

VOLUME II

SANITARY SEWER

SECTION 1 - SEWER PIPE LINES

1.01 SEWER CONSTRUCTION MATERIALS

All sewer construction materials proposed to be used shall be new materials approved by the Engineer, prior to start of construction.

Where material specification numbers are used herein, they shall refer to the latest revision thereof.

For the purpose of these specifications, all pipe materials are classified as either "rigid" or "flexible."

1.02 PIPE MATERIALS

The following table identifies the types of pipes which can be utilized for the sanitary sewer system where it can be used and design criteria associated with the pipe material. For additional requirements refer to the individual pipe sections.

Type of Pipe	Where Pipe May be Used	Design Criteria
Rigid Pipe and Fittings		
Vitrified Clay Pipe (VCP) – extra strength (bell and spigot only)	Main sewer Public laterals Private laterals	<ul style="list-style-type: none"> • Non-residential use • Minimum cover - 36" • Engineer's approval required for less than 3' of cover
Flexible Pipe and Fittings		
Acrylonitrile Butadiene Styrene (ABS)	Private laterals	<ul style="list-style-type: none"> • Residential use • Minimum cover - 12" • Solid Wall
Poly Vinyl Chloride (PVC) (gravity) – SDR 26	Main sewer Public laterals Private laterals	<ul style="list-style-type: none"> • Non-residential use from building to grease interceptor • Minimum cover - Cover 36" • 3"-4" Diameter permitted for private laterals
Poly Vinyl Chloride (PVC) – C900/C905 or SDR 18	Main sewer Public laterals Private laterals	<ul style="list-style-type: none"> • Residential use • 4"-12" Diameter shall meet AWWA C900 or SDR 18 • 14"-35" Diameter shall meet AWWA C905 or SDR 18

Type of Pipe	Where Pipe May be Used	Design Criteria
Poly Vinyl Chloride (PVC) – Schedule 40 / Schedule 80	Private laterals (gravity)	<ul style="list-style-type: none"> Residential use Minimum cover - 12" Glue joint only
Poly Vinyl Chloride (PVC) – Schedule 40 / Schedule 80	Private laterals (forced/pumped systems)	<ul style="list-style-type: none"> Minimum cover - 12" Glue joint only
Fused Poly Vinyl Chloride (FPVC) C900/C905 or SDR 18	Main sewer Public laterals	<ul style="list-style-type: none"> 4"-12" Diameter shall meet AWWA C900 or SDR 18 14"-35" Diameter shall meet AWWA C905 or SDR 18 Butt fused joints
Cured In Place Pipe (CIPP)	Public laterals Private laterals	For residential and commercial deteriorated or partially deteriorated pipe.
High Density Polyethylene Pipe Bursting	Public laterals Private laterals	<ul style="list-style-type: none"> For residential and commercial deteriorated or partially deteriorated pipe. Must be electro-fused HDPE, no joints allowed for replacement ACP shall not be burst

Cover requirements depend on the strength characteristics of the pipe and soil characteristics, as approved by the engineer.

A. RIGID PIPE AND FITTINGS

Rigid pipe and fittings may be used only with prior approval of the Engineer to accommodate special circumstances. Rigid pipe, fittings, and joint materials specified herein consist of Vitrified Clay Pipe (VCP) and Cast Iron Soil Pipe (CISP). All materials incidental to rigid pipe installations shall be supplied by the pipe manufacturer. All rigid pipe required in odd lengths shall be cut using a proper cutting tool and guide that insures true line cut on planes perpendicular to the pipe axis. No bevel cuts for pipeline alignment will be permitted.

1. Vitrified Clay Pipe (VCP) and Fittings:

VCP shall be installed for private and public laterals for all commercial and industrial projects. Vitrified clay pipe and fittings shall conform to ASTM Designation C-700 extra strength, unglazed, bell and spigot. Mechanical type joints having resilient properties conforming to ASTM Designation C-425 shall be

used and installed. The pipe shall be tested during manufacture in accordance with ASTM Designation C-301.

2. Cast Iron Soil Pipe (CISP) and Fittings:

CISP shall not be used.

B. FLEXIBLE PIPE AND FITTINGS

Flexible pipe, fittings, and joint materials specified herein consist of Acrylonitrile-Butadiene-Styrene (ABS), Polyvinyl Chloride (PVC), Cured In Place Pipe (CIPP), and High Density Polyethylene (HDPE). All materials incidental to flexible pipe installations such as gaskets, joint lubricants, cements, etc. shall be supplied by the pipe manufacturer. All flexible pipe required in odd lengths shall be cut using a proper cutting tool and guide that insures true line cut on planes perpendicular to the pipe axis. No bevel cuts for pipeline alignment adjustments will be permitted. All flexible pipe for new construction shall be solid wall pipe.

Sewer force mains shall be constructed to Waterworks Standards using AWWA C900 or C905 PVC or Fusion Welded HDPE.

1. ABS Solid Pipe:

ABS pipe shall only be used for private laterals. All ABS pipe and fittings shall be solid wall pipe manufactured in accordance with ASTM Designation D-2751, minimum wall thickness SDR 26, and tested in conformance with the requirements of paragraphs under Section 7 and 10 of said ASTM D-2680, for SDR 26 pipe.

Cement used for non-gasketed ABS pipe shall conform to ASTM Designation D-2295 and will be allowed for private laterals only. Jointing of wet pipe is not allowed. No primer shall be used in the pipe installation. Jointing shall be accomplished by applying a coating of cement to the inside of the socket, and to the outside of the spigot end of the pipe to be joined in sufficient quantity that when the spigot is fully inserted into a socket, a bead of excess cement will form around the entire circumference of the outside juncture of said spigot and socket. Excess cement shall then be removed.

2. PVC Solid Wall Pipe:

All PVC solid wall pipe and fittings shall be in accordance with the requirements for SDR 26 sewer pipe as stated in ASTM Designation D-3034, PVC cell class 12454 ASTM D1784, minimum wall thickness of SDR 26, ASTM Designation F-789 Type PS-46. Pipe joints and fittings shall be factory assembled, integral wall bell and spigot configuration, compatible with the pipe. PVC solid wall pipe shall be used only for gravity sewer applications.

Gasketed PVC pipe shall have a solid cross section rubber ring gasket. The gasket shall be securely attached to the pipe to prevent displacement of the gasket when installed in the field. All rubber ring gaskets shall be in accordance with ASTM Designation F-477. Lubricant used for field assembly of gasketed PVC pipe shall have no detrimental effect on the gasket, joint, fitting, or pipe and shall be as recommended by the manufacturer.

Cement used for non-gasketed PVC pipe for private laterals only shall conform to ASTM Designation D-2564. Jointing of wet pipe is not allowed. Jointing of pipe shall be accomplished by applying a coating of cement to the inside of the bell and the outside of the spigot. The cement shall be applied in sufficient quantity to produce a bead of cement around the entire circumference of the pipe joint. Excess cement shall then be removed.

3. PVC Pressure Pipe:

Where PVC pressure pipe is required, PVC pressure pipe shall conform to the requirements of AWWA C900 minimum Class 165 for Pressure Pipe manufactured in sizes from four (4) inches to twelve (12) inches in diameter and AWWA C905 Class 165 for sizes 14 inches to 24 inches in diameter. PVC pressure pipe shall be furnished in Ductile Iron Pipe (DIP) equivalent outside diameters with rubber gaskets, separate couplings, or approved equal. Thrust restraint shall be provided at valves and changes of direction for pressure flow applications.

4. FPVC Pipe:

All piping shall be made from PVC compound conforming to cell classification 12454 per ASTM D1784. Fusible PVC pipe shall be tested at the extrusion facility for properties required to meet all applicable parameters as outlined in AWWA C900, AWWA C905 and applicable sections of ASTM D2241. Testing priority shall be in conformance with AWWA C900 and AWWA C905.

Fusible C900^R, Fusible C905^R and FPVC. Fusible PVC shall conform to AWWA C900, ASTM 2241 or ASTM D1785 for standard dimensionality, as applicable or AWWA C905. Fusible PVC pipe shall be extruded by plain ends. The ends shall

be square to the pipe and free of any bevel or chamfer. There shall not be bell or spigot of any kind incorporated into the pipe. The PVC pipe shall be manufactured in standard 40' lengths, and green in color for wastewater. Unless otherwise noted, fusible PVC pipe lengths shall be assembled in the field with butt-fused joints per the manufacturer's recommendations.

5. HDPE Pipe:

All HDPE pipe shall be solid wall, butt-fused pipe conforming to AWWA C906 and ASTM D-3035 and shall meet the minimum cell classification of 345434 E for gravity sewers or 345434 C for pressure sewers as described in ASTM D3350. HDPE pipe shall meet the requirements of TYPE III, Class B, category 5 grade P34 material as described in ASTM D-1248. The pipe may contain no more than 10 percent reworked resin gathered from within the manufacturer's own plant from resin meeting these specifications.

Pipe color for gravity sewer application shall be natural gray. Pipe color for pressure sewer applications may be natural gray or black. Wall thickness shall be no less than DR 21.

The pipe shall be marked at 5-foot intervals or less with a coded number that identifies the manufacturer, SDR, size, material, machine, date and shift on which the pipe was extruded.

Any pipe, which has cuts or abrasions in the pipe wall exceeding 10 percent of the wall thickness, shall be removed from the site.

The pipe shall be joined using the butt fusion method in strict accordance with the pipe manufacturer's recommendations and ASTM D2657. The fusion equipment shall be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, fusion temperature, alignment, and fusion pressure. All joints shall be smooth and any beading shall be removed.

Fittings shall conform to ASTM D-3261. Electro-fused fittings may be used provided approval is granted in advance by the Engineer.

6. CIPP (Cured in Place Pipe) Lining:

The CIPP liner shall consist of thermosetting resin and an absorbent carrier tube to hold the resin. When the resin and carrier tube are combined followed by installation into the existing pipe and curing, they shall result in a finished CIPP liner that meets the requirements of ASTM F1216-03 for inversion liners, ASTM F1743 for pull-in liners and ASTM D5813 for CIPP materials. The final cured in place liner materials shall provide the mechanical and chemical resistance properties in accordance with the requirements of ASTM F1216 or F1743 and

D5813. At a minimum, the cured CIPP liner shall be fully resistant, chemically and mechanically to regular municipal sewage.

CIPP will be allowed for residential and commercial uses on private and public laterals as a “stand alone” liner for deteriorated or partially-deteriorated pipe. The limits of lining work for public mains shall extend the entire distance between manholes. Spot repairs will not be accepted. The limits of lining for public laterals shall extend the entire distance between the sewer main and the District cleanout. The limits of lining for private laterals shall be submitted for review by the Engineer, with the lined section to terminate at an approved junction points (i.e., cleanout). Submittals for CIPP lining material for public laterals and public mains are required to be approved by the District Engineer.

7. Pipe Bursting:

Bursting may be allowed for residential and commercial uses on private and public laterals. Specific material types for existing public laterals may be suitable for pipe bursting, including plastic pipe, vitrified clay, cast iron, plain concrete, and reinforced concrete pipe if deteriorated and not heavily reinforced.

- a. All existing adjacent utilities must be located prior to any pipe bursting activity. Submit a plan to District Engineer including bursting method and equipment to be used, bypass methods, plan and profile of existing sewer laterals including location of all adjacent utilities both crossing and parallel, and limits of pipe bursting including insertion and reception pits.
- b. Replacement pipe shall be fusible PVC or fused HDPE. No joints shall be allowed for replacement pipe.

8. Storage:

- a. Pipe shall be stored if possible at the job site in unit packages provided by the manufacturer. Caution shall be exercised to avoid compression, damage, or deformation to bell ends of the pipe and barrel.
- b. When unit packages of flexible pipe are stacked, ensure that weight or upper units do not cause deformation to pipe in lower units.
- c. Flexible pipe unit packages shall be supported by racks or dunnage to prevent damage to the bottom during storage. Supports shall be spaced to prevent pipe bending.
- d. When long-term storage with exposure to direct sunlight is unavoidable, flexible pipe shall be covered with an opaque material while permitting

adequate air circulation above and around the pipe as necessary to prevent excessive heat accumulation.

- e. Flexible pipe shall not be stored close to heat sources or hot objects such as heaters, boilers, steam lines, engine exhaust, etc.
- f. Gaskets, if required, shall be protected from excessive exposure to heat.

9. Deflection:

The inside diameter of an installed section of flexible pipe shall not be allowed to deflect more than five percent (5%) of the base inside diameter (as defined in ASTM D3034) following 30 days after installation. Deflection testing conducted during daily installation and any time prior to 30 days after installation shall be based on an allowable deflection of 3-1/3 percent of the base inside diameter. The testing mandrel sizes for PVC SDR 26 pipe are shown in the following table. For flexible pipe materials other than PVC SDR 26, the mandrel diameter shall be calculated based on the minimum inside diameter according to manufacturer’s published information.

Nominal Diameter⁽¹⁾ (inches)	Pipe Specification	Base Inside Diameter (inches)	96-2/3 Percent Mandrel Diameter⁽²⁾ (inches)	95 Percent Mandrel Diameter⁽³⁾ (inches)
8	PVC SDR 26	7.488	7.24	7.11
10	PVC SDR 26	9.342	9.03	8.87
12	PVC SDR 26	11.102	10.73	10.55
15	PVC SDR 26	13.575	13.12	12.90

⁽¹⁾ Larger pipe diameters shall be as determined by the Engineer.

⁽²⁾ Use for testing less than 30 days after installation.

⁽³⁾ Use for testing 30 days or more after installation.

- a. Flexible pipe deflection shall be checked by means of a 9-arm “go – no go” mandrel pipe deflection gauge. The mandrel shall have pulling rings at each end and shall be pulled by hand through the sewer without the aid of mechanical pulling devices. The pipe deflection shall be checked in the presence of the Engineer or Inspector after the placement and compaction of all trench backfills, but prior to installation of aggregate base and/or asphalt concrete.
- b. The mandrel deflection gauge shall be fabricated to permit passage through installed sections of pipelines within the specified tolerances for flexible pipe.

Any section or sections of flexible pipe that does not permit deflection gauge passage will not be accepted and said section or sections shall be properly repaired or replaced and rechecked as directed by the Engineer or Inspector.

10. Miscellaneous Requirements:

A water stop specified by the pipe manufacturer and approved by the District shall be installed at all manhole connections. The water stop shall be placed in the manhole base and centered under the manhole wall. The water stop shall be firmly fitted around the pipe exterior. Said water stop may also consist of a manhole coupling with rubber sealing rings cast into the structure base. No rubber boot type connections are allowed. The water stop shall consist of at least two continuous circles of contact.

C. OTHER PIPE

Other pipe materials may be used for sewer installation with approval by the Engineer.

The pipe shall be joined with couplings as furnished with the pipe by the manufacturer, and installed as specified by the manufacturer.

1.03 PIPE COUPLINGS

- A. Fernco with shear bands or equal shall be used for PVC SDR 26 connections to: VCP, ACP, Concrete, Orangeburg, CIP, and PVC Schedule 40.
- B. Bell-by-bell slip couplings shall be used for C900 connections to: PVC SDR 35 and PVC SDR 26.
- C. Glue-by-glue (or slip-by-slip) couplings shall be used for ABS connections to: PVC SDR 35 and PVC SDR 26 (as an example, connection to wye at District cleanout).

1.04 MAIN CONNECTIONS

Where laterals are smaller than the existing sewer main, a PVC SDR 26 or C900 tee-branch saddle fitting "Tap Tite", "Fernco" tap saddle with pressure kit, or equal shall be used to connect to existing main. The saddle fitting shall be fabricated of material approved by the Engineer and with a flange which will prevent the saddle from entering the main sewer beyond its inside surface. The flange shall have a curvature designed for the size main on which it is to be used. The saddle shall create an airtight connection and at the option of the Engineer may require air testing.

- A. When connecting a lateral to a new main (SDR26) use a PVC SDR 26 wye or C900 wye.

- B. When connecting a lateral to an existing main that has been rehabilitated by HDPE pipe bursting, use an HDPE electro-fused saddle.
- C. When connecting a lateral to an existing main that has been rehabilitated by CIPP lining, use a “Tap-Tite” saddle, Fernco tap saddle with pressure kit, or approved equal. If the lateral and the main are both lined with CIPP, a “top hat” fitting is required. The application, upon approval by the Engineer, may contribute to future project in lieu of installing a “top hat”.
- D. Where laterals are the same size as the main, connection must be made with a manhole.
- E. When connecting a lateral to an existing trunk sewer (18 inches and larger), connection shall be made at a manhole.

1.05 EMBEDMENT

All pipe shall be embedded and backfilled as specified with extra care taken in compaction of said embedment and backfills as specified in Volume II Section 5 – Trench Backfilling.

1.06 STAINLESS STEEL BANDS

Stainless steel bands shall be ASTM A-167, Type 316. Any fitting or coupling using stainless steel bands shall have the area of the band wrapped twice with 10-mil plastic tape.

SECTION 2 - PORTLAND CEMENT CONCRETE AND MORTAR

2.01 CONCRETE

Concrete shall consist of a mixture of Type II Portland cement, sand, fine aggregate, coarse aggregate and water. The proportions of the water, sand and aggregate shall be regulated so as to produce a plastic, workable and cohesive mixture yielding the strength indicated. Unless noted otherwise, all concrete shall be Class "A".

A. CLASS "A"

Class "A" concrete shall contain 564 pounds (6 sacks) of Portland cement per cubic yard and shall have a minimum 28-day compressive strength of 4,000 PSI in accordance with ASTM C-39.

B. CLASS "C"

1. Class "C" concrete shall contain 376 pounds (4 sacks) of Portland cement per cubic yard and shall have a minimum 28-day compressive strength of 2,500 PSI in accordance with ASTM C-39.
2. All material required, and the procedure of mixing, shall meet the requirements set forth in Section 90 of Caltrans State Standard Specifications, except that 3/4 inch maximum size aggregate shall be used and slump ranges of three (3) to four (4) inches for Class "A" concrete and four (4) to eight (8) inches for Class "C" concrete shall be maintained.
3. No admixtures will be permitted unless authorized by the Engineer.
4. Cement and aggregates shall be stored in such a manner as to prevent deterioration or intrusion of foreign matter.
5. Mixed concrete shall be used before initial set and in no case will retempering with additional water be permitted.

