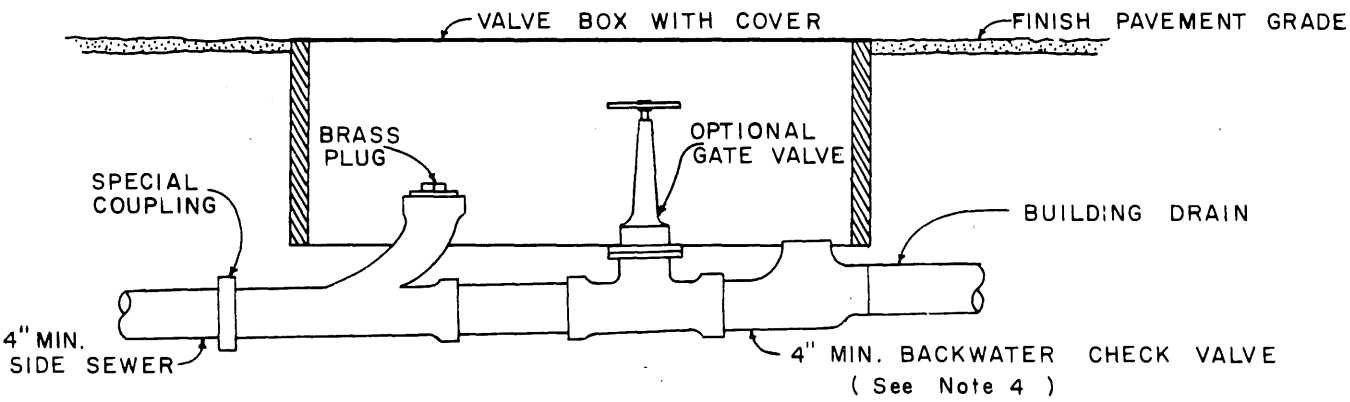
CLEANOUTS LOCATED UNDER PAVED DRIVEWAYS, WALKWAYS, ETC. SHALL BE RAISED TO GRADE AND INSTALLED IN YARD BOXES AS DIRECTED BY THE DISTRICT ENGINEER.



STANDARD CLEANOUT



TYPE A BACKWATER PREVENTION DEVICE



TYPE B BACKWATER PREVENTION DEVICE

NOTES:

1. A Standard 4" Cleanout is the minimum District requirement.

2. A Backwater Prevention Device is required and shall be installed where the side sewer serves plumbing fixtures that are located less than one foot above the rim elevation of the upstream manhole or rodhole in the reach of main sewer into which the side sewer connects.

3. A Type A Backwater Prevention Device shall be installed in those locations where sewage can overflow on the surrounding area without damage to property. The overflow safety device shall be as manufactured by Ream Machine Shop, 3297 Mount Diablo Blvd., Lafayette, California, or approved equal.

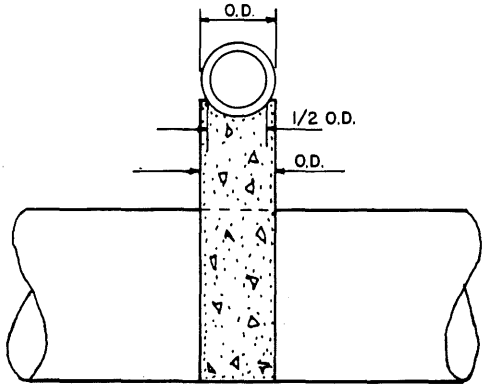
4. A Type B Backwater Prevention Device shall be installed in those locations where the cleanout must be located within a paved area, or where, because of potential damage to adjacent property, an overflow device cannot be used. The gate valve is optional but should be installed for additional protection. The backwater check valve shall be Josam Series No. 1170, or approved equal.

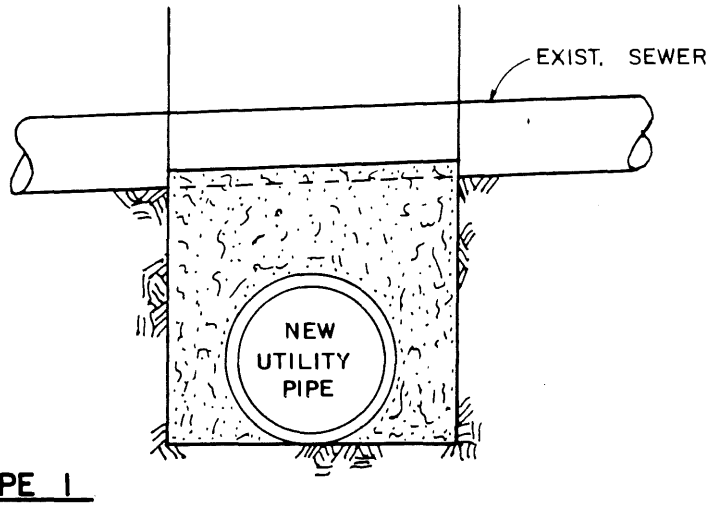
1	Changed B.P.D. require. Note 2	4-1-75

NOVATO SANITARY DISTRICT
Sanitary District No. 6 Of Marin County
NOVATO CALIFORNIA

