

## **SECTION 4**

**STANDARD SPECIFICATIONS FOR CONSTRUCTION OF**

**SANITARY SEWER LINES**

**CITY OF SEBASTOPOL  
SONOMA COUNTY, CALIFORNIA  
JULY 1998**

**To be used with City of Sebastopol Sewer Standards dated July, 1998 and State of California  
Department of Transportation Standard Specifications, latest edition.**

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**SECTION 1 - EARTHWORK**

**1.01. SCOPE OF WORK:**

1. Pipe line excavation and backfill.
2. Structural excavation and backfill.

**1.02. GENERAL:**

Earthwork shall include the loosening, removing, loading, transporting, depositing and compacting in final location all materials, wet and dry, necessary to be removed for the purposes of construction, or as required for pipelines, and other purposes as indicated on the drawings; the furnishings, placing, and removing of all sheeting and bracing; all pumping and draining of excavation; the supporting of structures above and below ground; the handling of all water encountered in the excavations; all backfilling around structures and backfilling of all trenches and pits and all other incidental excavation as shown on the drawings and as specified.

**1.02. PIPELINE EXCAVATION:**

1. **TRENCHING:** Where trenching occurs in paved areas, the pavement shall be cut on neat lines prior to ditching, parallel to the trench at the width required for the trench. Concrete pavement shall only be cut by sawing. Any pavement damaged outside these lines shall be restored by the Contractor at his own expense.

The width of unsheathed trenches shall not be greater than 16 inches plus the outside diameter of the pipe barrel. Where sheathing is required, the width of trench shall be increased only sufficiently to accommodate the sheathing and timbers. The bottom of the trench shall be finished off with a firm bed free of gravel or rocky projections as approved by the Engineer. Bottom of trench must be free from loose material before placing backfill material. No steel wheeled or crawler type construction machinery, exclusive of trenching machines, shall be operated on the pavement without the approval of the Engineer.

2. **BLASTING:** No blasting will be permitted without the approval of the City. When blasting is permitted, it shall be done only by skilled operators and under the direction of a competent foreman.

Permits for blasting shall be obtained and paid for by the Contractor.

3. **EXCAVATED MATERIAL:** Material excavated shall be laid alongside the trench, and kept trimmed up so as to cause as little inconvenience as possible to public travel and the normal use of adjacent properties.

4. **BEDDING:** In such cases where the ground is too soft to furnish a firm support for the pipe at the grade of the line, excavation shall be carried, when directed by the Engineer, to firm ground or a minimum depth of 12 inches below the grade. The trench shall then be backfilled with Type I material to the grade line and compacted. The Engineer shall be the sole judge of the suitability of the trench bottom and as to the amount of imported backfill required to stabilize a soft foundation.

The Contractor shall remove any soft material when ordered to do so by the Engineer. If any trench, through neglect of the Contractor, be excavated below the bottom grade as required by the drawings, it shall be refilled to grade with Type I backfill at the Contractor's expense.

As pipe laying proceeds, bell holes shall be excavated at each joint to facilitate the jointing operation, and shall be only of sufficient size for that purpose. In order that bell holes may be properly located, not more than six (6) bell shall be excavated ahead of the actual pipe laying.

5. **LENGTH OF TRENCH OPEN:** Unless otherwise approved by the Engineer, the length of trench at any location remaining open at the end of each day's work shall not exceed 50 feet as measured from the point where excavation is in progress to the point where backfill has been completed to a degree that the trench is passable to traffic.

When construction is within State highways or County roads, the length of open trench at the end of each day's work, if permitted, shall conform to the requirements of the appropriate encroachment permit. It will be the responsibility of the contractor to secure such permit(s) and be familiar with the requirements therein.

1.04. **PIPELINE BACKFILL:**

1. **SCOPE:** Pipeline trenches shall be backfilled with appropriate material to the level of the original ground surface, to the underside of the pavement base course, or as shown on the drawings, unless otherwise ordered by the Engineer. Typical trench sections for the various pipeline materials are shown on the drawings.

2. **GENERAL:** Before backfilling, the trench shall be cleared of all timber and debris such as wood blocks, grade stakes, paper, rope, rags, and broken pavement. Care shall be taken to insure that backfill material is free from debris.

All backfill material shall be placed in the trench to the full width as excavated. Backfill material shall not be dropped directly upon the pipe. All selected excavated material placed within six inches of the pipe shall be free from rocks and boulders larger than four inches in maximum dimension and from unbroken masses of earthy materials which might lodge and thereby cause unfilled pockets.