C. CONTROLLED LOW STRENGTH MATERIAL (CLSM)

CLSM shall be flowable, hand-excavatable mixture of cement, pozzolan, coarse and fine aggregate and water which has been mixed in accordance with ASTM C 94. Cement shall be Type II in accordance with ASTM C150. Pozzolan shall be added to improve flowability and shall be Type F in accordance with the requirements of ASTM C618. Coarse aggregate shall consist of a well graded mixture of crushed rock, soil, or sand with a maximum size aggregated of ½ inch conforming to the following gradation:

Sieve Size	Percent Passing
3/4-inch sieve	100
3/8-inch sieve	70
No. 200 sieve	12 maximum

CLSM density shall be between 120 pounds per cubic foot (PCF) and 135 pounds per cubic foot (PCF).

Compressive strength at 28 days for flowable CLSM shall be between 50 PSI and 150 PSI.

2.02 MORTAR AND GROUT

The dry materials used for mortar shall be thoroughly mixed with sufficient clean water to produce a uniform, plastic, workable and cohesive mixture.

Sand for mortar and grout shall be clean, dry, well-graded sand, free of organic or other deleterious matter, silt or other objectionable inorganic matter, and shall be of such size as determined by laboratory sieves, conforming to the following gradation:

Sieve Size	Percent Passing
3/8-inch sieve	100
1/4-inch sieve	95 - 100
No. 20 sieve	50 - 85
No. 100 sieve	0 - 15

Cement shall be Type II Portland cement. An industrial grade all-purpose non-shrinking cement such as "All Crete" or "Speed Crete" may be used.

No admixtures shall be used in the mortar or the grout unless otherwise specified or approved by the Engineer.

Mortar shall be composed of cement and sand proportioned and mixed as specified herein. Type "A" mortar shall be used unless Type "B" is specified by the Engineer.

A. TYPE "A"

Type "A" shall consist of one part by volume of cement and two parts by volume of sand.

B. TYPE "B"

1. Type "B" shall be a case basis, mixed and used in accordance with manufacturer's recommendations.
2. Mixed mortar shall be used before initial set and in no case will retempering with additional water be permitted.

SECTION 3 - SEWER PIPE AND STRUCTURE INSTALLATION

3.01 SEWER PIPE INSTALLATION

A. CONSTRUCTION STAKING

All main sewers and laterals shall be staked in the field in accordance with the requirements of the Napa Sanitation District. The grades and alignment of the sewer staked shall be approved by the Engineer prior to start of sewer construction. See Standard Specifications Section 9.02, Volume I and Section 10.08, Volume II for staking requirements and submission of cut sheets.

B. ALLOWABLE DEVIATION OF ALIGNMENT AND GRADE

The horizontal deviation of the sewer from the line shown on the plans shall be no more than three (3) inches. The sewer grade shall not deviate from the profile shown on the plans, and the grade shall be maintained during and after backfilling operations. Sewer grades with deviations exceeding 1/2 inch shall be removed and replaced at the Contractor's expense. If deviations less than 1/2 inch from the design grade occur, pipe joints may be deflected to bring the invert back to grade. Grade corrections shall be made gradually to prevent sags in the pipe invert at low spots. Pipe shall be installed to be free draining (no sags) between any two points. No reverse (adverse) grade will be allowed.

C. LASERS

When laying main sewers, unless otherwise approved by the Engineer, the Contractor shall use a commercial laser grade setting system. When using a laser, the following requirements and conditions must be met:

1. The Contractor shall have the responsibility of providing an instrument operator who is qualified and trained in the operation of the laser and said operator shall adhere to the provisions of the State of California Construction Safety Orders issued by the Division of Industrial Safety. Attention is particularly directed to Section 1514, 1800, and 1801 of said orders for applicable requirements.
2. When using a laser, the laser shall be connected firmly to a tripod set firmly on compacted soil. The laser height of instrument shall be taken from one (1) offset hub and checked with at least two (2) more hubs until 2 or more hubs show consistent readings or until readings coincide. This shall be done every time the laser is set up or disturbed.
3. The laser and level instruments shall be properly calibrated within six (6) months prior to use. A laser or level instrument found to be out of calibration or without

records showing it has been calibrated within the last six (6) months shall be removed from the job site until it has been properly calibrated.

D. GRADE LINE

1. When laying pipe for laterals, in lieu of a laser grade setting system, the Contractor may use a grade line. When laying the pipe, except where vertical curves are shown on the plans, or otherwise authorized by the Engineer, the Contractor shall use a grade line with at least two (2) adjacent runs at all times in order to detect any variation from a straight grade.
2. The grade line must be established over the center of the trench in vertical trenches and over the center of the pipe in V-type trenches during the laying operations and grade line shall be maintained up until the pipe grade is checked by the Engineer.
3. The grade line shall be accurately and securely fastened at each staked station to securely erected batter boards and kept taut at all times.
4. The measuring pole shall be a solidly constructed straight pole with a metal foot at one end at right angles to the pole. The batter board construction, string line, and measuring pole construction shall be approved by the Engineer prior to start of sewer pipe laying.
5. In caving ground and in other circumstances when the above is not practicable, and when so authorized by the Engineer, the pipe must be checked by surveying instruments under the direction of a Registered Civil Engineer or Land Surveyor who shall accept the responsibility for the pipe being installed on the proper grade.

E. SEWER PIPE PLUGS

Sewer pipe 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 plugs or caps may only be removed when so authorized by, and in the presence of, the Engineer.

F. JOINT DEFLECTIONS AND MINIMUM RADIUS

When approved by the Engineer, curved sewers shall be in conformance with the following requirements.

1. Rigid Pipe:
No deflection of rigid pipe will be allowed.
2. Flexible Pipe:

For flexible pipe, horizontal curves shall be achieved only with approval of the District Engineer and the use of fused pipe. The minimum allowable bending radius is shown in the following table, which follows the equation:

$$\text{Radius} = 300 \times \text{Pipe Diameter (in feet)}.$$

Smaller radii may be approved by the Engineer.

Pipe Diameter (inches)	Minimum Radius (feet)
4	100
6	150
8	200
10	250
12	300
15	350
18	450

G. VERIFICATION OF EXISTING SEWER OR STRUCTURE

Where connection is to be made to an existing sewer or structure, said existing sewer or structure shall be uncovered and checked for location and elevation prior to submitting cut sheets. Any discrepancy between the plans and field information shall be reported immediately to the Engineer.

H. COMMENCEMENT OF NEW SEWER PIPE LINE

Unless otherwise authorized by the Engineer, laying of the pipe in finished trenches shall be commenced at the lowest point of the project, with the spigot ends abutting and pointing in the direction of the flow. The joints shall be carefully centered so that when laid to proper grade and alignment as designated on the plans, they will form a sewer line with a uniform invert.

I. SEWER PIPE LINE THROUGH MANHOLES

Sewers shall be laid continuously through proposed manhole locations on all straight runs and at angle points. A minimum drop of 0.1 feet is required for mains of the same size. When mains on the upstream and downstream connections to the manhole are different size pipes, the upstream and downstream pipe crowns should be at the same elevation. When excavation is made below the pipe for manhole construction, care must be taken that the pipe spanning this area is firmly supported.

J. FLEXIBLE COUPLINGS AT MANHOLES

For rigid pipes, a flexible pipe coupling, such as a calder coupling, shall be installed at a point 1 to 3 feet outside of the manhole base block on both upstream and downstream sides. In all cases, the flexibility of the coupling must be maintained by keeping all concrete away from the joint or coupling. A bell joint is not acceptable for this requirement.

For flexible pipes up to 12-inch in diameter, a formed bell shall be cast into the manhole. See standard details.

K. GROUND TO BE FILLED / FILL AREAS

In fill areas, fill shall be placed up to 3 feet above where the outside of the pipe would be and laterally to a width of the pipe outside diameter plus six (6) feet centered on where the pipe would be, and compacted prior to the construction of the sewer. The compaction requirements, as specified by the Agency governing the fill, shall be considered adequate except that not less than 90% relative compaction per ASTM D-1557 "Modified Proctor" shall be achieved. Evidence of these results in the areas concerned shall be furnished to the local agency (City/County) from an approved testing laboratory prior to construction of the affected sewer.

L. HANDLING OF PIPE

Pipe shall be protected during handling against impact shocks. Prior to making pipe joints, all surfaces of the portion of the pipe to be joined shall be cleaned, dried, primed or otherwise prepared as called for in these Standards. The interior of all pipe shall be kept free from all dirt and foreign matter as the work progresses. At the close of each day's work, and at such other times when the pipe is not being laid, the ends of all open pipes shall be closed with a water tight plug or cap. Any modification of this requirement must be approved by the Engineer.

M. FIELD CUTTING PIPE

Unless otherwise permitted by the Engineer, pipes that must be cut in the field shall be cut with mechanical cutters or as recommended by the pipe manufacturer.

N. BYPASS PUMPING

The Contractor, when required, shall provide for the flow of sewage around the section or sections of pipe designated for repair. Plugging the line at an existing upstream manhole and pumping the flow into a downstream manhole or adjacent system shall make the bypass. The pump(s) and bypass line(s) shall be of adequate capacity to accommodate the sewage flow. The District may require a detail of the bypass plan to be submitted that includes, at a minimum, 100% redundancy, 24-hour backup pumping equipment/generator, emergency contact numbers, qualified

personnel to provide continuous supervision of bypass pumping system, traffic control, surface pipe restrictions, etc., complete to accomplish the bypass pumping operation.

3.02 SPLICE

When a pipe is to be spliced into an existing sewer, the existing sewer shall be exposed and then mechanically cut at right angles to the pipe barrel, with sufficient length removed so that a pipe section with plain ends can be joined to the cut pipe with approved couplings to form an airtight joint. All work shall be done in the presence of the Engineer. Care must be taken to fill all voids under and around the pipe splice with import or approved native backfill material to properly support the new pipe and prevent any settlement of the spliced section.

3.03 MANHOLE

Manholes shall be sound watertight structures, constructed as shown on the Standard Details or on the improvement plans in the case of special structures. The type of manhole and its location is to be shown on the Plans. The manhole shall be constructed to the rim elevations shown on the Plans. The design, the specification and the name of the manufacturer shall be submitted to the District for approval prior to the purchase of any precast manhole units.

Types of Manholes:

1. Brick Manholes

Brick manholes are not authorized or accepted. Existing brick manholes shall be replaced per current District standards when new connections are made.

2. Standard Manholes

Standard manholes, consisting of base, riser, and top, are precast reinforced concrete manholes with concentric cones, and are forty-eight (48) inch diameter for main sewers and sixty (60) inch diameter (min.) for trunk sewers.

3. Drop Manholes

Drop manholes are standard manholes with an outside drop connection. Drop manholes shall be installed where the invert of the pipe into the manhole is greater than 2 feet above the invert out of the manhole and shall be constructed in accordance with detail SS-8.

4. Siphon Manholes

Siphon manholes shall be reinforced cast-in-place concrete manholes. Contractor shall provide siphon manhole design to the District Engineer for review and approval.

5. Cast-in-Place Concrete Manholes

Cast-in-place manholes shall be forty-eight (48) inches in diameter and constructed in accordance with Section D of this Section.

6. Metering Manholes

Metering manholes are standard precast sixty (60) inch diameter (min.) manholes.

A. MANHOLE CHANNELS

Sanitary sewer pipe shall have a joint or coupling not more than two (2) feet and not less than one (1) foot beyond the outside wall of the manhole. Where sewer lines pass through manholes the piping shall be laid as a whole pipe and after the manhole floor and walls have set, the top half of the piping inside the manhole shall be cut off and the sides mortared to form a smooth channel as shown on the Standard Details.

Channels through Siphon Manholes shall be formed or constructed to provide a channel width equal to the inside diameter of the pipe from the center of the pipe to the manhole floor and shall be checked with a template.

B. MANHOLE THROAT

See standard detail for maximum depth of manhole throat.

C. PRECAST MANHOLE BASE BLOCK

Precast base blocks are required for standard manholes and must be approved by the Engineer. Precast base blocks must be monolithically poured and shall meet the requirements of Standard Details SS-9 and SS-9A. Precast base blocks may not be used for trunk manholes.

D. CAST-IN-PLACE MANHOLE BASE BLOCK

Cast-in-place manhole blocks shall be used for trunk manholes. Where existing site conditions prohibit the installation of a precast manhole base block, Contractor may request approval by the Engineer to install a cast-in-place manhole base block. The following requirements must be followed for pouring a cast-in-place manhole base block:

1. The concrete pour shall be made only on dry, firm undisturbed ground or on "rock ballast" placed on undisturbed ground. If the pour is on filled ground, the ground shall be compacted to a 95% relative compaction per ASTM D-1557

“Modified Proctor.” The concrete shall be placed with a continuous pour deposited in such a manner that segregation of material does not occur. Once deposited, the concrete shall be consolidated with mechanical vibrators so as to secure a dense watertight mass.

2. An approved metal form ring shall be used so that a level keyed slot is formed in the fresh concrete to receive the precast manhole shaft section.
3. For connection to an existing sewer main, the top half of the sewer pipe shall be removed to within one (1) inch longitudinally of the inside wall of the manhole and the cut finished with mortar as specified by the Engineer.
4. The width of opening at the top of base block shall be the inside diameter of the pipes in the manhole.
5. In angle point manholes and in junction manholes, the pipes shall be joined by smooth curves, warped to conform to the lower half of the pipe. In all cases, the upper portion of the manhole channel from the mid-point of the pipes in the manhole to the top of the base block shall be constructed vertically.
6. When the manhole channel is not completed in the original pour, it shall be finished smooth by use of mortar with per Volume II, Section 2.02. Before application of the mortar, the existing concrete surface shall be thoroughly cleaned and roughened to secure a firm bond. All channels shall be troweled smooth so that a smooth uninterrupted surface is achieved. The top of the base block shall be troweled to slope towards the channel at an approximate slope of one (1) inch in six (6) inches.

E. CAST-IN-PLACE MANHOLES

Cast-in-Place manholes shall only be used if approved by the District.

F. MANHOLE SHAFT AND PRECAST BASE BLOCK

The manhole shaft shall be composed of precast concrete sections.

1. Precast concrete sections shall be in accordance with the Standard Details and shall conform to the requirements of ASTM Designation C-478 except that Type II or Type V Portland Cement shall be used. The cone section shall be concentric unless eccentric is allowed by the Engineer.
2. Unless otherwise directed by the Engineer, manholes to be installed in all proposed City and/or County streets and paved Public Easements will be constructed with standard cone section per Standard Detail Sheets. In these

cases, the grade rings and cast rings shall be installed after the street section has been completed.

3. Joints between precast sections shall have a "Ram-Nek" flexible plastic gasket installed between the tongue and groove joint to make a watertight joint. After the shaft is in place, the joint shall be trimmed smooth with a sharp tool on the inside of the manhole.
4. Manhole access, section joints, and pick holes shall be sealed with "WrapidSeal™" (sold by CCI Pipeline Systems) sheet roll encapsulation.
5. Manhole sections will be ordered without steps. Precast manhole base blocks, shall have a standard pipe bell cast into the base block. Rubber boot type connections are prohibited.

G. DROP CONNECTIONS

When a drop connection is shown on the Plans, it shall be included as part of the manhole construction. The drop shall be made with approved fittings outside the manhole shaft as shown on the Standard Detail SS-8. The lowest pipe shall be constructed into the base block by aforementioned channeling procedures. The base block shall be enlarged to encase these lower fittings.

After the manhole shaft is in place, the upper pipe run shall be constructed through the precast wall. The hole between the pipe and the precast section shall be mortared to a watertight condition. This pipe and drop shall then be encased in concrete to the point where the upstream sewer trench is of normal width and depth.

H. MANHOLE CASTINGS

Manhole frame and cover shall be Class 30 cast iron designed as shown on the Standard Details and conforming to ASTM Designation A-48. Manufacturer's name, initials or logotype shall be cast in the frame and cover. The bearing surfaces of the frame and cover shall be machined and the cover shall seat firmly without rocking. Before leaving the foundry, all casting shall be protected with an asphalt coating as follows:

1. The surface to be protected shall be clean, uncoated cast iron free of oil, grease, scale or rust.
2. The casting shall be painted with asphalt paint or as an alternative the entire casting shall be dipped in asphalt paint.

3. The manhole frame and cover shall be permanently set when so authorized by the Engineer.
4. The frame shall be centered on the manhole shaft and laid on mortar to final grade. The mortar shall be neatly struck.

I. MANHOLE COLLAR

Unless otherwise specified by the Engineer, a concrete collar shall be poured around the frame and shaft so as to securely anchor the frame to the shaft. (See the Standard Details)

J. WATERPROOFING MANHOLES

See Standard Detail for water proofing requirements upon completion of the manhole.

K. MANHOLE LINERS

All trunk manholes and drop manholes shall be lined with a liner embedded into the manhole concrete at time of pour. Standard manholes shall be lined where required by the Engineer. Liner material shall be submitted to the District for approval. Liner shall extend from the casting to the top of the bench wall shelf.

Joints in liner shall be water tight and shall be inspected and tested to the satisfaction of the District. Any holidays or pinholes shall be repaired. The manhole will not be accepted until it is holiday and pinhole free.

L. ADJUSTING OR REPAIRING MANHOLES

For repair of existing brick or cast-in-place concrete manholes, the repair or adjustment may be made utilizing pre-cast elements upon approval by the Engineer. The Engineer may authorize repair of the manhole using spray liner manufactured by Madewell Products Corporation or approved equal.

For existing manholes that are lined with T-lock, existing T-lock shall be inspected for defects or deterioration. Small areas which can be spot repaired shall be repaired per the manufacturer's recommendations. If the T-lock cannot be spot repaired, the Engineer shall determine whether the existing manhole can remain but replace the liner/coating or if the condition of the manhole requires a new manhole to be installed.