STANDARD CLEANOUT AND BACKWATER PREVENTION DEVICES

Drn. By: RLB	Approved By: Manager – Engineer	Drg. No. SD7
Date: 4-9-65		

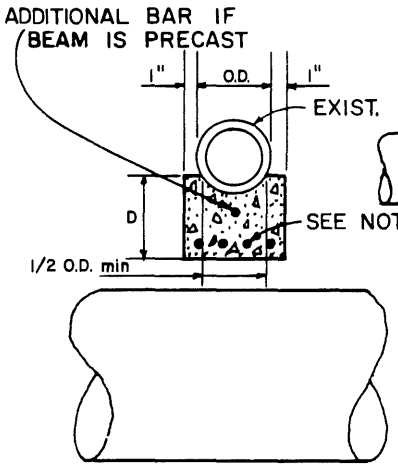


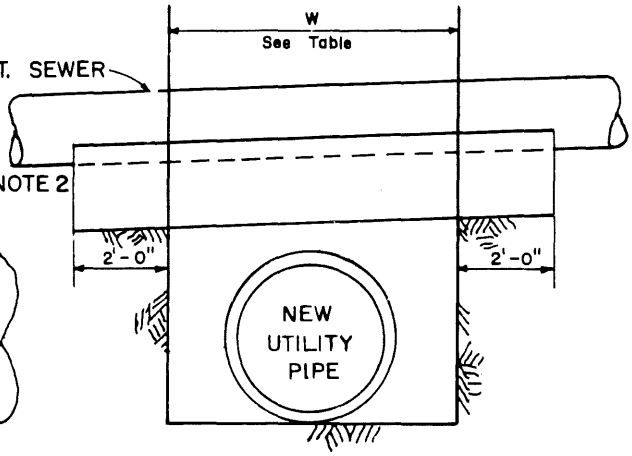


DIMENSIONS OF REINF. CONC. BEAM

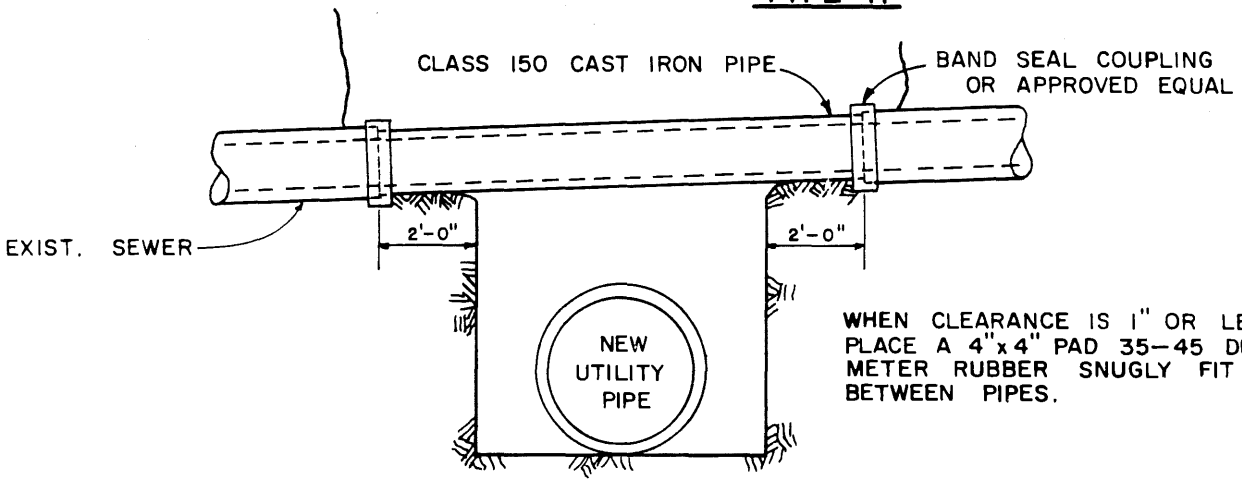
W	DEPTH OF COVER			
	0' to 8'-0"		8'-0" to 16'-0"	
	D	Bar No.	D	Bar No.
4'	8"	4	8"	4
5'	8"	4	9"	5
6'	8 1/2"	5	10 1/2"	5
7'	9"	5	11 1/2"	6
8'	10"	5	12 1/2"	6
9'	11"	6	13 1/2"	6
10'	12"	6	15"	7

TYPE I





TYPE II



WHEN CLEARANCE IS 1" OR LESS PLACE A 4"x4" PAD 35–45 DUROMETER RUBBER SNUGLY FIT BETWEEN PIPES.

TYPE III

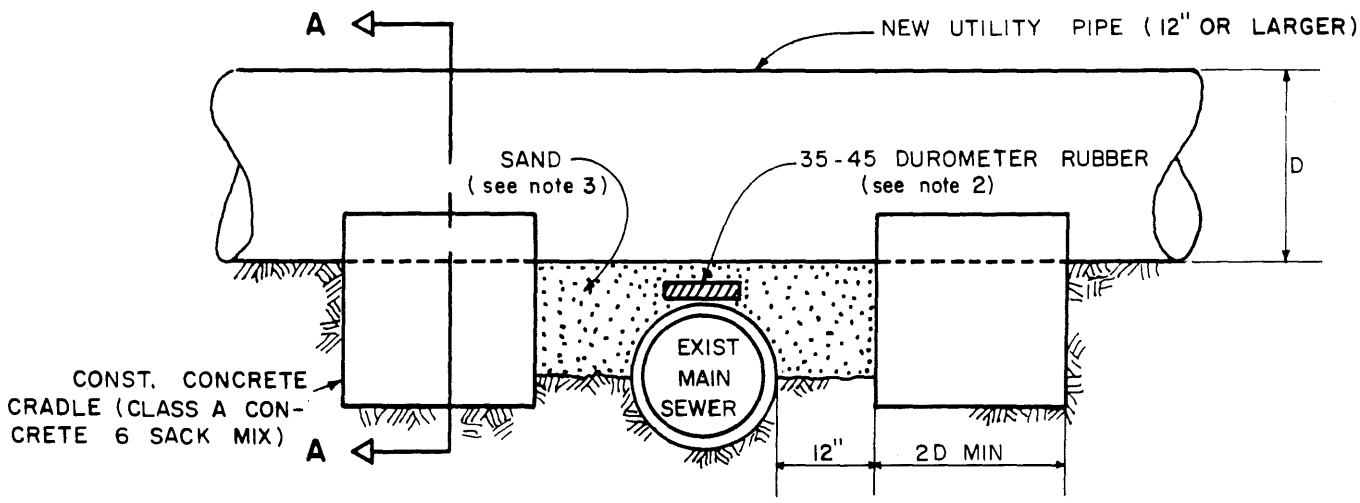
NOTES:

1. Sewer protection, as detailed hereon, shall be provided when a new utility pipe, 12" or larger, is installed below an existing main sewer. Type I, Type II or Type III may be used at the contractors option, unless otherwise shown on the plans or directed by the Engineer.
2. Maximum spacing of reinforcing steel to be 4" center to center.
3. Concrete to be Class A (6 sack mix).
4. Backfill shall not be placed until pipe has been inspected and approved.

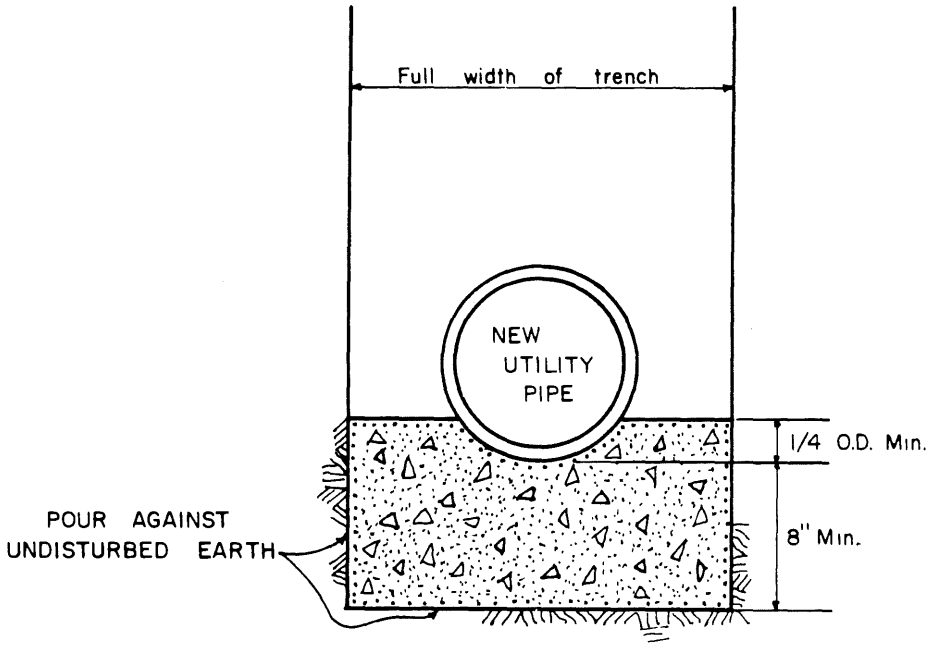
NOVATO SANITARY DISTRICT
Sanitary District No. 6
MARIN COUNTY, CALIFORNIA