It is highly important that a dense, well compacted backfill be placed around the pipeline. The

Contractor will be required to produce such a backfill under all circumstances. The materials used for the backfill, the amount thereof, and the manner of deposition shall be subject to the approval of the Engineer, but the Contractor will be held responsible for any displacement or instability of the pipeline or any damage to the coating caused by improper installation of backfill materials.

No material shall be used for trench backfill, which, because of excessive moisture or any other reason, cannot be compacted to the degree specified.

Any such material shall be considered unsuitable, and if it is deposited in the trench, it shall be removed and replaced with suitable material.

During the process of backfilling, any timbering, sheeting, shoring and sheet piling used to shore the excavation shall be carefully removed by the Contractor in such a manner as will result in a minimum of cabling, lateral movement or flowing of the soil. On approval of the Engineer, the Contractor may leave in place sheet piling, sheeting, and bracing, but in such event, no payment shall be made by the Owner for such materials left in place.

Low points along the pipe trench shall not be backfilled until all backfill at adjacent higher elevations has been completed. Water collecting at the low points along the trench from jetting operation or other causes shall be removed by pumping or other approved means in order to avoid softening of adjacent natural ground. An adequate number of sump pumps at proper spacing shall be supplied to prevent the accumulation of excess water in the trench.

3. **BEDDING:** Where shown in the typical trench sections on the drawings, a pipe bedding of compacted Type I backfill material shall be provided. The bedding shall be brought to a uniform grade in three (3)-inch compacted layers and bell holes formed to provide continuous support along the pipe barrel.

4. **BACKFILL (PVC & D.I.P.):** Initial backfill material for that portion of the trench from the grade of the pipe to a compacted depth of six (6) inches for PVC and three (3) inches for D.I.P. over the top of the pipe shall be Type I backfill material unless otherwise directed by the Engineer. After the pipe has been properly laid and inspected, initial backfill material shall be placed simultaneously on both sides and over the pipe.

Compaction shall be by saturation by water and vibrating or by hand tamping. Saturation shall be by the use of water jets or any other desensification by vibration is in progress. Consolidation shall be performed alternately on both sides of the pipe. Excessive or improper jetting or flooding of the backfill will not be allowed. All compaction methods and equipment shall be subject to the approval of the Engineer.

Backfill material for the remainder of the pipe trench shall be selected from the excavated material, if suitable in the opinion of the Engineer, or otherwise shall be imported material that will meet the compaction requirements.

5. **BACKFILL (PVC):** Haunching backfill material for that portion of the trench from the grade of the pipe to spring line (1/2 pipe diameter) shall be Type I and placed simultaneously on both sides of the pipe. Compaction shall be by hand tamping to 95% relative density. Care shall be taken to insure that all voids under the pipe are filled and compacted to provide full pipe support at haunches. After haunching backfill has been placed, compacted and inspected, the initial backfill of Type I material shall be placed from springline to 6" over the top of pipe. Compaction of this initial backfill shall be by hand tamping to 95% relative density.

Backfill material for the remainder of the pipe shall be selected from the excavated material, if suitable in the opinion of the Engineer, or otherwise shall be imported material, that will meet the compaction requirements.

6. **COMPACTION REQUIREMENTS:** Relative compaction shall be determined using ASTM D-1557-78 test.

Compaction requirements are shown on the typical sections on the Plans.

7. **JETTING:** Jetting (water consolidation of backfill) shall be accomplished by introducing water into the backfill by means of a jet pipe. The jet pipe shall not be less than one and one-half (1 1/2) inches in diameter and shall extend within fifteen (15) inches of the top of the pipe during jetting of backfill over pipe. The source of water for jetting shall be a water tank with a pressure of sixty (60) pounds per square inch. All bridges shall be completely broken down during the jetting process. Jet points along the line of the ditch shall be staggered from side to side at intervals not to exceed six (6) feet center to center or as necessary so that the backfill takes full possible subsidence while water is being introduced into it through the jet pipe. The maximum lift for jetting shall be six (6) feet.

8. **RE-EXCAVATING:** If the compaction requirements as specified above are not met within 60 calendar days after jetting the backfill, the trench shall be re-excavated. Backfill material shall then be compacted by tamping and/or rolling as specified above until the compaction requirements are satisfied. The cost of testing recompacted areas shall be paid by the Contractor.

9. **SUBGRADE PREPARATION:** Subgrade meeting the requirements of Section 19 of the July, 1995, Standard Specifications is required. The finished subgrade immediately prior to placing base material thereof shall have a relative compaction of not less than 95% for a depth of 2 1/2 feet below finished permanent surfacing grade. Mud or other soft or spongy material shall be removed and the space filled with import backfill material and rolled or tamped in layers not exceeding 8 inches in thickness until the above relative compaction requirement is satisfied.