Existing 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 twelve (12) inches. Adjustments shall be made by removing the upper portion of the manhole down to the first barrel section or equivalent. Precast concrete barrels and cone sections shall then be utilized to reconstruct the upper portion of the manhole in accordance with the Standard Detail.

The channels in the base of the manhole shall be protected by a 48" or 60" diameter "umbrella" type shield prior to any work be done on the manhole. The "umbrella" shall be carefully removed allowing no debris to fall or remain in the manhole when the repair has been completed.

3.04 RISER (MAIN SEWER ONLY)

A. RISER CASTINGS

The riser frame and cover shall be Class 30 Cast Iron designed as shown on the Standard Details and conforming to ASTM Designation A-48. Manufacturer's name, initials or logotype shall be cast in frame and cover. The cover shall seat firmly without rocking. Before leaving the foundry, all castings shall be cleaned and coated with asphaltic material.

1. The frame shall be centered on the riser shaft opening so that the pipe does not touch the frame. When the frame has been set to final grade, a concrete block shall be poured around the frame.
2. The riser frame and cover shall be permanently set when so authorized by the Engineer.

3.05 CLEANOUT TO GRADE (Private Lateral FOR Building Sewer Only)

A wye-branch fitting, with branch the same diameter as the private sewer, shall be installed so that it opens in a direction opposite to the flow of the sewer, vertically above the pipe barrel. Necessary fittings and pipe, of the same diameter as the private lateral, shall be used to bring the "cleanout" vertically to ground surface and an approved box and cover installed, all as shown on the Standard Details.

Cleanouts shall be constructed as shown on the Standard Details and in locations shown on approved plans. A transition coupling and cleanout shall be provided and installed at the property line.

The vertical pipe shall be plugged below subgrade of surface in improved areas and sufficiently below the ground surface in unimproved areas so as to be protected during final site preparation. After surface work is complete, the riser pipe will be extended to

finished grade, capped with an airtight threaded body and cap plug and protected with an approved cleanout box per Standard Details.

3.06 TWO-WAY CLEANOUT TO GRADE (Private Lateral Only)

A two-way fitting with a riser pipe, both of the same diameter as the private lateral shall be installed vertically above the pipe barrel. The two-way cleanout to grade will be brought to finished grade, capped with an airtight threaded body and cap and protected with an approved cleanout box per Standard Details.

When a plastic two-way fitting is used, a six (6) inch long plastic stub must be installed into the downstream bell of the two-way fitting in order to permit a proper coupling to be made with other types of material used for the private lateral.

3.07 TEST WYE (Private Lateral Only)

A wye-branch fitting, with branch the same diameter as the private lateral, shall be installed so that it opens in a direction opposite to the flow of the sewer vertically above the pipe barrel. The test wye shall not be removed after testing, but shall be capped with an airtight threaded body and cap and left in place. Rubber caps shall not be used.

3.08 SEWER THROUGH CASING

Unless otherwise required by the Engineer, when main sewer pipe cannot be installed by open cut methods, it must be installed in a casing as shown on the Plans.

Pipe casing size, material and thickness will be as specified on the Plans.

The casing material will be delivered to the job site with ends fabricated to a true right angle with the axis of the pipe to facilitate accuracy of jacking.

Welded Steel Pipe Casing shall conform to ASTM Designation A-53 Grade B, A-139 grade B or A-252 Grade 2.

Where approved by the Engineer, four (4) inch and six (6) inch pipes can be bored; larger diameters require casing. The minimum inside diameter of the pipe casing shall be eight (8) inches greater than the maximum outside diameter of the sewer to be installed therein, with a minimum outside diameter of thirty (30) inches for any casing unless otherwise approved by the Engineer.

The casing sections shall be joined by a continuous watertight weld.

The jacking pits shall be excavated and backfilled in accordance with Volume II, Sections 4 and 5, respectively. A submittal for, and inspection of, the jacking pit installation shall be required prior to the start of the jacking operation.

The guide rails for the jacking machine shall be accurately set and checked by a licensed surveyor, so that the casing, while being jacked, will be guided to correct line and grade to enable the sewer pipe to be centered in the casing.

The front of the casing pipe shall be provided with mechanical arrangements or devices that will positively prevent the auger from leading the pipe so that no unsupported excavation is ahead of the pipe. The auger and cutting head arrangement shall be recessed to prevent the flowing of material from the face of the casing into the casing. The auger and cutting head arrangement shall be removable from within the pipe in the event an obstruction is encountered.

The Contractor shall be responsible for surface subsidence and damage or disturbance to adjacent property and facilities that may result from the Contractor's Construction method. In the event that loose material is encountered and cave-ins occur or are anticipated, all jacking will be discontinued, approved shoring shall be provided and all voids filled by pressure grouting.

It is recommended that the Contractor make frequent checks on the casing grade during installation. Grade stakes, indicating pipe invert elevations, shall be located at both ends of proposed casing.

Voids created between the outside of the casing wall and surrounding earth shall be filled with grout or sand.

When the casing has been completed, and before the sewer is installed, it shall be inspected and approved by the Engineer. Pipe material as shown on the Plans shall then be joined and installed on proper grade through the casing.

The sewer pipe shall be securely supported through the casing as shown on the Standard Details. After the sewer pipe is installed, it shall be given a preliminary air test in the presence of the Engineer (see Volume II, Section 7 - Testing) and internally inspected by closed circuit television (see Volume II Section 8 – Television Inspection). After the test is satisfactorily completed, and the television inspection favorably reviewed, the annular space between the pipe and the casing shall be filled with dry sand mechanically blown in or filled with grout so as to completely fill all voids after which the space between the end of the casing and the pipe shall be sealed to a watertight condition. The pipe shall be anchored and secured to prevent movement during the filling of the annular space.

3.09 SEWER THROUGH BORE

Unless a casing is required by the Engineer, private sewer pipe that cannot be installed by open cut methods shall be bored.

When a sewer pipe is to be installed in a bored hole, 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 sewer pipe to be placed therein.

When the bore has been completed and before the sewer is installed, it shall be inspected and approved by the Engineer. PVC Pressure Pipe (AWWA C-900, Class 150), shall then be joined and installed through the bore.

After the sewer pipe is installed, it shall be given a preliminary air test in the presence of the Engineer (see Volume II, Section 7 - Testing of these Specifications) and internally inspected by closed circuit television (see Volume II, Section 8 – Television Inspection of these Specifications).

3.10 REHABILITATION OF PRIVATE LATERALS USING PIPE-BURSTING

A. GENERAL

Private laterals in poor condition due to cracked pipe or joints, leaking joints (infiltration), or root intrusion may be rehabilitated using the pipe-bursting method, if approved in advance by the District. Certain conditions, such as private laterals with insufficient grade, sags, or in close proximity to other utilities may not be suitable for rehabilitation using the pipe-bursting method. Asbestos cement pipe (ACP) is prohibited from pipe bursting. This specification is intended for rehabilitation of 4-inch or 6-inch diameter private laterals only.

Approval of the pipe-bursting method by the District can only be made after reviewing the pre-rehabilitation CCTV inspection tape, which is a required submittal item. Approval of the submittal by the District does not imply that the proposed pipe-bursting installation is appropriate for the specific location being proposed for installation. The Contractor is completely responsible for all elements of the pipe-bursting installation, including safety of installation, conflicts or damage to: utilities, property improvements, sidewalks, driveways, curbs, gutters, pavement, and equipment, or installation problems caused by existing private sewer pipe materials, subsurface conditions, or access restrictions.

B. DESCRIPTION

Pipe-bursting rehabilitation consists of fragmenting or splitting and expanding the existing pipe while simultaneously pulling, or pushing, a new high-density polyethylene (HDPE) pipe into the resulting void. The method requires the excavation of two pits. The insertion pit shall be used to insert the pipe bursting head followed by the new pipe. The exit pit or receiving pit shall be used to receive the bursting head and new pipe through the existing private lateral. After insertion,

a cleanout to grade shall be installed at the property line connecting the new private lateral to the existing public lateral and serving as delineation between the public and private laterals.

C. SUBMITTALS

Minimum pipe-bursting experience requirements:

1. The Contractor shall have completed a minimum of two pipe-bursting projects within the last two years. Submit short project descriptions and references (name and phone numbers of property owners or construction inspectors) for two projects.
2. A letter signed by the property owner authorizing the installation of the private lateral using the pipe-bursting method. The letter must also acknowledge that the pipe-bursting procedure and limitations have been explained to the property owner by the Contractor.
3. Pre-rehabilitation television inspection: The Contractor shall inspect the private lateral using a CCTV camera and provide a DVD-format video and inspection report for each private lateral. The tape shall show the footage of the camera and shall include the complete length of the private lateral to be replaced. Prior to television inspection, the existing pipe must be clean of all debris and must be wet so that sags can be easily detected. The television inspection shall be completed in the presence of the District Inspector. If approved by the Engineer, the television inspection may be completed without a District Inspector if the inspection videotape adequately documents the location and condition of the work.
4. Post-rehabilitation television inspection: The television inspection shall be completed in the presence of the District Inspector. If approved by the Engineer, the television inspection may be completed without a District Inspector if the inspection videotape adequately documents the location and condition of the work.

D. EQUIPMENT

The pipe-bursting equipment may be either hydraulic, pneumatic, or the cone cracking type. The bursting head shall be specially designed to force its way through the existing pipe materials by fragmenting the pipe and compressing the old pipe section into the surrounding soil as it progresses. The head shall be designed to produce a maximum opening dimension of 1 inch (diameter) larger than the outside diameter of the new HDPE pipe. The pipe-bursting system shall be used to replace the existing private sewer with the same nominal size pipe. The system shall not be used to increase the size of the private sewer.

E. PIPE

The HDPE pipe shall be as specified in Volume II, Section 1.02 of these Standard Specifications.

F. UTILITIES

At least 48 hours prior to excavation, the Contractor shall call Underground Services Alert (USA) at (800) 642-2444. The Contractor shall request utility markings for the entire reach of the proposed pipe burst. The Contractor shall pothole all utilities crossing the proposed pipe burst to determine the clear distance between each utility and the existing private sewer. Utilities with less than 12 inches of clearance or water mains and water services with less than 24 inches of clearance shall be left exposed during the pipe-bursting installation.

G. INSTALLATION

After coordinating with the property owner and residents, plug existing private sewer or provide by-pass pumping system to prevent sewage spills. Dumping or free flow of sewage within the excavation or on public or private property, gutters, streets, and storm drain facilities is prohibited.

1. The insertion pit shall be large enough so that HDPE pipe can be installed without exceeding the minimum bending radius. The minimum bending radius shall be 20 times the outside diameter of the pipe or as recommended by the pipe manufacturer, whichever value is larger.
2. After installation, the Contractor shall allow a minimum of four (4) hours for relaxation due to tensile stressing and to allow the pipe to thermally acclimate with the soil prior to installing final connections to public lateral. Temporary connections can be installed sooner to reinstate sewage flows.
3. Any installed pipe, which has cuts or abrasions in the pipe wall exceeding 10 percent of the wall thickness, shall be cut out and removed from the site.
4. After final cleaning of the private sewer, water shall be introduced into the new pipe section and the post-rehabilitation television inspection shall be completed and the tape or DVD submitted to the District for approval.

H. CONNECTIONS

A cleanout to grade, including box and cover, shall be installed at or near the property line as shown on the Standard Details. Connections shall be completed using flexible couplings with Type 316 stainless steel bands.

3.11 REHABILITATION BY CURED IN PLACE PIPE (CIPP) LINING

A. GENERAL

The CIPP process will rehabilitate the existing pipeline from the inside by the installation of an interior pipe that fits tightly to the inside of the existing pipe. The process will be accomplished through the use of existing access such as maintenance holes or other existing openings and is to be done with minimal excavation. The new interior pipe, called a CIPP liner, is provided in sufficient thickness to address the deterioration situation of the existing pipeline. Typical thickness ranges from 4.5mm to 50mm depending on the size, condition and depth of the existing pipe. Liner thickness shall be submitted to the Engineer for review and approval based on the project-specific situation.

1. Rehabilitation of existing sanitary sewers by installation of a resin impregnated flexible felt tube into the existing sewer line utilizing a vertical inversion standpipe and hydrostatic head and curing by circulating hot water or steam/air mixture to produce a hard, impermeable pipe during the cure process.
2. The finished pipe liner in place shall be fabricated from materials which when complete are chemically resistant to and will withstand internal exposure to domestic sewage having a pH range of 6.0 to 9.0 and temperatures up to 150°F.

Existing pipes with a sag or “belly” will require a spot repair prior to rehabilitating the sewer line by CIPP lining.

B. DESCRIPTION

CIPP rehabilitation consists of inserting CIPP liner into the existing pipe in a soft, flexible and expandable configuration containing thermosetting resin in a viscous liquid state. A resin absorbent carrier tube called a felt bag will be used to carry, properly position, and uniformly distribute the liquid resin within the existing pipe. Upon final positioning and expanding of the carrier tube against the inside surface of the existing pipe, the resin will be transformed to a solid state by a thermosetting process. The thermoset process will be initiated by applying heat to the resin that was previously catalyzed before its absorption into the carrier tube. The methods used to introduce the required heat will be by internally circulating heated water or by a flow through of steam/air mixture.

1. The process of absorbing the catalyzed resin into the carrier tube is called resin impregnation or wet-out of the carrier tube. The process of installing the resin impregnated liner tube into the existing pipe is called inversion or pull-in depending on the specific insertion method used and type of carrier tube. The process to make the liquid resin in the carrier tube transform to a solid by the thermoset reaction is called curing.

2. Following the cure of the CIPP liner, the closed ends of the liner at MH's or other accesses will be removed and the pipeline made available for flow. Incoming connections, such as service laterals will be reinstated into the pipeline by cutting corresponding openings in the cured CIPP liner. For non-man entry sized pipeline either CCTV monitored robot cutters will be used or reinstatement will be done by man-entry.
3. The CIPP lining installation process will include the cleaning and preparation of the existing pipeline to a suitable state and the provision of flow bypass when necessary. The CIPP rehabilitation is completed with CCTV inspection of the finished liner.

C. SUBMITTALS

1. The Contractor shall have completed a minimum of 50,000 feet within five years of the project bid, in wastewater collection systems. Submit short project descriptions and references (name and phone numbers of property owners or construction inspectors) for two projects.
2. Shop drawings, catalog data, and manufacturer's technical data showing complete information on material composition, physical properties, and dimensions of new liner.
3. Pre-installation television inspection reports and video tapes.
4. Detailed Project Plan including: drawings and written descriptions of the entire construction procedure to fabricate, wet-out, stage, install liner, bypass pumping configuration, details and equipment, inversion locations, and location of all special connections.
5. Television inspection reports and videotapes, and test results made after new liner is installed.
6. Testing reports and results from final installation.
7. Prior to construction, Contractor to submit CIPP liner installation and sequencing plan for the entire project, to the Owner for review and approval. Plan shall show where all insertion points are located, water draw locations, and staging areas.
8. Emergency Response Plan
9. Project Schedule
10. Resin manufacturer's heating and curing requirements.

11. Final design calculations, liner thickness, and resin design for all lined segments.
12. Resin and tube installation test results of field installations for system proposed.

D. MATERIALS

The materials for CIPP shall be as specified in Volume II, Section 1.02 of these Standard Specifications.

E. INSTALLATION

It shall be the responsibility of the contractor coordinate with the District to locate and designate all manhole access points open and accessible for the work, and provide rights-of-access to these locations. If a street must be closed to traffic because of the orientation of the sewer, the contractor shall institute the actions necessary to provide access during this for the mutually agreed time period. The contractor must coordinate with the District for access to water hydrants for cleaning, installation and other process related work items requiring water.

1. Cleaning of Sewer Lines - The Contractor, when required, shall remove all internal debris out of the sewer line that will interfere with the installation of CIPP. The contractor shall remove all debris removed from the sewers during the cleaning operation and dispose of at an acceptable facility.
2. Bypassing Sewage - The Contractor, when required, shall provide for the flow of sewage around the section or sections of pipe designated for repair. Plugging the line at an existing upstream manhole and pumping the flow into a downstream manhole or adjacent system shall make the bypass. The pump(s) and bypass line(s) shall be of adequate capacity to accommodate the sewage flow. The District may require a detail of the bypass plan to be submitted that includes, at a minimum, 24-hour backup pumping equipment/generator, emergency contact numbers, qualified personnel to provide continuous supervision of bypass pumping system, traffic control, surface pipe restrictions, etc., complete to accomplish the bypass pumping operation.
3. Inspection of Pipelines - Inspection of pipelines shall be performed by experienced personnel trained in locating breaks, obstacles, and service connections using close circuit television (CCTV) inspection techniques. The pipeline interior shall be carefully inspected to determine the location of any conditions that may prevent proper installation of CIPP. These shall be noted and corrected. A DVD and suitable written log for each line section shall be produced for later reference by the District.
4. Line Obstructions - It shall be the responsibility of the Contractor to clear the line of obstructions such as solids and roots that will prevent the insertion of CIPP.

5. Public Notification - The Contractor shall make every effort to maintain sewer service usage throughout the duration of the project. In the event that a connection will be out of service, the longest period of no service shall be 8 hours. A public notification program shall be implemented, and shall as a minimum, require the Contractor to be responsible for contacting each home or business connected to the sanitary sewer and informing them of the work to be conducted, and when the sewer will be off-line. The Contractor shall also provide the following:
 - a. Written notice to be delivered to each home or business the day prior to the beginning of work being conducted on the section, and a local telephone number of the Contractor they can call to discuss the project or any potential problems.
 - b. Personal contact with any home or business, which cannot be reconnected within the time stated in the written notice.
6. The Contractor shall be responsible for confirming the locations of all branch service connections prior to installing the CIPP.

SECTION 4 - EXCAVATION

4.01 DEFINITION

Excavation shall mean all of the below ground-surface work (including cutting of pavement; control of ground water, storm water and other extraneous water; removal, handling, stockpiling and/or proper disposal of removed material and water) necessary to prepare a firm, dry bed for the sewer line and structures.