MAIN SEWER PROTECTION ABOVE UTILITY CROSSING

DRAWN: RLB	APPROVED BY: Manager-Engineer	DWG. NO. SD8
DATE: 7-5-68		



MAIN SEWER

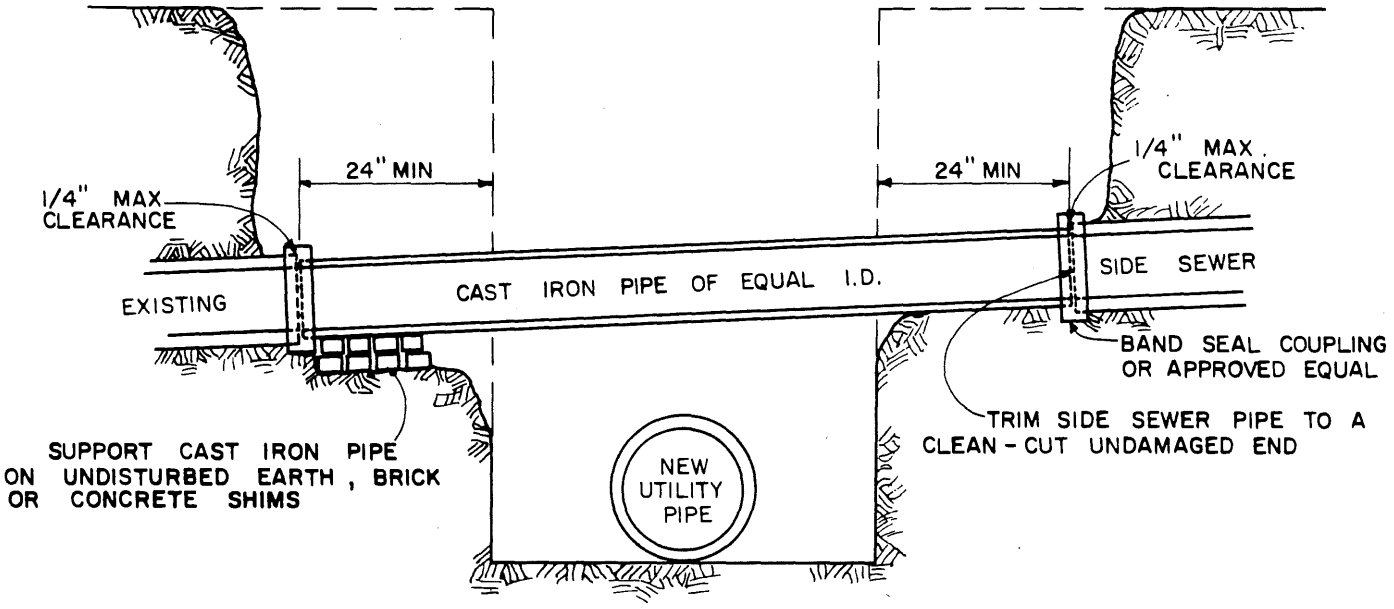


SECTION A-A

NOTES:

1. Sewer protection, as detailed hereon, shall be provided when a new utility pipe, 12" or larger, is installed above an existing main sewer and the clearance is less than 12".
2. When clearance is less than 1", install 4"x 4" pad of 35-45 durometer rubber snugly fit between pipes.
3. Existing material between cradles to mid depth of sewer to be carefully excavated and replaced with clean sand.
4. Backfill shall not be placed until pipe installation has been inspected and approved.

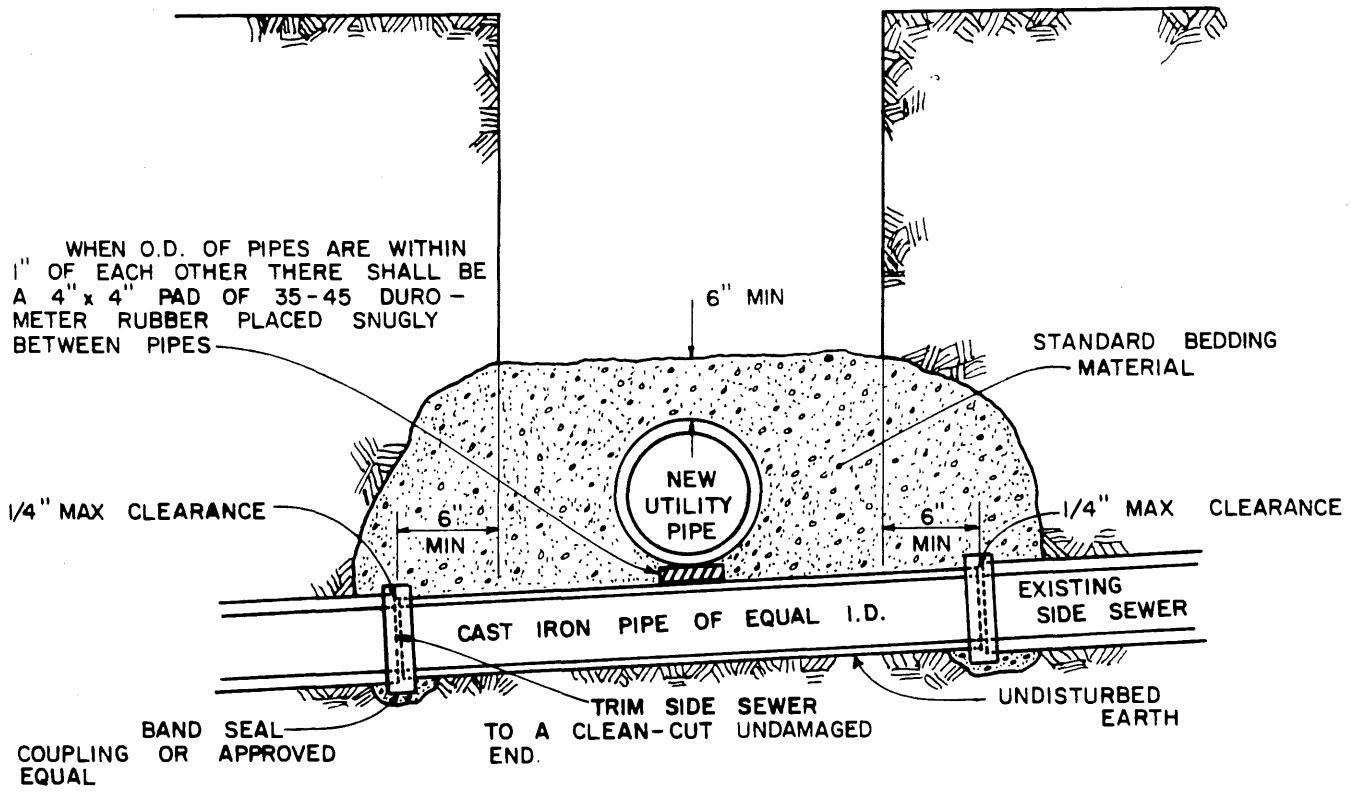
NOVATO SANITARY DISTRICT Sanitary District No. 6 MARIN COUNTY, CALIFORNIA		
MAIN SEWER PROTECTION BELOW UTILITY CROSSING		
DRAWN: RLB	APPROVED BY Manager-Engineer	DWG. NO. SD9
DATE: 6-28-68		



NOTES:

1. Sewer protection, as detailed hereon, shall be provided when a new utility pipe, 12" or larger, is installed below an existing side sewer.
2. Backfill shall not be placed until pipe installation has been inspected and approved.
3. When the outside diameter of the pipes are within 1" of each other there shall be a 4"x 4" pad of 35-45 Durometer Rubber placed snugly between pipes.