The Contractor shall be solely and completely responsible for conditions of the jobsite, including safety of all persons and property during performance of the Work. This requirement shall apply continuously and not be limited to normal working hours. Safety provisions shall conform to U.S. Department of Labor (OSHA), the California Occupational Safety and Health Act (CalOSHA), and all other applicable Federal, State, County, and local laws, ordinances, codes, including but not limited to the requirements set forth below, and any regulations that may be detailed in other parts of these Standard Specifications. In the event of conflicting requirements, the most stringent requirement as it pertains to the Contractor's safety responsibility shall be followed by the Contractor.

The excavation shall be made to enable the sewer to be laid to the grade and alignment designed on the Plans.

4.02 OPEN TRENCHING

Except where tunneling is necessary, excavation for sewers shall be made by open trenching in accordance with Detail SS-24. Existing pavement shall be saw cut and replaced in accordance with Volume I, Section 6 – Paving Replacement of these Standards. The walls of the sewer trench shall be vertical in the region between the bottom of the trench and the top of the sewer pipe. In this region:

Pipe Diameter (inches)	Clear Distance between Pipe and Vertical Trench Wall (inches)
≤ 8	6 inches
8 - 18	9 inches
≥ 18	Per Engineer

A minimum 12-inch clearance shall be maintained between the outer wall of the pipe barrel and the embankment or shoring, unless otherwise approved by the Engineer.

The trench shall be excavated to a level section and to such elevation as will give a uniform bearing and true flow line elevation when the sewer pipe is laid. All loose dirt in the bottom of the trench must be removed.

A. MUD OR OTHER SOFT OR SPONGY MATERIAL

Where mud or other soft or spongy material incapable of proper pipe support is encountered, it shall be excavated to a minimum depth of twelve (12) inches below sewer subgrade. Limits of the material to be removed shall be designated by the Engineer in the field. However, this does not relieve the Contractor of the requirements of these Specifications, including, but not limited to, allowable deviation of alignment and grade.

When so directed by the Engineer the trench shall be extended below the pipeline grades to permit the placement of ballast for the pipe foundation. All areas of over excavation, to remove unsuitable material, or for any other reason, shall be brought to grade with approved ballast material, and compacted.

B. ROCK

Where rock is encountered, the trench shall be excavated to a minimum depth of three (3) inches below the sewer subgrade and backfilled to sewer subgrade with approved import material, thoroughly compacted to grade before the sewer pipe is laid.

C. OVER-EXCAVATED AREAS

Over-excavated areas in the trench bottom where approved trench foundation material will be placed, shall be restored to sewer subgrade with Import, thoroughly compacted before the sewer pipe is laid.

D. COMPACTION

In all the above situations, the compaction shall be achieved by mechanical means. Water settling, flooding, jetting, and other water consolidation methods are expressly prohibited.

E. BRACING AND SHORING

The contractor shall at all times furnish, install, and maintain sufficient bracing and shoring in trenches to insure safety of the workmen and to protect and facilitate the work. When practical, all such bracing and shoring shall be removed from the trench as the backfilling proceeds.

F. BLASTING

In the event that blasting is necessary in excavation, special permission, in writing, must be obtained from the Agency having jurisdiction over the issuance of blasting permits before any blasting will be permitted. Such permission shall in no way relieve the Contractor of the responsibility for obtaining any permits or licenses required by State Law or Local Ordinance.

G. SEWER SUBGRADE

The sewer subgrade shall be kept dry at all times and precautions shall be taken that no storm water is allowed to enter the excavation prior to backfilling. The Contractor shall, at all times, have on the job, sufficient pumping machinery for immediate use. Water shall be disposed of in accordance with the requirements of the agency having local jurisdiction, and in such a manner as to cause no damage to public health or safety, or to public or private property.

H. EXCAVATION MATERIAL

Material excavated within streets and roadways may only be reused per approval of the City or County. Any such material shall be laid alongside the trench and kept trimmed up to minimize inconvenience to public travel.

1. Free access must be provided to all fire hydrants, water gates, meters and private drives, and means shall be provided so that water can flow in the gutters uninterruptedly.
2. All materials excavated in streets and roadways and not permitted for backfill, shall be immediately removed and properly disposed of at an approved facility by the Contractor. No surplus material shall be dumped on private property.

I. OPEN TRENCH PERMITTED

The Engineer will specify the amount of open trench permitted at any one time. In general, the length of trench open at any time shall be limited to the following:

Location	Maximum Open Trench Length
Business/commercial areas	100 feet
Residential areas	250 feet or 1 block, whichever is less
Undeveloped areas	1,000 feet

No trench shall be allowed to remain open outside of work hours and/or outside of immediate work area. At the end of a work day the trench shall be backfilled or secured with steel plates.

J. CONTRACTORS RESPONSIBILITY

It shall be the responsibility of the Contractor to conform to all the requirements of all permits obtained from all Agencies and to make the construction site safe against injury to people and/or livestock by erection of adequate posted barricades and/or temporary fences.

K. GROUNDWATER

The Contractor shall keep excavations free from water during construction. Groundwater shall be controlled to prevent sloughing or erosion of trench walls, softening of the bottom of excavations, or formation of "quick" conditions where effective stress is reduced due to upward movement of flow of water. The static water level shall be drawn down to a sufficient depth below the bottom of excavations to maintain the undisturbed state of natural soils and allow the placement of any fill to the specified density. Dewatering systems shall not remove natural soils. The Contractor shall control surface runoff to prevent entry or collection of water in excavations.

1. Dewatering and shoring plans should be coordinated, with consultation from a licensed geotechnical engineer as necessary, to verify subsurface soil and groundwater conditions and adequate handling of field conditions to facilitate construction.
2. The Contractor shall obtain any and all permits required in conjunction with the installation and removal of the dewatering system and shall meet all permit requirements.
3. The Contractor shall contact the local drainage authority for discharge requirements. The Contractor shall dispose of water from dewatering operations so as not to cause injury or damage to adjacent property and shall at all times remain in compliance with the requirements of the local drainage authority.

L. TRENCH DAMS

Trench dams are required when groundwater has the potential to erode trench backfill material.

SECTION 5 - TRENCH BACKFILLING

5.01 TRENCH BACKFILLING

Trench backfilling shall consist of all materials placed in an excavation in the process of constructing a sewer line and/or appurtenances. No backfill shall be deposited over a sewer line and/or appurtenances until pipe laid has been inspected and approved by the District for backfilling operations.

5.02 PIPE FOUNDATION - (If Required by Engineer)

Pipe foundation shall be that portion of the trench which is twelve (12) inches below the sewer subgrade. This portion of the trench shall be backfilled with "Trench Foundation" thoroughly compacted to achieve a firm, dry bed for the sewer pipe or structure. Locations of the "Trench Foundation" will be designated by the Engineer in the field. However, this does not relieve the Contractor of the requirements of these Specifications, including, but not limited to, allowable deviation of alignment and grade. Trench Foundation shall be wrapped in non-woven geotextile fabric composed of polypropylene. The fabric shall be consistent with 5.03 below.

A. TRENCH FOUNDATION:

Trench Foundation shall be 1-1/2 inch crushed, angular rock conforming to the following gradation:

Sieve Size	Percent Passing
2-inch sieve	100%
1 ½-inch sieve	90-100%
¾ –inch sieve	0-30%
3/8-inch sieve	0-20%
No. 200 sieve	0-4%

5.03 GEOTEXTILE FILTER FABRIC

If required by the Engineer, geotextile filter fabric shall be used to wrap pipe foundation and pipe embedment as specified herein and as indicated on the Standard Details. The requirement for geotextile filter fabric may vary depending on groundwater and soil conditions.

Geotextile filter fabric shall be a non-woven material consisting of polyester, nylon, polypropylene filaments formed into a stable network. The fabric shall be permeable, not act as a wicking agent, be inert to commonly encountered chemicals, be rot-proof, and resistant to ultraviolet light.

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

Property	Test value	Test method
Weight	5.4 oz/yd ² (min.)	ASTM D3776/D5261
Grab tensile strength	150 lb (min.)	ASTM D4632
Elongation at break	50% (max.)	ASTM D4632
Puncture strength	80 lb (min.)	ASTM D4833
Burst strength	300 PSI (min.)	ASTM D3786
Apparent opening size	#70 (max.)	ASTM D4751
Permittivity	1.0 sec-1 (min.)	ASTM D4491
UV resistance	70% (min.)	ASTM D4355

The geotextile fabric shall be Mirafi 160N, or approved equal.

Wrap foundation material with geotextile fabric in a “burrito wrap” and overlap geotextile minimum twelve (12) inches. Secure edges of geotextile to prevent unraveling.

5.04 PIPE EMBEDMENT

Pipe embedment shall mean that portion of the material placed within the trench from the sewer subgrade to a point at least six (6) inches, but no more than twelve (12) inches above the outside top of the pipe. "Sewer Subgrade" is defined in Section 5.02.

A. PIPE EMBEDMENT MATERIAL

1. Import:

Import material shall be 3/4-inch x1/2-inch clean crushed rock. Alternate backfill bedding material may be used only if prior written approval is granted by the District Engineer. This approval is on a case-by-case basis.

Pipe bedding material shall be compacted by and tamping to a minimum ninety (90%) relative compaction from six inches (6”) below the bottom of pipe to a point twelve inches (12”) above top of pipe.

B. BACKFILL

1. Import Backfill Material:

Import backfill is approved gravel, sand or rock material, free from deleterious substances, graded so that it will compact readily to a stable base with the following minimum requirements meeting the Caltrans Class 2 Aggregate Base standard for 3/4-inch maximum grading.

- a. The material shall be of such size that the percentage composition by weight, as determined by laboratory sieves, will conform to the following grading:

Sieve Size	Percent Passing (by weight)
1-inch sieve	100%
¾-inch sieve	90% - 100%
No. 4 sieve	35% – 60%
No. 30 sieve	10% – 30%
No. 200 sieve	2% – 9%

- b. The material shall also have a minimum sand equivalent (Test Method of Northern California 217) of 25, a minimum resistance (R) value (Test Method of Northern California 301) of 78, and a minimum durability index (Test Method of Northern California 229) of 35.

2. Approved Native Backfill Material:

Material free from vegetal matter, refuse, stones or clods larger than four (4) inches in diameter and containing sufficient fines so that all voids will be filled when compacted, and so constituted that compaction requirements can be met.

C. TRENCH EXCAVATION MATERIAL

Acceptable trench excavation material shall be that material which is free from vegetable matter and refuse and shall contain no concrete, stones or clods larger than 3/4-inch in diameter and shall contain sufficient fines so that all voids will be filled when compacted.

D. PIPE EMBEDMENT INSTALLATION

1. Main and laterals in public utility and District easements, public rights-of-way and paved private property:

Pipe bedding material shall be Import Backfill Material.

2. Private laterals (building sewers) in unpaved private property from property line to building:

Trenches other than in roadways or rights-of-way shall be backfilled with approved Import Backfill Material to twelve inches above the top of pipe and the balance with Import Backfill or Approved Native Backfill Material.

5.05 TRENCH BACKFILL MATERIAL

Trench backfill material is considered to be all material placed in the trench between the pipe embedment and the road bed or ground surface.

A. BACKFILL IN PUBLIC RIGHTS-OF-WAY, NAPA SANITATION DISTRICT EASEMENTS, PUBLIC UTILITY EASEMENTS, OR IN EXISTING OR FUTURE PAVED AREAS

The material, placement and compaction shall be done in accordance with the requirements and inspection of the City or County.

B. BACKFILL IN EXISTING AND FUTURE UNPAVED PRIVATE PROPERTY AREAS

The material placed must meet the following requirements:

1. Native Backfill:

Backfill shall be "Approved Native Backfill Material" compacted to the same degree of compaction as the adjacent ground or a minimum of 90% Relative Compaction per ASTM D-1557, whichever is greater.

2. Imported Backfill:

In areas where the excavated material does not meet the requirements for "Approved Native Backfill Material", then material meeting the requirements for "Import Backfill Material", or "Trench Excavated Material" under Section 5.04 may be used. It shall be compacted to the same degree of compaction as the adjacent ground or a minimum of 95% Relative Compaction, whichever is greater.

C. COMPACTION

The method the Contractor uses to meet compaction requirements is not specified except for the following limitations.

1. Compaction shall be achieved by mechanical means. Water settling, jetting, ponding, and other water compaction methods are prohibited. Compaction testing shall be done in accordance with the requirements of the City or other agency having jurisdiction.
2. For sloped trenches, or when heavy-impact compaction equipment is used, such as sheep-foot wheels and self-propelled compactors, the Contractor shall protect the pipe from being damaged during mechanical compaction. The remainder of the backfill shall be in accordance with the requirements of the City or County.

SECTION 6 - MISCELLANEOUS REQUIREMENTS

6.01 INSPECTION

A. CONFORMANCE TO THESE SPECIFICATIONS

All work done under these specifications shall be subject to rigid inspection and shall be performed to the satisfaction of the Engineer.

B. DOCUMENTS OF MATERIALS AND PERFORMANCE TESTS

The Contractor shall, at any time when requested by the Engineer, submit at his/her expense, properly authenticated documents of materials and performance tests as proof to the District of compliance with these Specifications.

C. ACCESS TO JOB SITE

The Engineer shall, at all times, have access to the work during construction, and the Contractor shall provide proper and safe facilities for such access and inspection.

6.02 ALTERATIONS

The Engineer reserves the right to make such alterations or deviations, additions or omissions from the approved plans as may be determined during the progress of the work to be necessary and advisable for the proper completion thereof.

6.03 DEFECTIVE WORK AND/OR MATERIALS

All work which has been rejected shall be remedied, or removed and replaced by the Contractor in a manner acceptable to the Engineer.

All materials not conforming to these Specifications shall be considered as defective and all such materials, whether in place or not, will be rejected. They shall be removed immediately from the site of the work.

6.04 MANHOLE PROTECTION

Particular care must be taken to protect new and existing manholes from damage and to keep rock, dirt or debris from getting into the sewer. The contractor will be responsible to see that the manholes are kept clean and free from debris. Submit protection plan to District Engineer for review. Plan shall include protection materials, methods and devices.

On new manholes, or manholes that have had frame and cover removed, a steel cover of adequate strength, close fitted and well secured, shall be installed over the manhole opening until the frame and cover are permanently installed.

Ground or surface water must be kept out of existing sewers. Temporary plugs may be required by the Engineer to effect this protection.

6.05 USE OF EXISTING LATERAL SEWERS

Existing private sewers disconnected from buildings that have been demolished, or moved, may be used for new buildings only when found by the Engineer to be in conformity with these Specifications. Full bore rodding and television inspection of the building sewer will be required as part of the review process.

6.06 PUBLIC (STREET) LATERAL MARKING

Each public (street) lateral shall be marked at the location where it passes under the property curb in the following manner:

A. NEW CURB

Where new curbs are constructed, a three (3) inch high letter "S" shall be impressed with an approved stamp into the fresh concrete on the curb so as to be clearly visible.

B. EXISTING CURBS

Where curbs already exist, a three (3) inch high letter "S" shall be neatly chiseled on the curb so as to be clearly visible.

6.07 TRACER WIRE AND NON-DETECTABLE MARKING TAPE

Curved sections of sewer mains and laterals shall have tracer wire and green marker tape installed within the trench per the standard details.

A. TRACER WIRE

Tracer shall be No. 12 gauge solid copper with polyethylene or thermoplastic insulation recommended for direct burial. Except for approved splice locations, tracer wire shall be continuous and without splices between sewer structures. Where a spliced location is approved, the following conditions must be met:

1. Crimping wires is not an acceptable method for splicing.
2. The spliced connection shall be securely bonded together with a watertight connector such as 3M DBR or DryConn Direct Bury connectors or approved equal to provide electrical continuity.
3. Tracer wire shall be tested and all failed segments repaired by the contractor prior to paving.

B. NON-DETECTABLE MARKING TAPE

Non-detectable sewer marking tape shall be 5 mil., 3 inches wide, green in color, and shall read "Caution Buried Sewer Line Below".

6.08 MANHOLE MARKING

If deemed necessary by the Engineer, manholes located in easements will be marked with a District Marker. Marker will be supplied and installed by District Forces (at others expense.)

6.09 REPAIR OF DAMAGED SEWERS AND OTHER UTILITIES

A. NEW MAIN AND/OR PUBLIC (STREET) LATERALS

Main and/or public (street) laterals not yet accepted by the District that are damaged during construction will be repaired by the Sewer Contractor in accordance with these Specifications and Standard Details. The work shall be done in the presence of and to the satisfaction of the Engineer. The portion of the pipe bedding from sewer subgrade to outside bottom of sewer pipe shall be satisfactorily installed before the pipe is laid.

B. EXISTING MAIN SEWER OR APPURTENANCES

Repairs or relocations of existing main sewers or appurtenances required by reason of damage, or conflict, will be performed by the District or by Contractors engaged with the District through a Contract or Permit. Upon completion of the work, the District will bill the party responsible for payment thereof.

C. EXISTING PRIVATE LATERALS

Except as noted below or otherwise agreed to by the District, all work involving repair or relocation of existing private laterals shall be done by private Contractors. Minimum inspection fees must be paid and a sewer construction permit issued prior to start of work. All work must be done per District Specifications and subject to District Inspection.

D. REPAIR OF OTHER AGENCY FACILITIES

Repair of other Agency utilities damaged during construction shall be made in accordance with the requirements of the Agency concerned.

6.10 ABANDONMENTS

Abandonment of existing District facilities shall be performed by Contractors engaged with the District through a Contract or Permit.

A. MAIN SEWERS

Main sewer pipe that is required to be abandoned shall be abandoned by one of the following methods:

1. Filling with slurry. Slurry shall be a flowable mix containing a minimum of 2 sack cement per cubic yard. Volume of slurry shall be calculated by the contractor and provided to the Engineer in advance of performing the work. The sewer main to be abandoned shall be disconnected from the sewer system prior to filling with slurry.
2. Removing the existing pipe.

For all sewer main abandonments, the contractor shall submit a plan to the District to review. The plan shall include disconnection of the sewer main from the live manhole, the proposed method of abandonment, and proposed new alignment of sewer main if applicable.