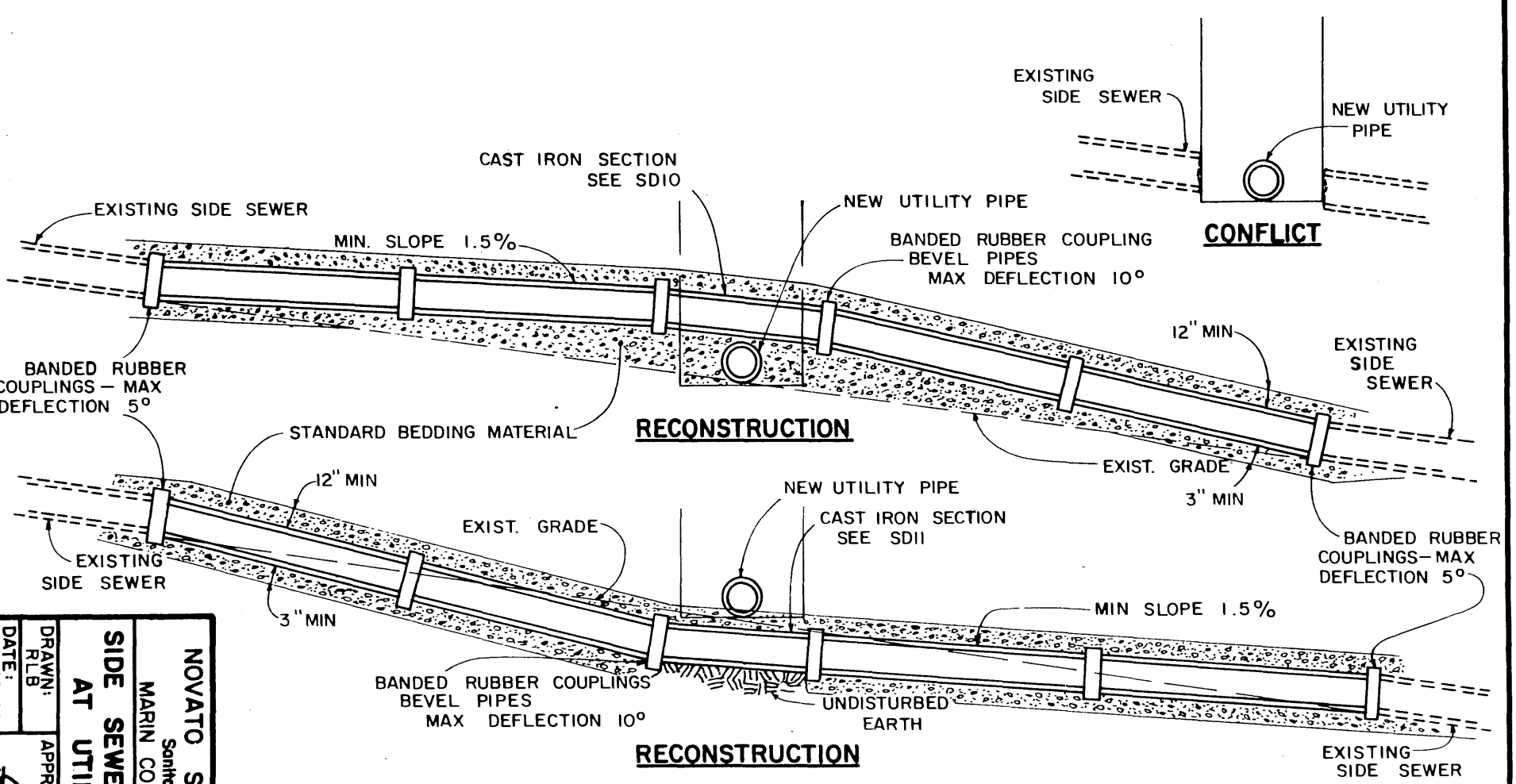
NOVATO SANITARY DISTRICT Sanitary District No. 6 MARIN COUNTY, CALIFORNIA		
SIDE SEWER PROTECTION ABOVE UTILITY CROSSING		
DRAWN: RLB	APPROVED BY: Manager - Engineer	DWG. NO. SD10
DATE: 11-29-68		



NOTES:

1. Sewer protection, as detailed hereon, shall be provided when a new utility pipe, 12" or larger, is installed above an existing side sewer and the clearance is less than 12".
2. Backfill shall not be placed until pipe installation has been inspected and approved.

NOVATO SANITARY DISTRICT Sanitary District No. 6 MARIN COUNTY, CALIFORNIA		
SIDE SEWER PROTECTION BELOW UTILITY CROSSING		
DRAWN: RLB DATE: 11-29-68	APPROVED BY: Manager-Engineer	DWG. NO. SD11



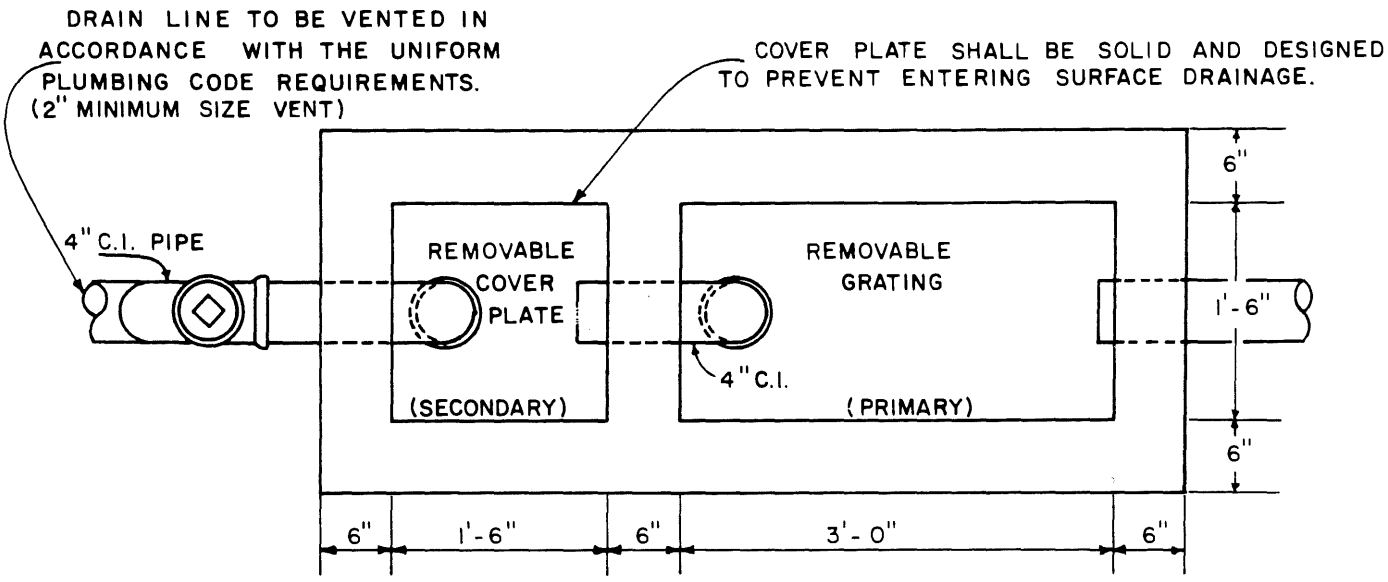
NOTES:

1. When new utility pipe or conduit conflicts with sewer line grade, the utility pipe or conduit shall be raised or lowered, if possible, to miss the sewer line. If it is not possible to move the utility line, written permission shall be obtained from the Novato Sanitary District and the sewer line reconstructed in accordance with one of the details above and the Standard Specifications of the District. (When O.D. of pipes are within 1" of each other, there shall be a 4" x 4" pad of 35–45 Durometer Rubber placed snugly between the pipes.)

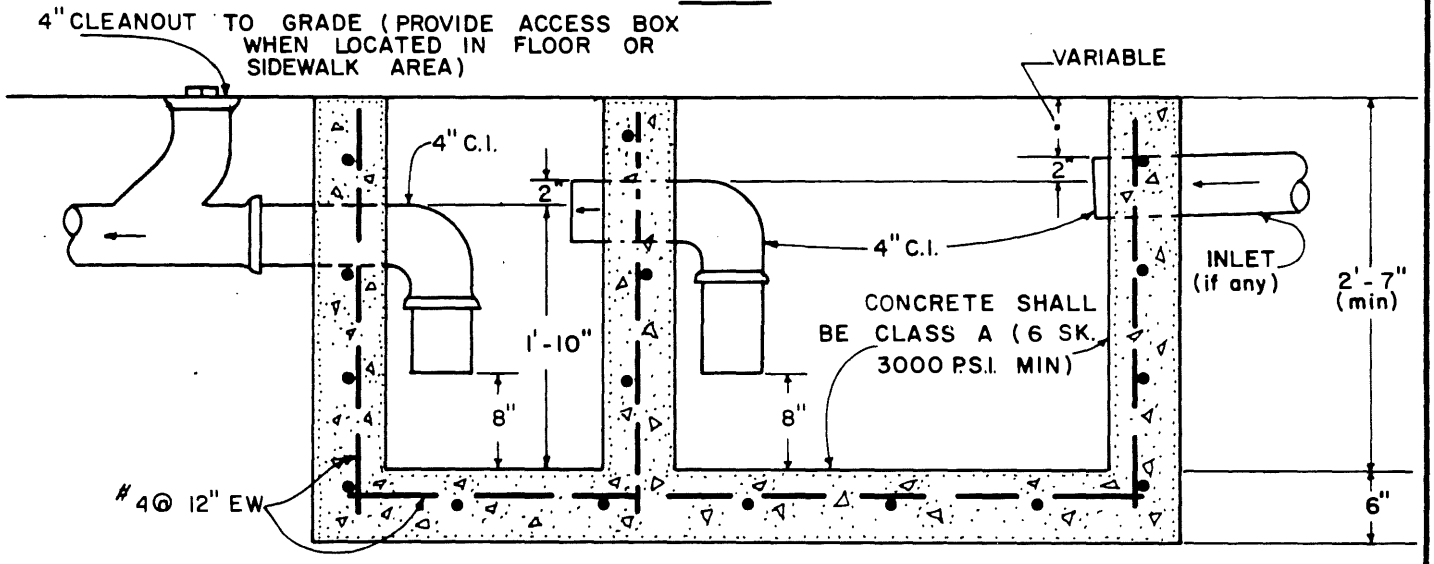
NOVATO SANITARY DISTRICT
Sanitary District No. 6
MARIN COUNTY, CALIFORNIA