B. PRIVATE AND PUBLIC LATERALS

Contractor, at its own expense, shall cap, at the property line, any private lateral serving a building that is to be moved or demolished.

1. If it is noted on the improvement plans that the public lateral is to be abandoned, the lateral shall be filled with slurry (as directed by the Engineer) and capped by the Contractor. The sewer shall be capped with an approved coupling and a watertight cap at the main and property line (right of way). This work shall be done in the presence of and to the satisfaction of the District Inspector. Alternatively, the public lateral may be removed.
2. If it is not noted on the improvement plans, the contractor shall contact the District for abandonment requirements.

C. MANHOLE

Castings and manhole body shall be removed to a minimum of three (3) feet below final street grade or existing ground elevation, whichever is lower. The castings shall be delivered to Napa Sanitation District, Corporation Yard located at 1515 Soscol Ferry Road.

Drainage holes shall be made at the bottom of the manhole and the channel shall be sealed to a watertight condition with concrete. The manhole shall then be filled and compacted with self-compacting material such as slurry or as approved by the Engineer and City jurisdiction. Entry into "live" District manholes is generally

prohibited, but may be allowed if the Contractor secures an Encroachment Agreement from the District.

D. SEPTIC TANK

Every cesspool, septic tank, and seepage pit which has been abandoned or has been otherwise discontinued from further use, shall be abandoned per Napa County Environmental Management standard.

E. GREASE INTERCEPTORS

Immediately prior to abandonment, grease interceptors shall be pumped and cleaned of debris, shall have 3-inch diameter holes drilled every 12-inches through the bottom of the structure to provide drainage of groundwater, and shall be filled and compacted with cement slurry, or as approved by the Engineer.

All existing sewer laterals shall be disconnected from grease interceptors to be abandoned. Reconnect laterals with approved couplings and pipe materials.

6.11 GREASE AND OIL COLLECTION SYSTEMS

A. GENERAL

For the purposes of this specification section, a restaurant is any facility that prepares or serves food to non-family members. This includes full-service restaurants, fast food restaurants, take-out restaurants, recreation facilities, cafeterias for employees, grocery store take-out facilities, catering facilities, bakeries, delicatessens etc.

All restaurants shall be equipped with grease interceptors and/or grease traps designed to limit the discharge of grease and oil to the District's sewer system. The size and type of restaurant shall dictate the size of the grease trap or grease interceptor required. The minimum sizes specified are subject to review by the Engineer and sized and installed according to criteria in the current Uniform Plumbing Code.

B. GREASE INTERCEPTORS

Food service facilities shall have an outside grease interceptor installed per the requirements of the current edition of the Uniform Plumbing Code.

1. Designation as a grease intensive restaurant shall be as determined by the District Engineer. Grease interceptors shall be two-compartment interceptors with sampling box as shown in the Standard Details and shall be manufactured by Jensen Precast, or approved equal.
2. All new construction for restaurants shall have grease interceptors.

3. Grease waste lines shall be marked by dig tape indicating grease line feeding the grease interceptor. Alternative marking may be allowed at the District Engineer's discretion.
4. The following table shows the plumbing fixture connection requirements:

Fixture	Connect Direct to Sewer	Connect to Grease Interceptor
Pot Sink		X
Prep Sink		X
3-Compartment Sink		X
Vegetable Prep Sink	X	
Kitchen Mop Sink		X
Floor Drain (in kitchen)		X
Hand Wash Sink (in kitchen)	X	
Dishwasher		X
Garbage Disposal	X	
Commercial Trash Compactor		X
Trash Enclosure		X
Floor Sink (for beverage dispenser)	X	
Condensate Discharge	X	
Walk-in Cooler Discharge	X	

C. GREASE TRAPS

The District may also allow the use of a grease trap in lieu of a grease interceptor for tenant improvement projects where it is not feasible to install a grease interceptor. Grease traps shall be sized and installed per the current edition of the Uniform Plumbing Code.

The following table shows the plumbing fixture connection requirements:

Fixture	Connect Direct to Sewer	Connect to Grease Trap
Pot Sink		X
Prep Sink		X
3-Compartment Sink		X
Vegetable Prep Sink	X	
Kitchen Mop Sink	X	
Floor Drain (in kitchen)	X	
Dishwasher	X	
Garbage Disposal	X	
Floor Sink (for beverage dispenser)	X	
Condensate Discharge	X	
Walk-in Cooler Discharge	X	

D. OTHER REQUIREMENTS

Grease interceptors shall also be required at commercial trash compactors, trash enclosures, and at other commercial and industrial establishments as deemed necessary by the District.

6.12 OUTDOOR SINK REQUIREMENTS

A. OUTDOOR SINKS ON RESIDENTIAL PARCELS

1. Option 1:
 - a) Cover outdoor sink (when not in use) with a device that will not allow rain water to enter into the sewer system.
 - b) The cover shall be permanently attached to the sink or counter top (This method also reduces the likelihood of rodents entering into the sewer lateral).
 - c) Outdoor floor drains will not be allowed to connect to sanitary sewer for this option.

2. Option 2:

- a) Install a permanent roof structure over the sink (kitchen) area. The roof shall be solid and extend past any open sides a distance equal to $1/2$ the height of the opening (i.e. if the distance from the countertop with sink to the roof is 4 feet the overhang is required to extend 2 feet past the wall).
- b) For floor drains, on the open side, a grade break line shall be constructed at the inside edge of the wall with the slab sloping inwards on the inside of the structure and away from the structure on the outside.
- c) For floor drains, the ground shall be sloped away from the structure on all other sides.

B. OUTDOOR SINKS ON COMMERCIAL PARCELS

1. Install a permanent roof structure over the sink (kitchen) area. The roof shall be solid and extend past any open sides a distance equal to $1/2$ the height of the opening (i.e. if the distance from the countertop with sink to the roof is 4 feet the overhang is required to extend 2 feet past the wall).
2. For floor drains, on the open side, a grade break line shall be constructed at the inside edge of the wall with the slab sloping inwards on the inside of the structure and away from the structure on the outside.
3. For floor drains, the ground shall be sloped away from the structure on all other sides.

6.13 TRASH ENCLOSURE DRAIN REQUIREMENTS

1. The District only allows wastewater drains in trash enclosure areas that are servicing restaurants or other types of food service facilities (i.e. grocery stores).
2. The drain is required to be connected to the facility's grease interceptor.
3. A roof shall be placed on the trash enclosure to prevent rainwater from entering the sanitary sewer system. The roof shall extend past open sides without a gate by a distance equal to $1/2$ the height of the opening (i.e. if the bottom of the roof is 2 feet above the top of the structure wall it is required to extend 1 foot past the outside edge of the wall). To allow garbage trucks to access the bins, the roof shall extend 6 inches past the outside edge of the gate (on the gate side of the structure only).
4. On the open side, a grade break line shall be constructed at the inside edge of the wall with the slab sloping inwards on the inside of the structure and away from the structure on the outside.

5. The ground shall be sloped away from the structure on all other sides.

6.14 CAR WASH REQUIREMENTS

1. Car wash facilities shall include a sand and oil separator and a metered water source (separate meter from the remainder of the site).
2. Car wash facilities shall be permanently covered and the area around the building shall be graded away from the car wash slab.
3. Permanent awnings shall be placed over the open sides of the car wash and shall extend a distance equal to 1/2 the height of the opening.
4. A plan meeting the above requirements and showing how the car wash will be connected to the sanitary sewer system shall be submitted to the District for approval.

6.15 POOL AND SPA REQUIREMENTS

1. No plumbing from pool/spa filter systems or water features shall be connected to the sanitary sewer system when the filter system is backwashed with pool water. Diatomaceous earth filter systems are not allowed. Filter backwash systems shall not use pool water to clean filters. When filter systems are backwashed with potable water, wash water may be discharged to the sanitary sewer upon approval by the District.
2. Pool drainage from outdoor pool decks is not allowed to connect to the sanitary sewer system. Deck drainage from indoor pools is permitted to connect to the sanitary sewer system when approved by the Engineer.
3. A permit is required for the temporary discharge of pool/spa water to the sanitary sewer system. Contact the District for requirements of the discharge permit.

6.16 WINTERIZING SANITARY SEWER SYSTEM DURING CONSTRUCTION

If the sanitary sewer system is connected to the District's existing sanitary sewer system but construction of the site improvements are not complete, the contractor shall install measures to block stormwater from entering the sewer system. If winterizing is required by the District Engineer, the contractor shall coordinate with the District regarding specific requirements.

SECTION 7 – TESTING

7.01 TESTING MAIN SEWERS

The Contractor shall, in the presence and under the direction of the Engineer, test the air tightness of all main sewer lines. The test will be made between each adjacent structure and between the most upstream structure and dead-end. The air test will be made only after all other utilities and the curb and gutter have been installed and before any street base rock has been oiled. The Engineer shall be present during installation of plugs prior to air testing.

A. WHEN TESTED

1. In areas to be left unpaved, the air test shall be made after the backfill is satisfactorily compacted.
2. In areas to be paved, per Improvement Plans, when the outside top of the sewer is less than three (3) feet below the top of backfill, the air test shall be made after the "base rock" portion of the paving is satisfactorily compacted and before any street base rock has been oiled.
3. In areas to be paved, per Improvement Plans, when the outside top of the sewer main is three (3) feet or more below top of backfill, the air test shall be made after all other utilities and the curb and gutter have been installed and the "sub-base" material portion of the paving is satisfactorily compacted.

The air test as noted in 1, 2 or 3 above is considered the "official test". However, preliminary air testing is strongly recommended and may be conducted by the Contractor at any time prior to the "official test".

4. As directed by the Engineer, the Contractor shall conduct a preliminary air test if the Engineer has reason to believe that the Contractor's means and methods have impacted the condition of the system. The preliminary test will not be considered the "official test".

B. EQUIPMENT

The Contractor shall furnish all necessary equipment, including but not limited to: an air compressor, air hoses, blank plug, liquid-filled test gauge, test plug, stopwatch, and personnel for conducting the test.

C. AIR TEST PROCEDURE

Air testing sewer mains, particularly larger diameter mains, can be very dangerous due to the very large forces developed. The Contractor shall be fully responsible and

take all precautions necessary to ensure the safety of their workers. All plugs shall be adequately braced and restrained to support the full load developed. No workers shall be allowed in the excavation or manhole while the line is under pressure. The Contractor shall make provisions for reading the pressure at the ground surface and for safely releasing the air pressure without entering the manhole or excavation.

The following procedure shall be used for air testing:

1. Prior to testing, clean pipe to be tested by propelling a snug fitting inflated rubber ball through the pipe with water and remove any debris.
2. Plug all pipe outlets with suitable test plugs. Brace each plug securely.
3. If the pipe to be tested is submerged in groundwater, insert a pipe probe by boring or jetting into the backfill material adjacent to the center of the pipe, and determine the pressure in the probe when air passes slowly through it. This is the backpressure due to groundwater submergence over the end of the probe. All gauge pressures in the test shall be increased by this amount.
4. Add air slowly to the portion of the pipe being tested until the internal pressure is raised to 4.0 PSIG.
5. Check exposed pipe and plugs for abnormal leakage by coating with a soap solution. If any leakage is observed, bleed off air and make necessary repairs.
6. After an internal pressure of 4.0 PSIG is obtained, allow at least two (2) minutes for air temperature to stabilize, adding only the amount of air required to maintain pressure.
7. After the two (2) minute period, disconnect the air supply.
8. When pressure decreases to 3.5 PSIG, start stopwatch. Determine the time in seconds that is required for the internal air pressure to reach 2.5 PSIG. The minimum allowable time in seconds shall be based on the diameters and lengths of pipe under test in accordance with the table below. At the Inspector's option, the test may be conducted for a pressure drop of 3.5 to 3.0 pounds per square inch and 1/2 of the time shown.

MINIMUM SPECIFIED TIME REQUIRED FOR 1.0 PSIG PRESSURE DROP* FOR SIZE AND LENGTH OF PIPE INDICATED FOR Q=0.0015												
PIPE DIA	MINIMUM TIME	LENGTH FOR MINIMUM TIME	TIME FOR LONGER LENGTH	SPECIFICATION TIME FOR LENGTH (L) SHOWN (MIN:SEC)								
				(IN)	(MIN:SEC)	(FT)	(SEC)	100 FT	150 FT	200 FT	250 FT	300 FT
4	3:46	597	0.380 L		3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	0.854 L		5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.520 L		7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	239	2.374 L		9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	199	3.418 L		11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	159	5.342 L		14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18	17:00	133	7.692 L		17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	114	10.470 L		19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:40	99	13.674 L		22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33
27	25:30	88	17.306 L		28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48
30	28:20	80	21.366 L		35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15
33	31:10	72	25.852 L		43:05	64:38	86:10	107:43	129:16	150:43	172:21	193:53
36	34:00	66	30.768 L		51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46

* PRESSURE AIR TESTING SHALL BE DONE IN ACCORDANCE WITH THE "UNI-BELL PVC PIPE ASSOCIATION" BULLETIN NO UNI-8-6-90 USING THE TABLE ABOVE.

If the pipe installation fails to meet these air test requirements, the Contractor shall determine the source or sources of leakage, and he shall repair or replace all defective materials or workmanship per approval of the Engineer. The completed pipe installation shall meet the requirements of this test.

D. MANDREL OR DEFLECTOMETER TEST

Mandrel test for flexible pipes shall also meet the requirements specified in Volume II, Section 1.02.B.8.

1. Flexible Pipe less than 18" in diameter:

Upon completion of the air test, the Contractor shall pull a mandrel or deflector, approved by the Engineer, through the installed flexible pipe. This test shall be performed without mechanical pulling devices. Mandrel shall not be tampered with.

2. Flexible Pipe equal to or greater than 18" in diameter:

At the end of each working day, or as directed by the District Inspector, the Contractor shall pull an approved mandrel or deflector through the portion of the pipe specified by the Engineer. This section of pipe will have pipe embedment fully in place and compacted per these specifications plus at least four feet of backfill in place with a minimum of 85% relative compaction per ASTM D-1557. This shall be a preliminary test only to insure the integrity of the pipe at the time of installation. The mandrel test for acceptance shall be performed after the air test as described in Section 7.01.C.

7.02 TESTING PRIVATE AND PUBLIC SEWER LATERALS

The Contractor shall, in the presence and under the direction of the District Inspector, test the air-tightness of all private and public sewer laterals. The test will be made between the cleanout to grade at the property line, "test-wye" or manhole and the most upstream dead-end at a point not more than two (2) feet outside the building line (see A-2 below for exception). Note that actual connection of the private sewer to the building plumbing will not be permitted until the main sewer to which it connects has been accepted for use by the District and the herein described testing has been satisfactorily completed. Entry into "live" District manholes requires District approval.

A. WHEN TESTED

1. In all areas, the official air test shall be made after the backfill is satisfactorily compacted, base rock installed and all other underground utilities, private and public, installed.

2. Preliminary air testing is strongly recommended and may be conducted by the Contractor at any time prior to the "official test".

3. Exception to 1 above is for residential private laterals when a water test is authorized by indication on the Plans or as directed by the District Inspector in the field. In these cases, the following procedure will be used: After the private sewer has been laid, and the pipe bedding installed to the satisfaction of the District Inspector, the sewer shall be filled with water in the presence of the District Inspector. Any and all leaks shall be found and repaired by the Contractor in accordance with these Specifications, after which the sewer trench shall be immediately backfilled.

B. EQUIPMENT

Same as main sewers Section 7.01.B.

C. PROCEDURE

Same as main sewers Section 7.01.C.

D. MANDREL OR DEFLECTOMETER

Upon completion of the air test, the Contractor shall pull a mandrel or deflectometer approved by the Engineer between manholes on sewer lines six (6) inches in diameter and larger. This test shall be performed without mechanical pulling devices. Pull tag lines shall be attached to both sides of mandrel.

7.03 TESTING PRESSURE SEWERS

This section is intended to be used for small diameter private pressure sewers four (4) inches in diameter or less with normal operating pressures of 10 PSI or less. The same procedure as described in "Testing Main Sewers" shall be used except that no air loss will be permitted in the time period computed for a gravity sewer of same size and length.

The pressure used will be determined by the Engineer and will be equal to 1-1/2 times the maximum pressure the sewer will be expected to withstand in actual use.

7.04 MANHOLE VACUUM TESTING

All manholes shall be vacuum tested. Vacuum test procedures and requirements shall be as follows:

1. After completion of the manhole barrels but prior to backfilling, sealing of PVC liner seams and installing grade rings, all openings in the manholes are sealed with plugs and a rubber ring "donut" type plug inserted inside the opening of the cone.
2. A small vacuum pump is attached to a hose connected to the plug and 4 PSI (8 in. Hg) of vacuum applied.

3. The vacuum is permitted to stabilize at 3.5 PSI (7 in. Hg) for 1 minute; then the test is begun.
4. The manhole must maintain vacuum such that no greater than 0.5 PSI (1 in. Hg) of vacuum is lost during the specified test period. The specified test period is as follows:

Manhole depth (feet)	Test period (minutes)
0 - 5	4.5
5 -10	5.5
10 - 15	6.0
Greater than 15	6.5

5. Manholes that fail the test shall be corrected as required and retested.
6. A vacuum regulator shall be provided on the vacuum pump such that no greater than 10 PSI (20 in. Hg) can be applied to the manhole during the test. All manholes that do not meet the leakage test, or are unsatisfactory from visual inspection, shall be repaired to the satisfaction of the Engineer.

7.05 ORDER OF WORK

The following order of work shall be performed by the Contractor following construction of the sewer mains and laterals, manholes, and sewer system appurtenances after placement and compaction of road base:

1. Preliminary Punch list
2. Preliminary Air Test
3. Mandrel Test
4. Installation of curb, gutter, sidewalk, and other surface features
5. Official Air Test
6. Clean Entire Sewer System
7. CCTV Inspection
8. Paving. Coordinate with District Engineer on timing for final pavement lift.
9. Final Punch list

SECTION 8 - TELEVISION INSPECTION

8.01 TELEVISION INSPECTION

Prior to acceptance of any sanitary sewer line by the District, said line shall be inspected internally by the contractor by television as outlined below.

Defects such as high and low spots, joint separations, offset joints, chipped ends, cracked or damaged pipe, infiltration points and debris in lines shall be corrected by the Contractor. The camera equipment shall include a gauge that is visible on the DVD to accurately determine the depth of any standing water. For joint separations, low spots and chipped ends, the following maximum acceptable limits shall apply:

PIPE SIZE/TYPE	LIMITS
4" Lateral	No standing water, indentation or chipped ends will be permitted.
6"-10" Diameter Sewer Pipe	Joint separations - 1/2 inch Low spots - 1 inch maximum depth Chipped ends - 1/4 inch
10" or Greater Diameter Sewer Pipe	Specific maximum limits set by District for each project.

1. The complete job is ready for television inspection when the following work has been completed.
 - a. All sewer pipelines are installed and backfilled.
 - b. All structures are in place, all channeling is complete and pipelines are accessible from structures.
 - c. All other underground facilities, utility piping and conduits are installed.
 - d. Final street subgrade is complete.
 - e. Pipelines to be inspected have been preliminarily balled, flushed and the vertical deflection test completed for flexible sewer lines.
 - f. Final air test has been completed.
2. When the above work is complete, the Contractor shall arrange for the television inspection.
3. The Contractor of the project will notify the District in writing as to the scheduled date of the television inspection.
4. After conditions in Section 8.01.1 as outlined above are met, the entire job will be initially televised.

- a. A DVD will be made and defects requiring correction will be noted.
 - b. If no deficiencies are observed, the work will be considered satisfactory.
5. The Contractor will be notified in writing of any deficiencies revealed by the television inspection that will require repair. If corrective work is indicated and the Contractor wishes to view videotapes, he shall contact the District to set a time for the viewing with the Engineer.
6. Corrective work shall be done.
7. Those portions of the pipeline system that have been corrected must be re-televised.
8. The procedure outlined above will be repeated until all deficiencies observed by television inspection have been corrected to the complete satisfaction of the District.

SECTION 9 - CLEANING

9.01 CLEANING

After the sewers have satisfactorily passed the tests required in Volume II, Section 7 - Testing, and structures, backfilling and final paving are completed, the Contractor, in the presence of the District Inspector, shall clean each section of the sewer in the following manner:

A. SEWER MAINS

The District Inspector shall visually inspect the sewer and if in his/her opinion cleaning is necessary, the Contractor shall clean the sewer to the satisfaction of the District Inspector. District may clean the sewer at Contractor's request and at his/her expense.

Cleaning shall be performed by high pressure hydraulic cleaning or jetting.

B. FOUR (4) INCH AND SIX (6) INCH PRIVATE AND PUBLIC SEWER LATERALS

When in the opinion of the Engineer, the sewer is not clean it shall be flushed or otherwise cleaned so as to properly serve its intended function.

1. High pressure hydraulic cleaning or jetting may be allowed with the prior approval of the District Engineer.
2. A screen or basket shall be used to remove debris removed from pipe during cleaning activities. The method shall be approved by the Engineer.

SECTION 10 - DESIGN AND POLICY STANDARDS FOR MAIN SEWERS AND PUBLIC LATERALS

10.01 PIPE MATERIALS

Pipe materials are limited to Vitrified Clay Pipe (VCP) extra strength, Poly Vinyl Chloride Pipe (PVC, SDR 26, and C900 CL 165), High density Polyethylene pipe (HDPE, DR 21 or less) as listed in the Standard Specifications. Additional pipe materials may be used upon approval by the engineer.

10.02 PIPE MATERIAL CHANGES

Size or pipe material changes and vertical deflections are not allowed between any two manholes.

10.03 SIZE AND SLOPE

A. SEWER MAIN

1. Minimum pipe size is six (6) inches in diameter for residential areas.
2. Minimum pipe size is eight (8) inches in diameter for commercial and industrial areas.
3. Unless otherwise permitted by the Engineer, the slopes shown in the following table will be the minimum for sewer sizes shown:

Pipe Diameter	Minimum Slope (feet per foot)	Desirable Slope (feet per foot)
6"	0.0048	0.006
8"	0.0032	0.005
10"	0.0024	0.004
12"	0.0020	0.0032
15"	0.0016	0.0024

(Larger sewer sizes shall have a minimum slope as specified by the Engineer).

Sewer design will be based on District Master Plans as to ultimate total volume of flow expected from the tributary area. Sewers are designed to flow full at peak flows $d_n/D= 0.7$ for new pipe and $d_n/D= 0.9$ for upgrading existing pipe. Peaking factors are based on location and expected future conditions. (Manning formula with $n = 0.013$ will be used for all pipe materials).

B. PUBLIC LATERAL

A minimum pipe size of 4-inch with a minimum slope of 2.0% will be allowed for public laterals only.

10.04 MAIN SIZING CRITERIA

Public mains will be sized to serve the entire tributary area at build-out densities conforming to the District's Collection System Master Plan. Engineers for large developments may be required to provide trunk or collection system calculations or have a wastewater model performed.

A. THE DESIGN FLOWS WILL BE BASED ON THE FOLLOWING CRITERIA:

1. Population density for a single family home shall be 210 gpd/ EDU;
2. Peaking Factor: A minimum peaking factor of 2.5 shall be utilized; however, for flows less than 0.45 mgd refer to chart in Figure 10-1 at the end of this section; and
3. I/I = 500 gpd/acre

Design all gravity sewers to achieve a minimum velocity of 2 fps at average dry weather flow (ADWF) and a maximum velocity of 10 fps using design flows. Less than 2 fps velocities require approval of the District. When analyzing the existing or proposed sewer systems, use Manning's Formula to determine the design flow and velocity. Use a Manning's "n-value" of n=0.013.

10.05 ALIGNMENT

Sewer shall be laid in a straight alignment except that horizontal curved sewers may be used for flexible pipe only when located within a defined street area and concentric with center of street unless otherwise approved. Minimum curve radius shall be in accordance with Volume II, Section 3.01.F.

10.06 CROSS CONNECTION

Sewers will be required to be designed with cross-connections to existing sewer except in dead end streets or as required.

10.07 GRADE

Sewer shall be designed and constructed on a straight grade.

10.08 GRADE STAKES

Unless otherwise required by the Engineer, sewer construction stakes will be located at 50 feet maximum intervals except that on horizontal curves and on sewers with a slope flatter than 0.0034 feet per foot the maximum spacing will be 25 feet.

The stakes shall be offset from the center line of the sewer at a safe distance from the edge of the trench but in no case greater than 10 feet unless authorized by the Engineer. The stakes will be marked with off-set distance and station only. Cut sheets for the staking should be provided to the District.

10.09 DESIGN DEPTH

To avoid interference between sewer laterals and other utilities, the sanitary sewer main should be designed, when possible, with no less than three (3) feet and no greater than eleven (11) feet of cover from finished grade.

10.10 MINIMUM PIPE COVER

Minimum permitted cover over outside top of pipe bell to top of "backfill" or to existing ground at time of sewer installation, whichever is lower, shall be no less than three (3) feet. Cover requirements for other pipe materials and sizes will be based on their strength characteristics as approved by the Engineer.

Special Pipe Cover – Main and Trunk Sewers – Special pipe cover shall be used when total cover over main or trunk sewers is less than three (3) feet, and may be required when total cover will not be placed immediately after pipe installations, or when other special conditions exist.

1. Two (2) to three (3) feet of cover shall require the use of C-900, DR 18, or shall require concrete encasement of pipes of material other than C-900, DR 18.
2. Less than two (2) feet of cover requires special design subject to the approval of the Engineer.
3. Through cultivated or landscaped areas, special pipe cover requirements shall be modified by replacing the upper six (6) inches of excavation material with top soil.

10.11 TRENCH INTERSECTIONS

Non-perpendicular crossings/intersections between the sanitary sewer and other underground utilities require approval of Engineer.

10.12 HORIZONTAL AND VERTICAL CLEARANCE REQUIREMENTS

A minimum outside-to-outside horizontal clearance of five (5) feet should be maintained between the sewer mains and structures and adjacent non-potable water and stormwater underground utility mains and structures. Provide eight (8) feet outside-to-outside separation from planter strips and six (6) feet separation from continuous sidewalk and concrete curbs, unless approved by the engineer.

Meet separation requirements set by California Department of Public Health (CDPH), Section 64572 – Water Main Separation, dated February, 2008. Horizontal and vertical clearances less than the required dimensions require District approval.

A minimum vertical clearance between the sewer main and adjacent, non-potable water underground utility mains shall be six (6) inches. Greater clearance may be required by the District.

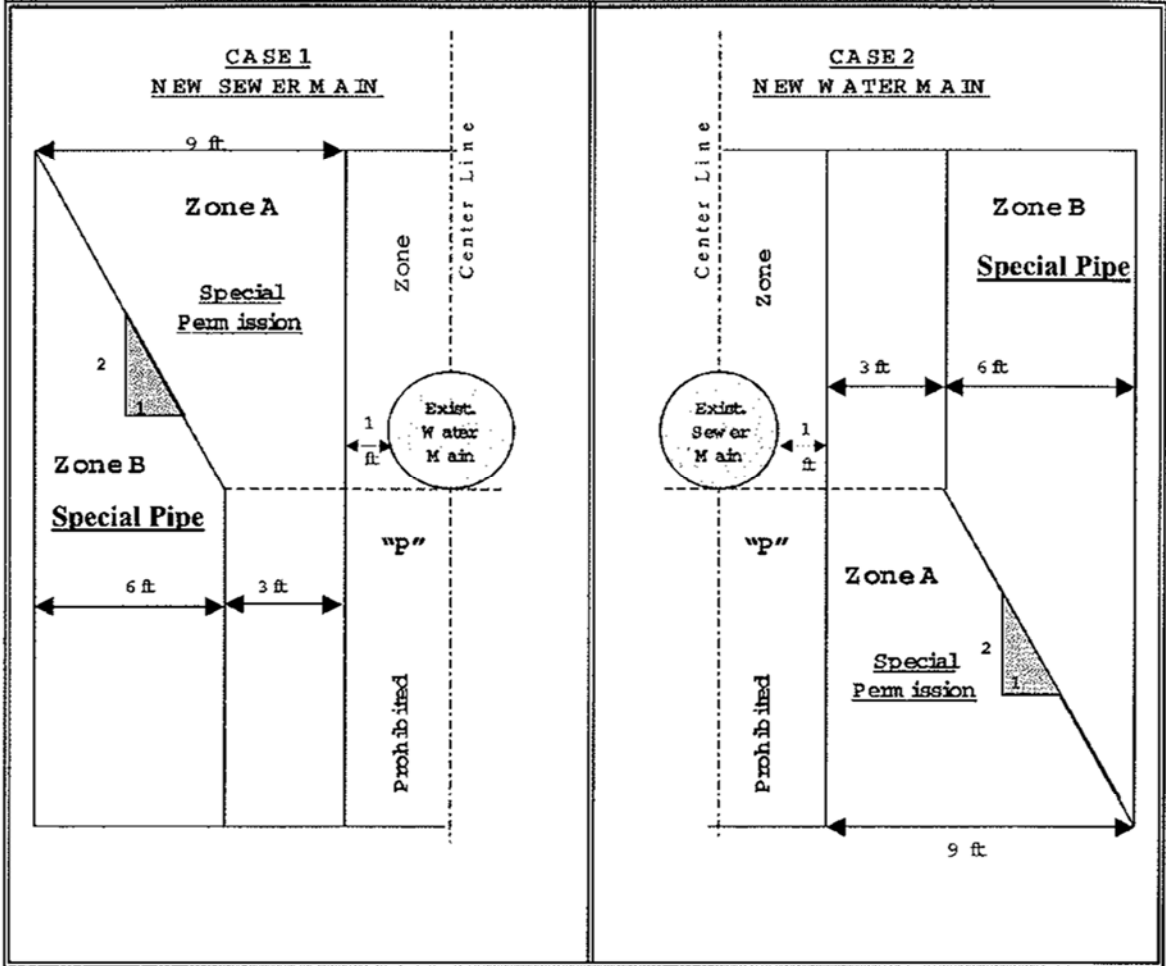
10.13 WATER MAIN SEPARATION

The following list provides separation criteria of water mains and sewer lines:

- A. New water mains shall not be installed in the same trench as, and shall be at least ten (10) feet horizontally from and one foot vertically above, any parallel pipeline conveying untreated sewage.
- B. New water mains and new water service lines shall be installed at least four (4) feet horizontally from, and one foot vertically above, any parallel pipeline conveying disinfected tertiary recycled water (defined in Section 60301.230 of Title 22 CCR).
- C. If crossing a pipeline conveying a fluid listed in subsection (A) or (B), a new water main shall be constructed no less than 45-degrees to and at least one foot above that pipeline. No connection joints shall be made in the water main within eight horizontal feet of the fluid pipeline.
- D. The vertical separation specified in subsections (A) and (B) is required only when the horizontal distance between a water main and pipeline is less than or equal to ten (10) feet.
- E. New water mains shall not be installed within 100 horizontal feet of the nearest edge of any wastewater disposal pond or within 25 horizontal feet of the nearest edge of any cesspool, septic tank, sewage leach field, seepage pit, underground hazardous material storage tank, or groundwater recharge project site.
- F. The minimum separation distances set forth in this section shall be measured from the nearest outside edge of each pipe barrel.
- G. With City Water Division approval, newly installed water mains may be exempt from the separation distances in this section, except subsection (E). Water mains should be installed in a manner that minimizes the potential for contamination, including,

but not limited to sleeving the newly installed main, or utilizing upgraded piping material.

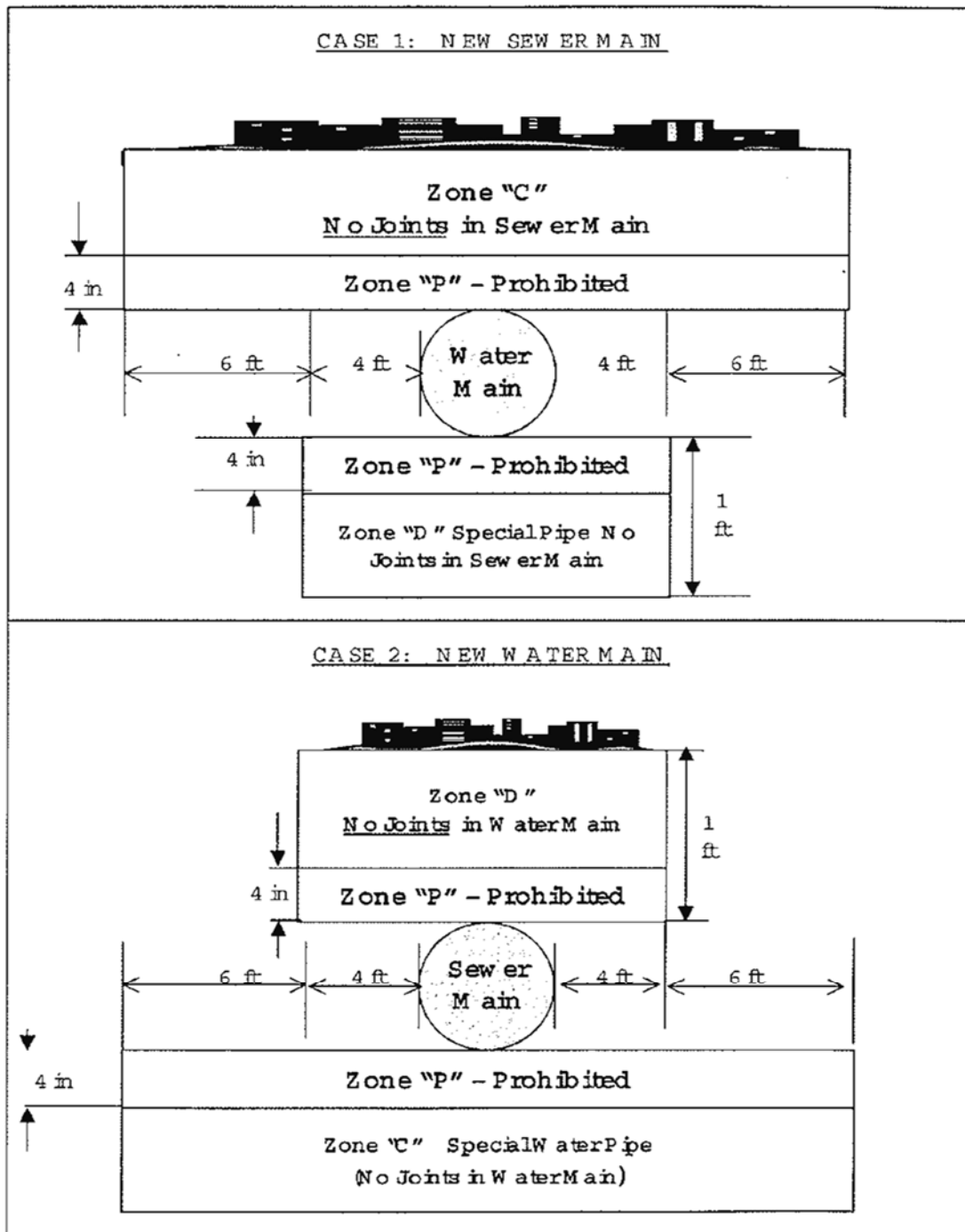
FIGURE 1 PARALLEL CONSTRUCTION



Note: Zones identical on either side of center lines

Zones "P" is a prohibited zone, Section 64630 (e) (2) California Administrative Code, Title 22

FIGURE 2 CROSSINGS



10.14 CROSSING STORM DRAINS

Generally provide a minimum of six (6) inches of vertical separation from storm drains. Joints shall be located outside the storm drain trench. When the minimum cannot be maintained, plans will indicate installation of felt expansion material or equivalent between facilities. To protect the sewer main from distorting under extreme loads, other measures, such as concrete encasement may be submitted for approval.