SIDE SEWER RECONSTRUCTION AT UTILITY CROSSINGS

DRAWN: RLB
DATE: 11-22-68
APPROVED BY: Manager/Engineer
DWG. NO. SD12



PLAN



SECTION

NOTES:

1. Waste dischage shall conform to provisions of District Ordinance No. 14 and amendments. A Standard Grease and Sand Interceptor shall be installed when required by the District Engineer in accordance with said Ordinance. The standard shown is applicable for conditions usually encountered. A special design may be required by the District Engineer when large flows or other special conditions exist.

2. Cover Plate and Grating shall be designed to sustain anticipated wheel or other loadings.

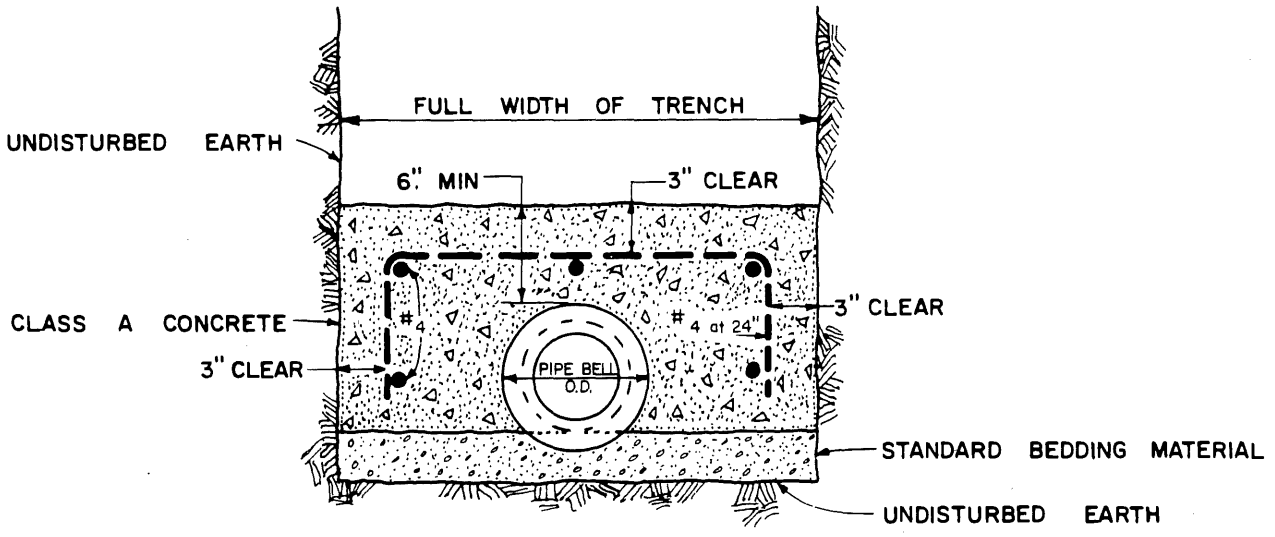
3. No surface or roof drainage will be permitted to enter interceptor.

4. Primary interceptor may be separated from secondary interceptor. Maximum separation shall be 25' unless separately vented.

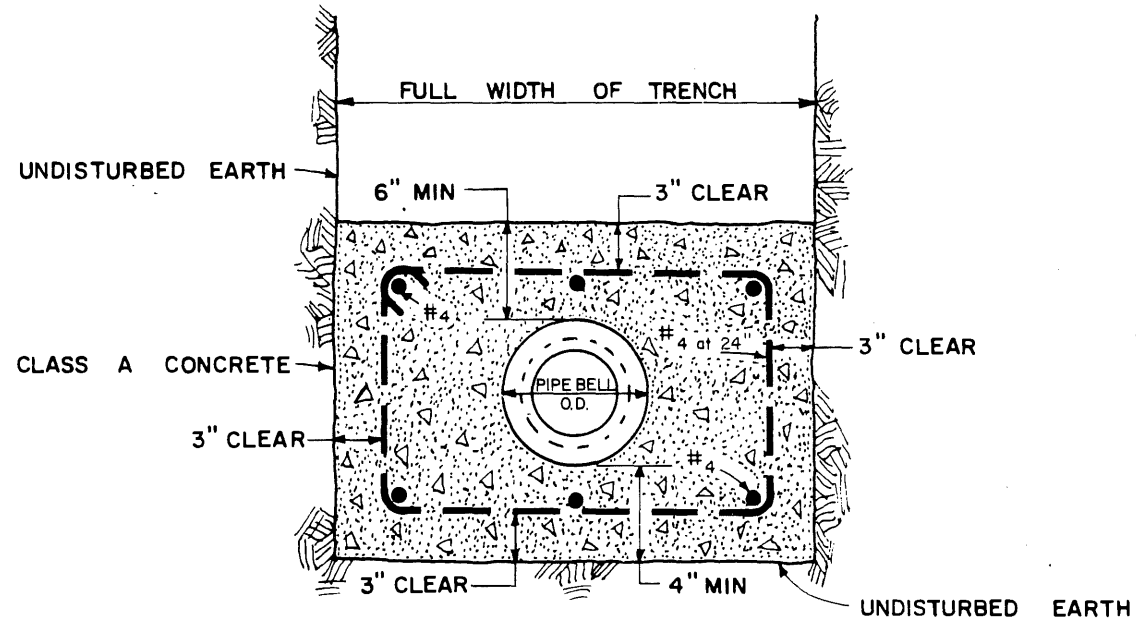
NOVATO SANITARY DISTRICT
Sanitary District No. 6
MARIN COUNTY CALIFORNIA