10.15 STRUCTURE LOCATIONS

Except as noted below; manholes are required at all angle points, changes in grade and permanent dead ends. Maximum structure spacing is 450 feet unless otherwise permitted by the Engineer. A flush hole riser may be used in lieu of a manhole on dead end runs only in cul-de-sacs that are less than 225 feet in length. Manholes shall be provided at locations where pipe slope changes, pipe material changes and where new public lateral connections to existing or new main which is 18 inches and larger in diameter.

10.16 MAIN LOCATIONS

To accommodate traffic control and access, mains should be located in the center of traffic lanes, when possible. For two-lane streets without medians, the mains should typically be located approximately five (5) feet on either side of the street centerline.

10.17 IN AND OUT ELEVATIONS AT MANHOLES

The "IN" and "OUT" elevations of the incoming and outgoing sewers shall be shown on the plans, and unless authorized by the Engineer, the following shall apply:

A. SEWERS OF SAME DIAMETER

Where two or more main sewers of the same diameter intersect, the difference in invert elevations of the incoming and outgoing sewers shall be a minimum of 0.10 feet. For flow through manholes, maintain grade.

B. SEWERS OF DIFFERENT DIAMETERS

Where two or more main sewers of different diameters intersect, the incoming and outgoing sewers shall be so related that the inside tops (crown) of the sewers are at the same elevation.

10.18 MAXIMUM DEFLECTION AT MANHOLES

At manholes, the upstream deflection angle at the intersection of two main sewers must not be greater than 90 degrees.

10.19 MANHOLE RIM ELEVATION

Manhole rim elevation shall be shown on Plans to nearest 0.1 foot. Unless otherwise indicated on the Plans, it shall be assumed to be flush with the adjacent ground surface. In areas where future streets will be constructed, rim elevation shall also be shown for future finished grade.

10.20 CONNECTION TO EXISTING MANHOLE

In existing manholes where no stub exists, Contractor shall provide a channel in the portion of the base block located inside the manhole two inches larger than the outside diameter of the proposed stub. It shall be the responsibility of the Contractor to perform all the necessary work on the exterior of the manhole in preparation for the installation of the new stub. The Contractor shall be responsible for the alignment and grade of the new stub. The Contractor shall make a water-tight seal of the new stub from the outside of the manhole. All work by the Contractor shall be performed in a manner that will maintain the integrity of the existing manhole. The Contractor shall provide 24 hours' notice to the District prior to the start of any work.

10.21 CONNECTIONS BETWEEN MAIN SEWERS

Connections of new main sewers into existing main sewers must be made by means of a new manhole installed by the Contractor. (See Volume II, Sections 6.09 and 11.08 herein for connection of private sewer into existing main sewer).

10.22 CONNECTION BETWEEN PUBLIC AND PRIVATE LATERAL

A test wye shall be constructed at locations shown on Plans or as required by the Engineer to facilitate testing of the private sewers.

10.23 DROP MANHOLES

See Volume II, Section 3.03.3.

10.24 BOLT-DOWN MANHOLES

Standard District bolt-down manhole frame and cover without vent holes shall be required when manhole is located on a lot where there will be a residence.

10.25 EASEMENT ALL-WEATHER ACCESS REQUIREMENTS

All manhole structures appurtenant to sanitary main sewers must be accessible to District maintenance vehicles.

Where deemed necessary by the Engineer, this accessibility shall be achieved by means of an adequately surfaced roadway of a design approved by said Engineer.

10.26 EASEMENT ACCESS REQUIREMENTS

Access to and along the easement, including all manholes shall be feasible and safely achievable by District maintenance vehicles.

10.27 EXTENT OF SEWER MAIN IMPROVEMENTS

When the sewer main will serve properties beyond the project limits, the sewer main must be designed and installed to cross the full frontage.

10.28 PUBLIC LATERAL CONNECTIONS TO EXISTING MAIN OR NEW MAIN

The public lateral will connect to an existing or new main as follows:

A. CONNECTION OF MAINS OF THE SAME DIAMETER

When the diameters are of the same size a new manhole shall be installed and the inverts shall be offset as described in Section 10.17.A.

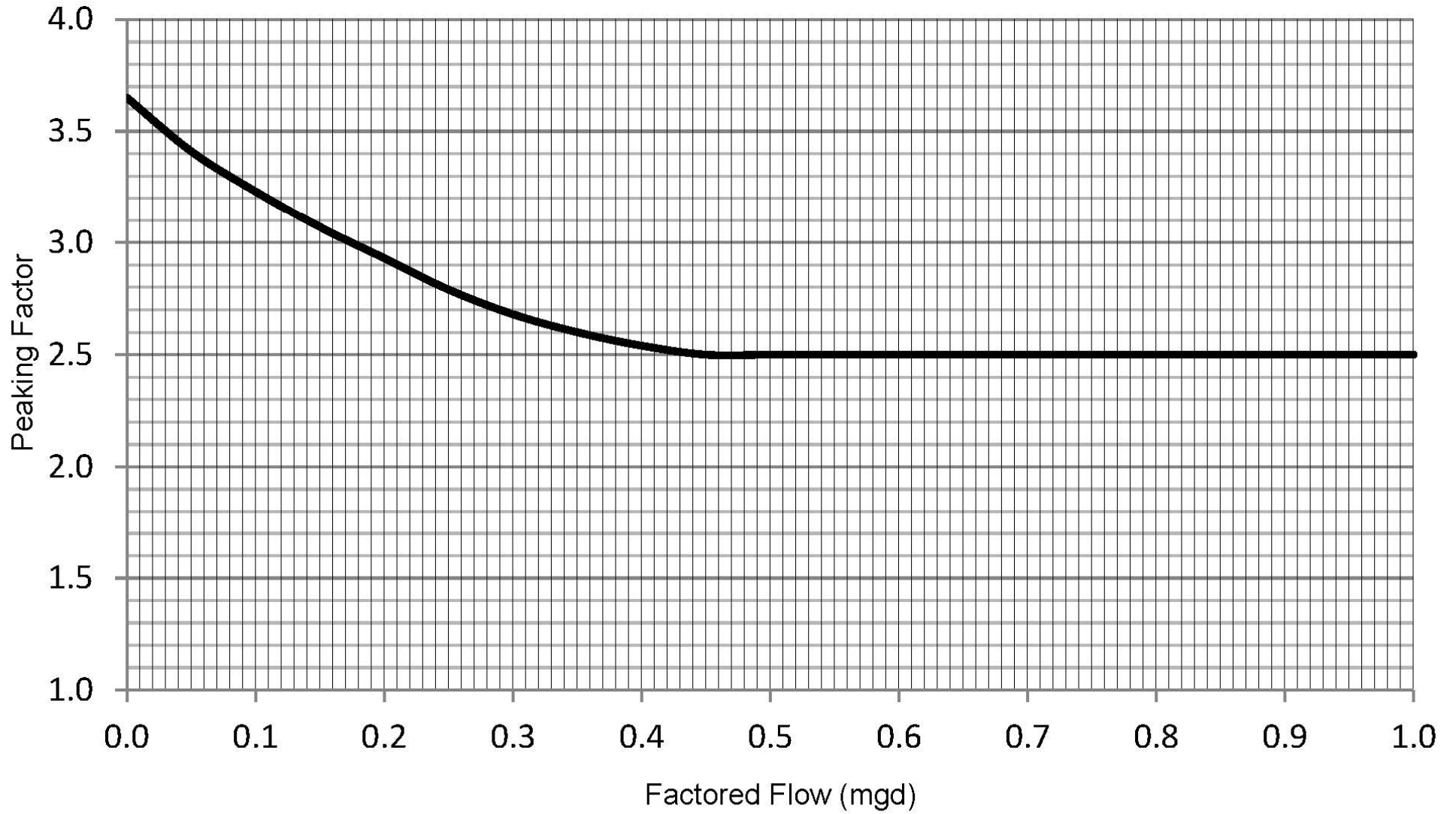
B. CONNECTION OF MAIN TO EXISTING WITH DIAMETER GREATER THAN 15 INCHES

When connecting a new main or lateral to an existing or new main greater than 15 inches in diameter, a new manhole shall be installed and the incoming and outgoing sewers shall be offset as described in Section 10.17.B.

C. CONNECTION OF PUBLIC LATERAL WITH DIAMETER LESS THAN THE SIZE OF THE EXISTING/NEW MAIN

When the diameter of the connecting public lateral is less than the diameter of the existing or new main the contractor shall match the crowns at the connection.

Figure 10-1
Peaking Factor Curve



SECTION 11 - DESIGN AND POLICY STANDARDS FOR PRIVATE LATERALS

11.01 SIZE AND SLOPE

Minimum size of private sewer shall be four (4) inches in diameter but in no case smaller than the building drain (building plumbing) stub diameter. Plumbing fixture unit values, as established by the latest edition of the Uniform Plumbing Code, shall be used in designing the private sewer.

Pipe Diameter	Minimum Slope (%)
4"	2.0%
6"	1.0%

Slopes for larger pipes will require review and approval by the engineer.

11.02 PIPE MATERIALS

Pipe materials shall be limited to Vitrified Clay Pipe (VCP), Poly Vinyl Chloride Pipe (PVC, SDR 26 or C900 CL 150), ABS, High density Polyethylene pipe (HDPE, DR 21 or less) as listed in the Standard Specifications. Additional pipe materials may be used upon approval by the engineer.

11.03 ALIGNMENT

Sewer alignment shall be as straight as possible. When angle points are approved, only one vertical 45-degree (maximum) change of direction is permissible without a cleanout. Any additional vertical changes of direction, thereafter, in excess of 22-1/2 degrees shall be served by a cleanout or manhole. A cleanout shall also be placed at all blind bends or other locations along the alignment where access is limited. Ninety degree bends or tees and horizontal changes of direction are not permitted.

11.04 GRADE

Unless otherwise authorized by the Engineer, the sewer shall be designed and constructed on a straight grade between the main sewer and the property line and between the property line and the building drain (building plumbing). Changes in grade shall be served by a cleanout or manhole.

11.05 GRADE STAKES

When cut sheets are required by the Engineer, sewer construction stakes shall be located at angle points, grade breaks, cleanouts, wyes, structures and at a 50-foot maximum spacing. An additional stake will also be required at property line and at connection point with building plumbing (building drain).

The stakes shall be offset from the center line of the sewer at a safe distance from the edge of the trench but in no case greater than ten (10) feet unless authorized by the Engineer. The stakes will be marked with off-set and station only.

When the sewer is to be constructed to property line only, the Engineer may require a stake to be set at the point prior to construction.

11.06 CURB MARKING

At the time the curb stakes are set (prior to construction of curb and gutter) an additional stake must be set on the curb stake line opposite the point at which the private sewer crosses the property line. This will insure that the "S" can be stamped in the fresh concrete in the proper location as required under Volume II, Section 6.06.

11.07 CONNECTION TO PUBLIC LATERAL

Unless otherwise permitted or required by the Engineer, the connection of the private lateral shall be made at the clean out stub from the public lateral at the property line see standard detail. The connection of the private lateral to the public lateral shall be airtight and at the option of the Engineer may require air testing.

11.08 CONNECTION TO EXISTING PRIVATE SEWER

Private laterals, from a) a structure having a finished floor elevation at or lower than the top elevation of the nearest upstream manhole; or b) structures on a parcel with different finish floor elevations, shall have either:

1. An approved backwater overflow device or
2. An approved backwater check valve installed.

These backwater preventing devices shall be installed on the private lateral outside of and adjacent to the structure being protected. In the event any question exists whether such device is required, the final decision shall be made by the District.

The connection may be made by means of a private manhole, wye spliced into existing private sewer or stub installed by means of a tap made by "Tap Tite" or approved equal, all as shown on Standard Details and on District Approved Plans.

Actual connection of a new private sewer to an existing private sewer will not be permitted until the new sewer has been satisfactorily tested. If authorized by the Engineer, a test wye may be used with a plug in lieu of leaving a temporary gap in the sewer.

11.09 CONNECTION TO BUILDING DRAIN (PLUMBING KICK-OUT)

After a permit authorizing said construction has been issued, private sewers may be constructed up to a point five (5) feet from the building wall. Actual connection of the private sewer to the building drain (building plumbing) will not be permitted until the main sewer or private sewer to which it connects has been accepted by the District and the subject private sewer has been satisfactorily tested in accordance with Volume II, Section 7 - Testing.

Actual connection must be done by a sewer contractor with a valid sewer construction permit issued by the District. Work must be done in the presence of and to the satisfaction of the District Inspector.

11.10 CLEARANCES

All clearances shall conform to the State of California, Department of Health Services, "Guidance Criteria for the Separation of Water Mains and Non Potable Pipelines". See also Volume II, Section 10.12.

11.11 SEWER UNDER OR NEAR STRUCTURES

1. Any sewer deeper than the footing of any building or structure and paralleling the same must be designed to be of sufficient distance from the footing so that no part of the trench will fall within a 45-degree line drawn downward from the bottom of the footing.
2. Any sewer than crosses under a structure or retaining wall shall be installed in a casing.

11.12 MINIMUM PIPE COVER

Minimum cover for private lateral sewers shall be:

Cover Required	Location
3.0 – 5.0 feet	Property line
1.0 foot minimum	Building cleanout/connection

Cover requirements for other pipe materials and sizes will be based on their strength characteristics as approved by the Engineer.

11.13 TRENCH INTERSECTIONS

Avoid non-perpendicular crossings/intersections between the sanitary sewer and other underground utilities.

11.14 HORIZONTAL UTILITY CLEARANCE

A minimum horizontal clearance of five (5) feet should be maintained between the private sewer and adjacent underground utility lines and concrete curbs. A minimum horizontal clearance of ten (10) feet should be maintained between the private sewer and parallel water mains or services.

11.15 STRUCTURE TYPE AND LOCATION

A. PRIVATE MANHOLE

Private manholes must be constructed on private sewers eight (8) inches in diameter and larger with maximum spacing of 300 feet, at changes in horizontal or vertical direction, and at other locations required by the Engineer. Manholes may also be used on smaller private sewers in lieu of cleanouts.

Each user in an industrial building is required to install a separate manhole at the connection on the private sewer.

B. CLEANOUT TO GRADE "C.O.T.G."

A cleanout shall be constructed on four (4) inch and six (6) inch sewer laterals at intervals not to exceed 100 feet as well as at blind bends greater than 45-degrees. See Section "C" below for requirements at connection to building plumbing. Also see "A" above for use of manholes in lieu of cleanout to grade. No cleanout is required on runs less than 10 feet in length (See Volume II, Section 3.05).

C. TWO-WAY CLEANOUT TO GRADE

Two-way cleanouts shall be constructed on all four (4) inch sewers at the connection of the private sewer with the plumbing drain. This cleanout shall be located no further than two (2) feet from the building wall and protected with an approved box. (See Volume II, Section 3.06)

D. ANY OTHER STRUCTURES

Other structures required will be located as shown on approved Plans and be constructed in accordance with District requirements.

11.16 OVERFLOW DEVICES

Overflow protection devices shall be installed on private sewers when specifically required by the Engineer. The particular device to be used and its installation must be approved by the Engineer. This device will be required on all residential and commercial buildings where the floor elevation is six (6) inches or less above the closest upstream manhole rim elevation.

11.17 NUMBER OF PRIVATE SEWERS REQUIRED

See Volume I, Section 8.05.

11.18 PRIVATE PUMPING STATIONS

Private pumping stations should be avoided if possible. Private pumping stations must be approved by the Engineer. The pumping stations should be designed and stamped by a California registered civil engineer. Submittals including design calculations, flows, pump information, etc. shall be provided to the District. Minimum requirements for private pumping stations are provided in the following section.

SECTION 12 - DESIGN AND POLICY STANDARDS FOR PRIVATE MAINS

12.01 GENERAL

Private mains shall be designed and constructed per the requirements in Volume II, Section 10 – Design and Policy Standards for Main Sewers and Public Laterals. The minimum slope requirements are as follows:

Pipe Diameter	Minimum Slope (%)
4"	2.0%
6" or greater	1.0%

The owner/developer shall enter into a Private Main Agreement with the District.

SECTION 13 – PUMP STATIONS

13.01 PUMP STATIONS

A. GENERAL

Public pumping stations serving more than one parcel are not normally allowed. They may be considered under extraordinary circumstances, but only by specific approval by the District Engineer during the preliminary design stages. If a pump station is allowed, the planning and design must consider at a minimum, but not limited to, the following:

- a. SCADA
- b. Remote Monitoring
- c. Noise
- d. Backup Power
- e. Corrosion
- f. Odor
- g. Pumping Equipment
- h. Electrical Equipment
- i. Telemetry

Further conditions are provided in this section. They should be considered minimum conditions for use in the basis of design.

Plans and specifications for all lift stations are to be prepared by a Registered Professional Engineer and submitted to the District for review and approval.

B. HYDRAULICS

The following list provides the hydraulic design criteria for new pump stations:

1. Design Conditions:
 - a. Minimum force main velocity: 2 fps
 - b. Maximum force main velocity: 8 fps
 - c. Minimum inlet pipe slope: 2%
2. Firm-capacity for the lift station is defined as the pumping capacity for the facility with the largest pump out of service.
3. The preferred-operating-region (POR) for a given pump is between 70% and 120% of the flow at the best-efficiency-point (BEP). Use the pump-speed affinity relationships to estimate the BEP at reduced speeds.

4. Design the lift station to serve the entire tributary area using build-out densities that conform to the City's or County's latest General Plan.
5. The lift station must be capable of operating within the POR at all flows between the firm-capacity and one quarter of the firm-capacity.
6. The ratio of minimum net positive suction head available (NPSHa) to net positive suction head required at BEP (NPSHr) must be 2.0 or greater.
7. Pump station design calculations shall address surge and "waterhammer," and, if required, surge control shall be provided.
8. Unless waived by the District Engineer, a hydrogen sulfide study will be required. Corrosion control and odor control may be required based on the results of the hydrogen sulfide study.