STANDARD
GREASE and SAND INTERCEPTOR

Drn. By: RLB	Approved By: Manager-Engineer	Drg. No: SD13
Date: 9-1-66		

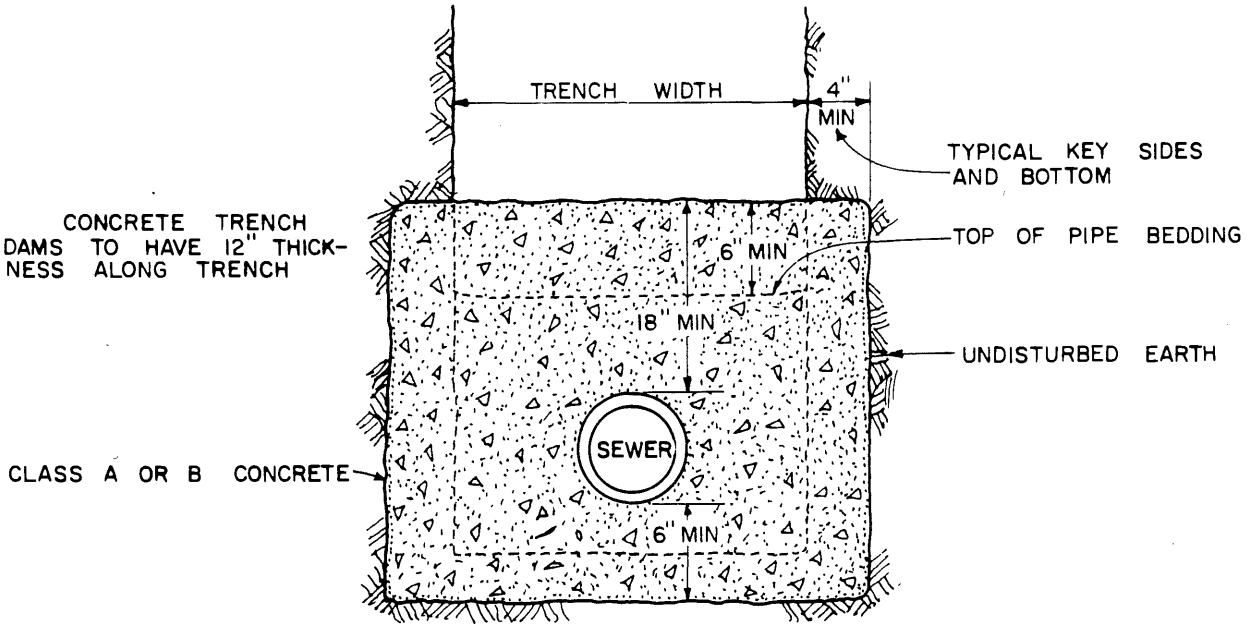


JACKET

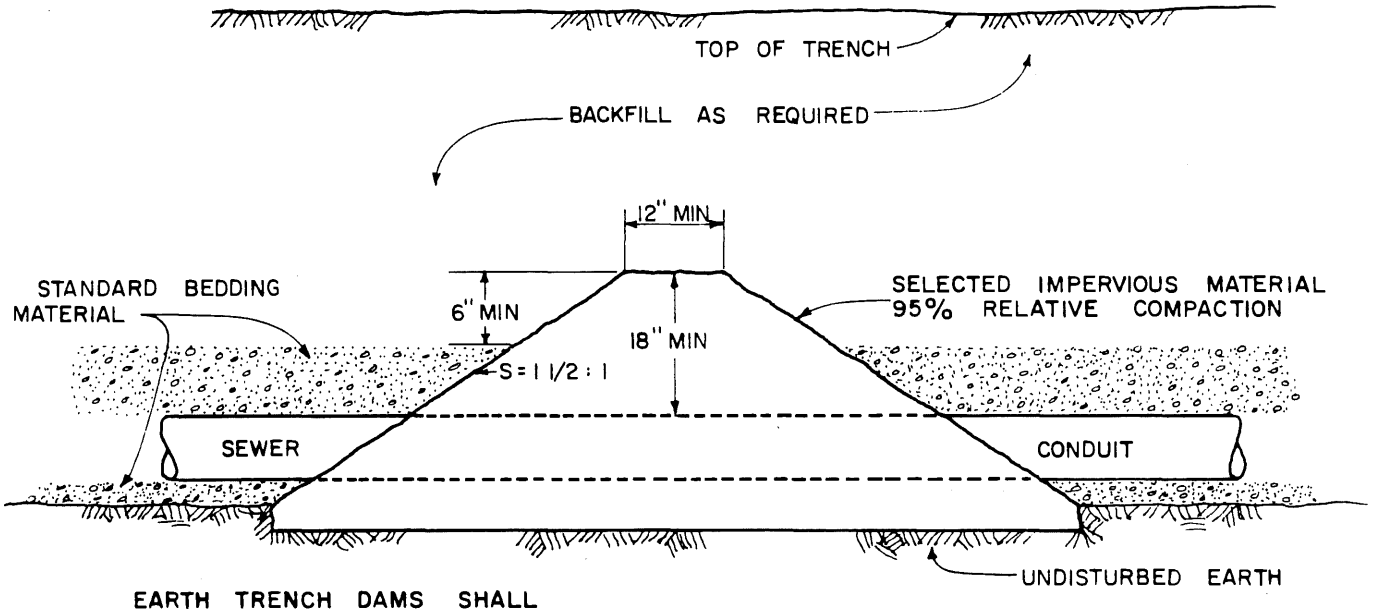


ENCASEMENT

NOVATO SANITARY DISTRICT Sanitary District No. 6 MARIN COUNTY, CALIFORNIA		
STANDARD CONCRETE JACKET AND ENCASEMENT		
DRAWN: RLB DATE: 12-13-68	APPROVED BY: Manager - Engineer	DWG. NO. SD14



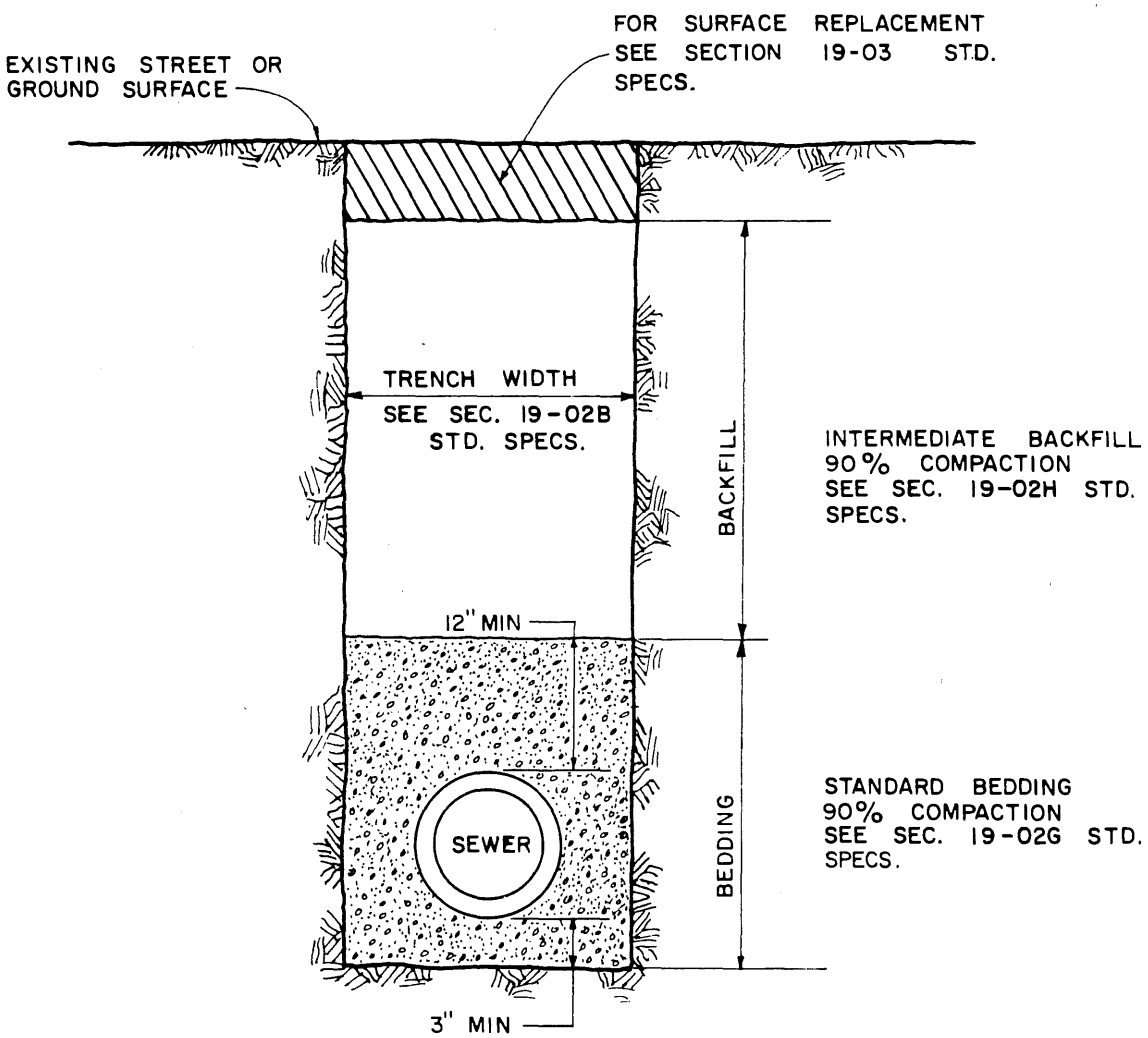
CONCRETE TRENCH DAM



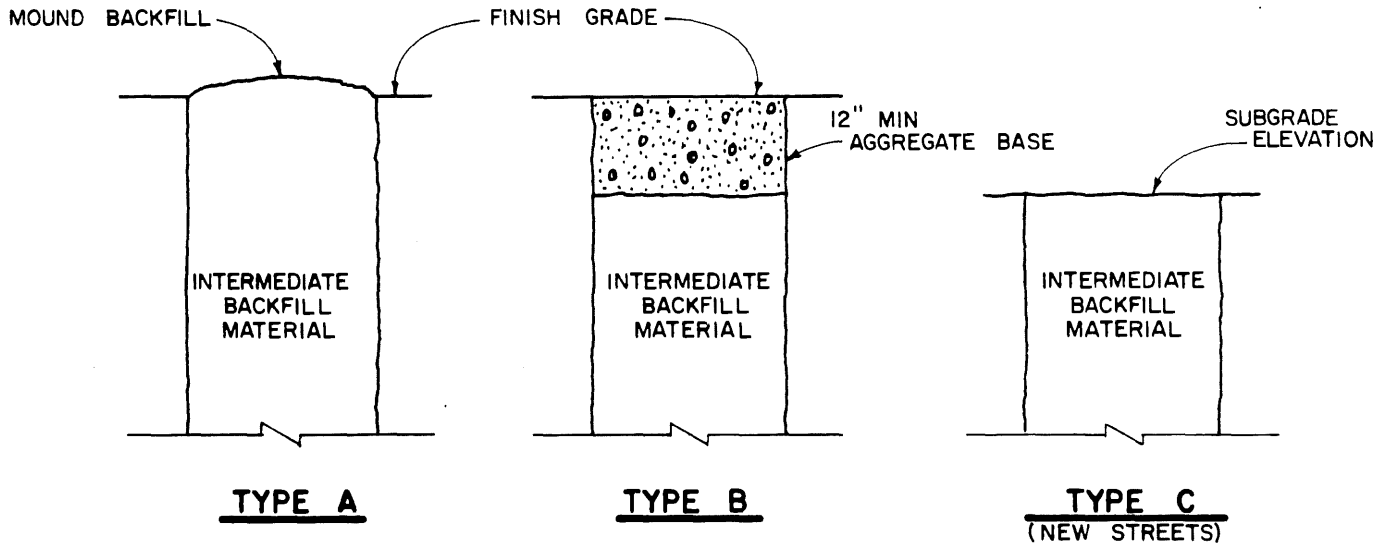
EARTH TRENCH DAMS SHALL BE KEYED INTO EACH SIDE AND BOTTOM OF TRENCH A MINIMUM OF 4"

EARTH TRENCH DAM

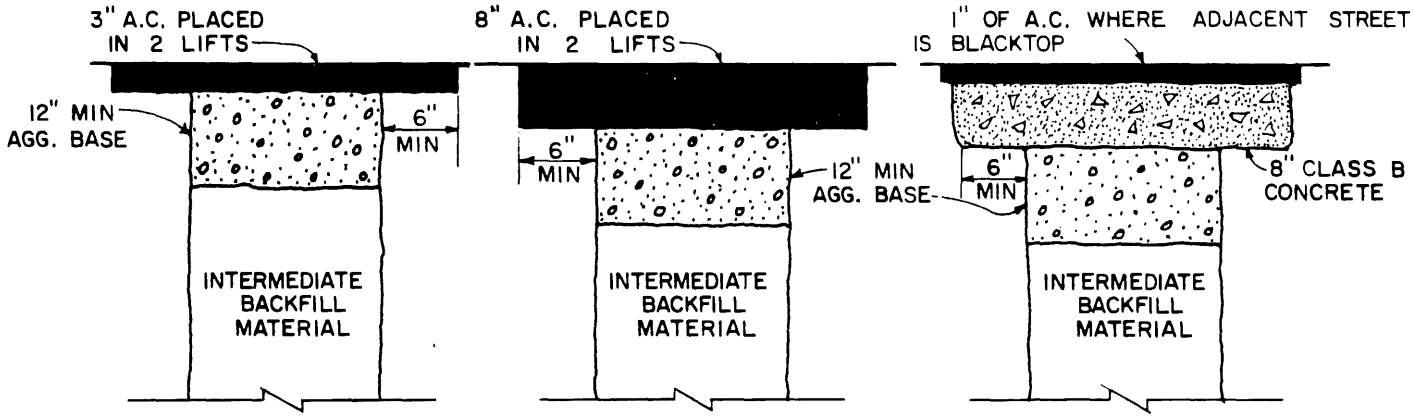
NOVATO SANITARY DISTRICT Sanitary District No. 6 MARIN COUNTY, CALIFORNIA		
STANDARD TRENCH DAMS		
DRAWN: RLB DATE: 12-17-68	APPROVED BY: Manager / Engineer	DWG. NO. SD15



NOVATO SANITARY DISTRICT Sanitary District No. 6 MARIN COUNTY, CALIFORNIA		
STANDARD TRENCH DETAIL		
DRAWN: RLB	APPROVED BY: Manager - Engineer	DWG. NO. SD16
DATE: 11-15-68		



TYPE A | **TYPE B** | **TYPE C** (NEW STREETS)



TYPE D | **TYPE E** | **TYPE F**

NOTES:

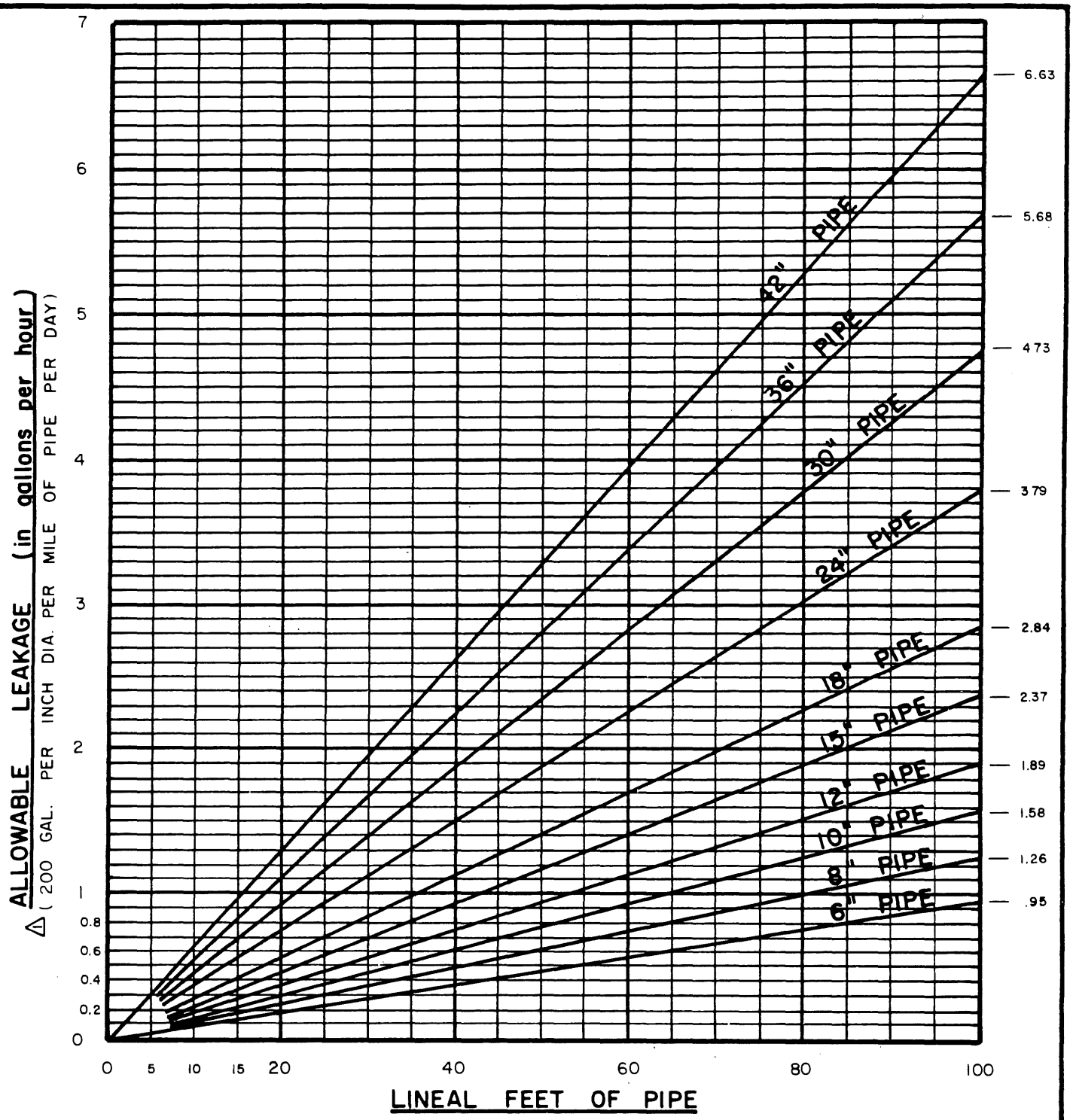
1. Surface replacement shall be of the type specified in Section 19-04 of the Standard Specifications.