C. PUMPS AND MOTORS

The following list provides the design criteria for pumps and motors of a new pump station:

1. All pumps shall be designed to handle solids, and must be capable of passing a minimum 3-inch diameter sphere.
2. All pumps shall be identical.
3. All pumps shall be fitted with 460 VAC, 3-phase, premium-efficiency, inverter-duty motors except as approved by the District Engineer.
4. Brake horsepower shall not exceed the nominal rating of the motor between shutoff and the maximum flow shown on the manufacturers' published performance curves.
5. The service factor for all motors shall be 1.15.
6. Provide thermal overload protection for all pump motors.
7. Provide a spare mechanical seal and other spare parts as recommended by the pump manufacturer.

D. WET WELL

The following list provides the design criteria for the wet well of a new pump station:

1. Working capacity of the wet well is defined as the volume between the maximum and minimum normal operating levels.
2. Wet well shall have enough working capacity to prevent any pump from starting more than four times per hour.
3. Wet wells shall be designed in accordance with Hydraulic Institute Standard No. 9.8 (Pump Intake Design), except as noted otherwise in this standard.
4. Set the high-level alarm at the invert elevation of the nearest upstream manhole. Provide a minimum clearance of six (6) inches between the maximum normal operating level and the high-level alarm.
5. Set the low-level alarm at least one foot above the motor (for submersible pumps), and at least three feet above the suction bell. Provide a minimum clearance of six (6) inches between the minimum normal operating level and the low-level alarm.
6. Design the wet well to counteract the effects of buoyancy due to high groundwater conditions. The groundwater elevation used for design shall be determined by a licensed geotechnical engineer. Ground surface may be used as groundwater level in lieu of a Geotechnical Report.
7. Wet well shall be constructed using reinforced concrete. Concrete mix design shall be suitable to resist damage from sulfides.
8. Wet wells shall be lined with GSE 5 mm HDPE Studliner in accordance with manufacturer's recommendations.
9. Penetrations into the wet well shall resist infiltration and exfiltration.

E. PIPING AND VALVES

The following list provides the design criteria for the piping and valves of a new pump station:

1. Provide a control gate or plug valve on the wet well inlet to permit isolation of the wet well.
2. Provide a plug valve and rubber-flapper style check valve on the discharge of each pump. Plug valves shall be non-lubricated neoprene faced eccentric. Check valves shall be installed in the horizontal plane.
3. Buried pressure piping shall be AWWA C151 ductile iron or C900/C905 PVC with AWWA C110 mechanical joint fittings.

4. Provide mechanical joint restraint at all fittings and pipe joints. Thrust blocks are permitted only if mechanical joint restraint is not feasible.
5. Design pressure piping to maintain velocities between 2 ft/s and 8 ft/s.
6. Design gravity piping in accordance with the District's standard for sewer construction.
7. Provide a connection to the force main to permit bypass pumping. Coordinate sizing and connection details with District staff.
8. Provide restrained flanged coupling adapters to permit removal of all valves, meters, and other mechanical equipment connected to the piping.
9. District Engineer will determine if swabbing or pigging facilities are required at the lift station. If so, all downstream piping and related equipment shall be designed to accommodate this appurtenance. Launching facility will be detailed on lift station plans and must accommodate using lift station pumps for propulsion. Provide all necessary valving. Contact the District for suggested design requirements.

F. ELECTRICAL EQUIPMENT

Electrical equipment shall meet the following criteria:

1. Install all major electrical equipment including utility meter and main circuit breaker enclosures, panel boards, control panels, and motor control centers outside of hazardous areas as defined in the National Electric Code, Article 500.
2. Provide utility meter and main circuit breaker in an overall 316 stainless steel enclosure rated NEMA 4X with a viewing window centered on the utility meter.
3. Provide NEMA 3RX, 316 stainless steel enclosures for electrical equipment and control devices where ventilation or air conditioning of the devices is required. Provide NEMA 4X, 316 stainless steel enclosures for all other equipment and devices.
4. Provide OSHA approved rubber mat in front of all indoor control panels.
5. Provide industrial fluorescent strip fixtures in the building interior.
6. Provide an exterior light in accordance with STD #601. Provide 12-inch diameter pole-mounted luminaires at 120V, 70W HPS.

7. Provide a 6-pulse variable-speed drive for each pump. Manufacturer: Allen Bradley, or equal.

G. INSTRUMENTATION AND CONTROLS

Instrumentation and controls shall meet the following criteria:

1. Provide a magnetic flowtube (Rosemount Model No. 8705) on the pump station discharge. Connect flowtube to remotely mounted transmitter (Rosemount Model No. 8712) using manufacturer's cable.
2. Provide guided wave radar or ultrasonic level transmitter for continuous level monitoring in the wet well.
3. Provide discrete level float switches for high-high level and low-low wet well level alarms.
4. Provide a programmable logic controller (PLC) and human-machine interface (HMI) for monitoring all instrumentation signals, alarm conditions, and pump control. Provide a minimum of 20% spare I/O capacity. Manufacturer and model shall be approved by the District Engineer.
5. Develop Wonderware screens for the District's SCADA system. Coordinate screen development with District Engineer.
6. Use a proportional-integral-derivative (PID) control loop to maintain a user-specified set-point level in the wet well. The process variable will be the level transmitter output; the control variable will be the pump speed signal that is transmitted to the variable-frequency drives.

H. TELEMETRY

All control panels shall incorporate the following general features:

1. Provide a lamp with switch.
2. Provide a 120 VAC duplex convenience outlet.
3. Provide 120 VAC uninterruptible power supply (UPS) or an equivalent DC voltage subsystem sized for 150% of peak load for all internal panel components for a minimum of 30 minutes run time.

4. Provide an 800 MHz-band spread-spectrum radio to interface with the District's SCADA system. Perform radio signal strength study to verify antenna and signal transmission requirements.
5. Provide a dial-up telephone line and an automatic alarm dialer to annunciate critical alarms. Provide a wall mounted telephone using the same dial-up line for operator convenience.

I. STANDBY GENERATOR

At the discretion of the District Engineer, a standby generator may be required. The following minimum requirements for the standby generator are as provided herein.

1. Provide permanently installed, diesel-fueled generator with an automatic transfer switch. The generator's engine must meet the Bay Area Air Quality Management District (BAAQMD) emission standards. Provide Crouse Hinds E0400-1686 Posi-lok load bank receptacles to test generator for load bank connection.
2. Generator sizing calculations will assume loading based on lead pump running, lag pump starting and full operation of all electrical equipment at the site.
3. Obtain Fire Department approval for fuel tank.
4. Provide instrumentation:
 - a. Generator voltage, frequency, and amp meters.
 - b. Oil pressure gauge.
 - c. Battery volt meter.
 - d. Water temperature gauge.
 - e. Hour meter.
 - f. External battery with trickle charge.
 - g. Dry contacts for telemetry - showing generator running.

5. Provide automatic shut-off and alarms:
 - a. Low engine oil pressure.
 - b. High engine temperature.
 - c. Over speed.
 - d. Over crank.
6. Provide sound attenuation as necessary to meet or exceed applicable noise standards for location. Attenuation may include silencers and/or insulation.

J. DETAILS REQUIRED ON IMPROVEMENT PLANS

Improvement plans shall be submitted to the District for approval. The plans shall include the following:

1. Site Plan: Locations of power pole, transfer switch, emergency generator, grounding electrode, control panel, wet well, driveway, fencing, water service, emergency suction/discharge boxes. Provide site grading and drainage details.
2. Wet well: Influent piping (standard inside drop manhole); suction piping (min. 6 inches off bottom of manhole); emergency suction line; water/alarm levels (pump on, pump off, low level, high level), redundant high water float switch.
3. Force main discharge details.

K. RECORD DRAWINGS AND MANUALS

1. Provide three (3) copies of approved record drawings and electronic scan of the drawings in *.TIF or *.PDF format with a minimum 200 dpi resolution, and an electronic copy in AutoCAD.
2. Provide three (3) copies of O&M Manuals plus an electronic copy when available.

L. BUILDING STRUCTURE

Pump station buildings shall be constructed of split-face concrete masonry unit (CMU) with standing-seam metal roofing.

13.02 PACKAGED PUMP STATIONS

A. SYSTEM DESCRIPTION

Provide packaged sewer lift station system, shop assembled with basin, submersible, non-clog grinder pumps and single automatic control for in ground installation. Provide duplex system (one operating pump and one installed spare pump).

B. GENERAL REQUIREMENTS

1. Plans and specifications for lift stations shall be prepared by a California registered professional engineer and submitted to the District for review and approval.
2. Materials shall be corrosion resistant and rated for sewage service. Metal exposed to sewage environment must be stainless steel.
3. Manufacturer: Company specializing in manufacturing of packaged lift stations with minimum three years of experience.
4. Environmental: Comply with State of California, Department of Public Health Water Main Separation Criteria (Title 22).
5. Provide and install an approved reduced pressure (RP) backflow assembly for potable water service line to lot.

C. HYDRAULICS

Same as required for Pump Station per Section 13.01 (B)

D. PRODUCT REQUIREMENTS

1. General
 - a. Packaged sewer lift station must have a cartridge type, easily removable core assembly containing: pump, motor, grinder, motor controls, check valve, anti-siphon valve, electrical quick disconnect and wiring. Provide lifting hooks, mechanical and electrical disconnects with easy disconnect accessibility.
 - b. Packaged sewer lift station must be maintainable without entry. Entrance is not permitted without appropriate OSHA confined space permits.
 - c. Packaged sewer lift station shall be free from electrical and fire hazards.
 - d. Packaged sewer lift station shall be free from noise, odor or health hazards and shall have been tested by an independent laboratory to certify its capability to perform in sewer system applications.
 - e. Provide NSF International seal on product as evidence of compliance.

2. Pump

- a. Provide identical, submersible, non-clog grinder pumps with stainless steel impellers, shredding rings, cutters, shafts and hardware.
- b. Pump capable of delivering negative total dynamic head without overloading the motor(s). Use of in-line piping or valves to create false apparent head is not permitted.

3. Motor

- a. 120/240V, 60Hz, single phase, 1800rpm max, non-overloading.
- b. Service factor: 1.15
- c. Provide thermal overload protection.

4. Basin

- a. Working capacity of the basin is defined as the volume between the maximum and minimum normal operating levels.
- b. Basin shall have enough working capacity to prevent pumps from starting more than four times per hour.
- c. Basin shall have capacity for emergency storage to accommodate a 1-day (24-hour) lift station outage during maximum day demand.
- d. Design basin to counteract the effects of buoyancy due to high groundwater conditions. The groundwater elevation used for design shall be determined by a licensed geotechnical engineer. Ground Surface may be used as groundwater level in lieu of a Geotechnical Report.
- e. Basin shall be suitable to prevent damage from sulfides and use custom molded HDPE or fiberglass reinforced polyester resin.
- f. Penetrations into the basin shall resist infiltration and exfiltration.
- g. Basin shall be dual contained with a smooth internal wall to promote scouring.
- h. Basin seams shall be thermally welded, factory tested and leak-proof.
- i. Basin shall be sufficient to withstand saturated soil loads at maximum burial depth.
- j. Basin Cover must be lockable and sufficient to withstand live load of 150 psf minimum. If basin cover potentially accessible to vehicular traffic, provide HS20 rated cover.

- k. Basin shall have integral bug-free vent, an inlet piping connection and a discharge piping connection
5. Packaged Lift Station Piping and Valves
- a. Provide stainless steel discharge piping and hardware.
 - b. Provide non-clog check valve.
 - c. Provide anti-siphon valve.
 - d. Provide full port, stainless steel isolation valve.
6. Site Piping and Valves
- a. Force main piping: HDPE (SDR 11) or PVC (Schedule 80) with a minimum depth of cover of 3 feet.
 - b. Provide plug-style isolation valves for buried service with corrosion resistant valve stem extension, riser and cover plate labeled "sewer" for basin inlet and force main to permit isolation of the basin.
 - c. Provide non-clog check valve immediately upstream of force main plug valve.
 - d. Connect to inlet and force main piping to basin with flexible connector.
 - e. Valves and appurtenances shall use either of the following bolts and nuts:
 - 1) Fluoropolymer coated carbon steel: bolts (ASTM A307, Gr. B) and nuts (ASTM A563, Gr. A)
 - 2) 316 stainless steel: bolts (ASTM A193 Gr. B8M) and nuts (ASTM A194 Gr. 8).
 - f. Refer to Standard Details for force main discharge.
7. Operations
- a. Level control: non-fouling level detection with no moving parts in direct contact with wastewater.
 - b. Level control points: "pump on," "pump off," and "high level" in basin. Start pump automatically when "pump on" set-point is activated. Stop pump automatically when "pump off" set-point is activated. Signal alarm condition automatically when "high level" set-point is activated.
 - c. "High level" alarm shall be visual and audible.
 - 1) Audible alarm to be silenced with externally mounted push-button.

- 2) Visual alarm to remain illuminated until sewage level drops below the “pump off” setting. Mount visual alarm in top of enclosure. Maintain NEMA 4X rating.
 - d. Sound, Vibration, and Thermal Control: Dampen or suppress noise, absorb vibration, accommodate thermal expansion and stresses, and adjust or correct for misalignment in piping systems.
8. Electrical
- a. Power/Alarm cable:
 - 1) Provide NEMA 6P quick disconnect.
 - 2) Provide cable shroud and strain relief cord connector.
 - 3) Provide cable for direct burial use.
 - b. Back-up power: As an alternate to providing emergency storage within the basin, provide back-up power source to ensure continuous operations in the event of a power outage.
 - c. Alarm/Disconnect Panel
 - 1) Corrosion resistant NEMA 4X rating
 - 2) UL listed.
 - d. Wiring: in accordance with requirements of National Electrical Code.

E. INSTALLATION REQUIREMENTS

1. Install per manufacturer’s standard printed instructions.
2. Seal cover penetrations with manufacturer’s recommended sealant.
3. Set cover frames and covers level without tipping, to correct elevations.
4. Provide Basin anchorage.

F. STARTUP, INITIAL TESTING AND OPERATIONS

1. Notify the District three days prior to testing. Coordinate and operate pumps in conjunction with District.
2. Provide startup and initial testing of system. District Inspector must be present to observe testing (including retests).
3. Hydraulically test station to performance requirements by receiving, pumping and discharging 500 gallons of water to/from basin.

4. Correct failures during test by repairing or replacing malfunctioning parts or equipment or faulty workmanship.
5. After correcting failures, re-test until failures are eliminated.
6. Confirm general sequencing of pump and level control operations at basin and control panel are in accordance with performance requirements.
7. Document and certify lift station system startup and initial testing results in startup report. Submit startup report to the District for review and permitting approval. Do not operate lift station without a District-approved permit.

G. PROTECTION OF FINISHED WORK

Do not allow access to general public. Provide secure, lockable access.

H. DETAILS REQUIRED ON IMPROVEMENT PLANS

1. Site plan: Location of packaged sewer lift station, driveway, fencing, water services within 120 ft. Provide site grading and drainage.
2. Basin inlet piping and force main discharge details.

I. RECORD DRAWINGS

Provide three (3) copies of approved record drawings and electronic scan of the drawings in *.TIF or *.PDF format with a minimum 200 dpi resolution and an electronic copy in AutoCAD.

13.03 PRIVATE LIFT STATIONS

A. GENERAL

Private individual pump stations shall not be allowed where an alternative gravity option exists.

B. GENERAL REQUIREMENTS

1. Tank size for a residence (additional fixtures shall be evaluated on a case-by-case basis) shall have a minimum capacity of 100 gallons for a duplex system, a minimum 100 gallons for a simplex system serving a washing machine or a single bathroom, and a minimum of 600 gallon capacity for a simplex system.
2. The tank design shall consider buoyancy and corrosion.
3. The outlet pipe material shall be a minimum of Schedule 40 PVC glue joint pipe. The outlet pipe shall be designed based on the pump size.
4. An audible and visible high-water alarm is required. The audible alarm shall be able to be heard throughout the house.

5. A check valve and gate valve are required downstream of each pump.
6. The pressure line from the pump system shall break to gravity flow prior to connecting to the public lateral.
7. If the pressure line is connected to a gravity private lateral, a District-approved overflow device shall be installed outside next to the foundation upstream of the connection point.
8. Private individual pump stations are not allowed within street right-of-way.
9. All work shall conform to the latest Uniform Plumbing, Electrical, and Building Codes. A City of Napa building permit is required.
10. Designs shall be submitted to the District for review and approval.

STANDARD DETAILS

- SS-1 – Sanitary Sewer Cleanout
- SS-2 – Standard Residential Public Lateral for New Construction
- SS-3 – Sewer Lateral Crossing Above Utility, No Conflict in Grade
- SS-4 – Sewer Lateral Crossing Below Utility, No Conflict in Grade
- SS-5 – Simple Sewer Lateral Break with Conflict in Grade
- SS-6 – Sewer Lateral Layout 1
- SS-7 – Sewer Lateral Layout 2
- SS-8 – Drop Type Manhole
- SS-9 – Standard Pre-Fab Manhole (Sheet 1)
- SS-9A – Standard Pre-Fab Manhole (Sheet 2)
- SS-10 – Barrel Section Joints for Standard Pre-Fab Manhole
- SS-11 – Typical Manhole Using Impression Ring
- SS-12 – Pre-Cast Concrete 48"x24" Reducer Slab for Manholes
- SS-13 – Typical Method for Setting Appurtenances
- SS-14 – Standard 24" Manhole Frame and Cover
- SS-15 – Bolt-Down 24" Manhole Frame and Cover
- SS-16 – 36" Diameter Manhole Frame and Cover
- SS-17 – Typical Installation Irrigation "Subtraction" Meter
- SS-18 – Standard Casing Installation
- SS-19 – Redwood Check Dam
- SS-20 – Trench Dams
- SS-21 – NOT USED
- SS-22 – Two Stage Grease Interceptor
- SS-23 – Grease Interceptor Sampling Box
- SS-24 – Standard Trench Section
- SS-25 – Standard Tracer Wire Installation Detail
- SS-26 – Abandoned Pipe Plug
- SS-27 – Abandoned Manhole
- SS-28 – Standard Flush Hole for 6" and 8" Sanitary Sewer Mains
- SS-29 – Standard Trench Section for Private Sewer Lateral