1	Added "6" MIN" Type D, Sawcut A.C.	4-1-75

NOVATO SANITARY DISTRICT
Sanitary District No. 6
MARIN COUNTY, CALIFORNIA

STANDARD SURFACE REPLACEMENT

DRAWN: RLB	APPROVED BY: Manager - Engineer	DWG. NO. SD17
DATE: 12-13-68		



CONVERSION TABLE		
DIA. OF PIPE OR M.H. IN INCH.	GAL. PER FT. OF DEPTH IN PIPE OR MH	GAL. PER IN. OF DEPTH IN PIPE OR MH
6" PIPE	1.5 GAL/FT	.125 GAL/IN
8" "	2.6 "	.217 "
10" "	4.1 "	.342 "
12" "	5.9 "	.492 "
15" "	9.2 "	.766 "
24" "	23.4 "	1.95 "
36" "	52.7 "	4.39 "
48" MH	94. "	7.83 "
60" "	147. "	12.25 "

1	Revised allowable leakage from 500 to 200 gal	7-8-74

NOVATO SANITARY DISTRICT
Sanitary District No. 6
MARIN COUNTY, CALIFORNIA

ALLOWABLE LEAKAGE CHART
WATER TEST

DRAWN:	APPROVED BY:	DWG. NO.
RLB	Manager - Engineer	SD18
DATE: 7-8-74		

ALLOWABLE AIR TEST LEAKAGE CHART

DIAMETER OF PIPE (inches)	LENGTH OF TEST (minutes)
4	2.0
6	3.0
8	4.0
10	5.0
12	6.0
15	8.0
18	9.0
21	10.0
24	12.0

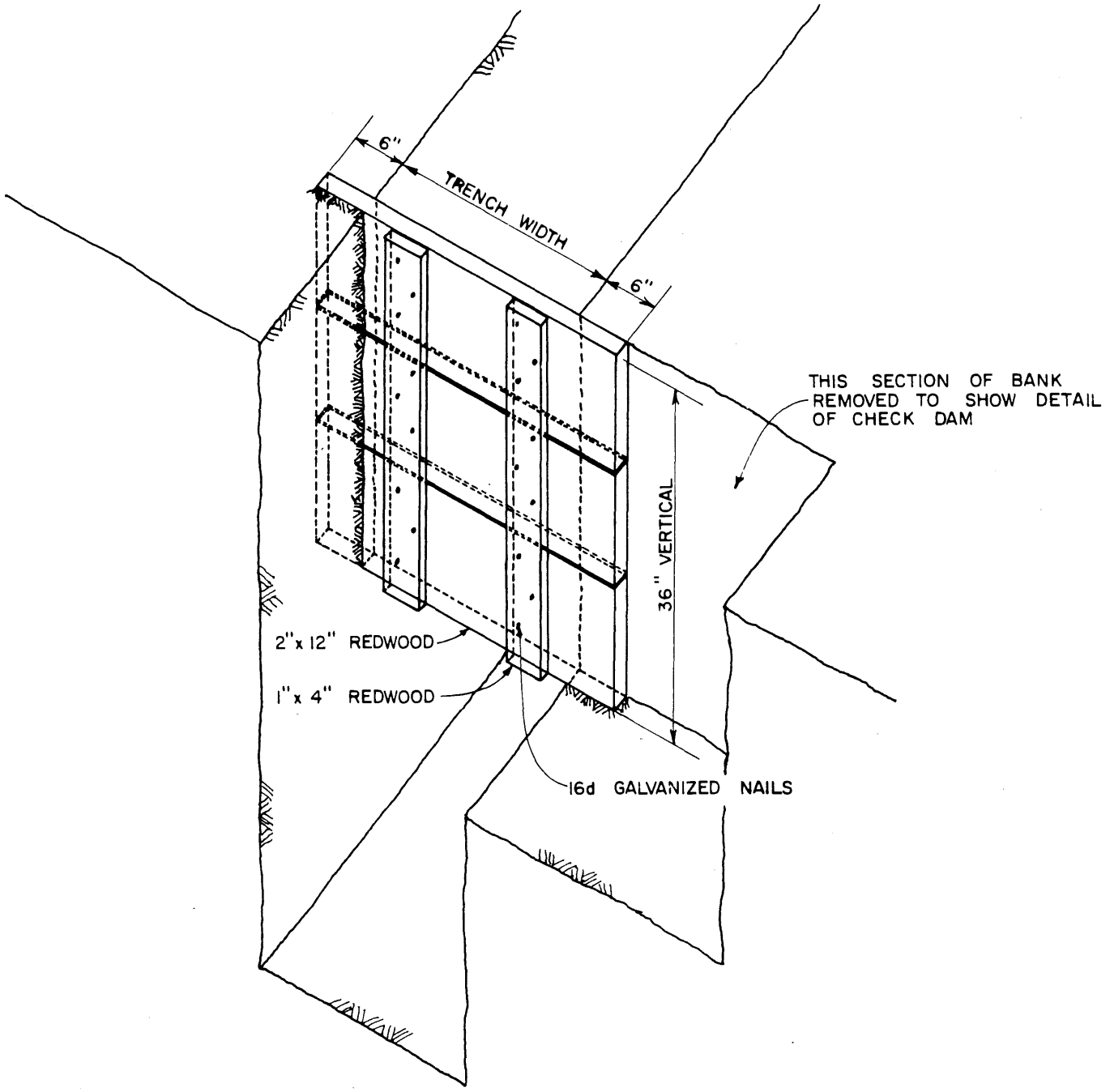
NOTES:

1. The Length Of Test shown is the minimun allowable time for a pressure drop from 4.0 to 3.0 p.s.i. after a 2 minute waiting period.
2. The maximum length of sewer to be tested at one time shall be 500 feet , exclusive of any laterals.
3. When a section of main sewer to be tested includes laterals , the Length Of Test shall be determined only by the size of main sewer being tested.
4. If ground water is present, the beginning test pressure shall be increased as directed by the District Engineer.

NOVATO SANITARY DISTRICT
Sanitary District No. 6
MARIN COUNTY CALIFORNIA

ALLOWABLE LEAKAGE CHART
AIR TEST

DRAWN BY	APPROVED BY	DRAWING NO.
RLB	C.A. Joseph	SD19
DATE 4-1-75	MANAGER – ENGINEER	



NOTES:

1. Standard Redwood Check Dam to be placed at 20 foot intervals where ground slope is 1 to 1 or greater or as required by the District Engineer.

NOVATO SANITARY DISTRICT Sanitary District No. 6 MARIN COUNTY, CALIFORNIA		
STANDARD REDWOOD CHECK DAM		
DRAWN: RLB	APPROVED BY:	DWG. NO.
DATE: 12-16-68	Manager - Engineer	SD20