Subgrade preparation is not required in unimproved area where trench surfacing is not required.

10. **EXCESS MATERIAL:** Excess trench material shall be promptly removed and disposed

of elsewhere by the Contractor at his own expense and profit. The Contractor shall not dump material on any private property without first obtaining a permit to do so from the regulating authority.

1.05. BACKFILL MATERIAL:

a. Type I backfill - materials furnished for Type I backfill shall consist of any one or a mixture of broken stone or crushed gravel, natural material having essentially the same qualities of angularity or surface irregularities and roughness as broken stone or natural rough surface gravel. The material shall be of such a nature that it will bind and compact readily to form a firm, stable base.

The percentage composition by weight of Type I backfill shall conform to the following gradings:

<u>Sieve Size</u>	<u>Percent Passing Sieve</u>	
	<u>MIN.</u>	<u>MAX.</u>
1/2"	100	
3/8"	30	100
No. 4	5	35
No. 8	0	5

b. Type 2 backfill - with the approval of the Engineer, material for Type 2 backfill may be obtained from the excavation. Type 2 backfill shall be free from stones, lumps, broken concrete or bituminous surfacing exceeding four (4) inches in greatest dimension, vegetable matter or other unsatisfactory material.

The material shall have a plasticity index not exceeding 10 and an R value of not less than 25. The material shall compact into a stable mass which will not flow nor run whenever lateral support (such as the side of a trench) is removed.

The material shall contain sufficient fines to ensure that voids will be filled and that specified compaction requirements will be met. When material from the excavation is not suitable for use as backfill, it shall be disposed of and suitable material shall be furnished.

Representative samples of all materials to be imported shall be submitted sufficiently in advance of installation operations for testing and approval of the Engineer. Imported material shall not be installed until it has been so approved.

Tests will be made in accordance with the following standards: grading, ASTM C117 and C136; plasticity index, ASTM D424; and sand equivalent value, Test Method No. California 217 (Department of Transportation).

1.06. JACKED CROSSINGS:

The pipe shall be enclosed in a smooth steel casing (as indicated on the drawings) at the locations shown on the drawings and the pipe casing shall be installed in a hole bored by use of a "hydrauger" or equal earth boring machines, which will cut a true circular tunnel to the required line and grade. Bored tunnels shall be not greater in diameter than four (4) inches larger than the outside diameter of the conductor pipe to be placed herein. Conductor pipes shall be of the type and size delineated on the drawings.

The Contractor may, at his option, jack the conductor pipe into position in lieu of boring. The method and materials must meet the Engineer's approval.

The metal casing shall be filled with sand before completion of the work and redwood bulkhead constructed at each end of the conductor casing.

1.07. TRENCH SURFACING:

1. **GENERAL:** Where an unimproved surface is encountered, the trench shall be restored to its original surface.

Where gravel surface is encountered, it shall be replaced over the width of the trench with Class II Aggregate Base six (6) inches in depth.

Where the existing surface is of asphalt concrete, it shall be restored with a temporary surface followed by a permanent surface as specified herein.

2. **TEMPORARY SURFACING:** The temporary surfacing shall be Class II Aggregate Base as specified in Section 26 of the Standard Specifications and plant-mixed Cold Laid Asphalt Concrete. The aggregate base shall be equal in depth to the existing pavement structural sections but in any case, not less than fourteen (14) inches in depth on the State Highway, 9 inches in depth on other paved streets, and 6" in depth on parking areas. Plant-mixed cold laid asphalt concrete shall be a minimum of 1" thick and consist of well-graded aggregate having 4% to 10% passing the No. 200 sieve and Mc-900 asphalt.

All temporary surfacing shall be laid within two (2) days after backfilling. Before the street is opened for traffic, all excess dirt, rock, and debris shall be removed and the street surface shall be swept clean. Temporary surfacing shall be maintained constantly so that at no time will there be any mudholes nor shall the surface settle below one (1) inch nor be raised more than one (1) inch from the existing pavement.

3. **PERMANENT SURFACING:** Shall not be constructed until the compaction requirements of the specifications are satisfied.

The existing pavement shall be neatly cut to a depth of two (2) inches and removed to at least five (5) inches outside each side line of the pipe trench to permit proper keying in the restored pavement. The existing pavement cut shall be straight, vertical, and with no ragged edges.

The base course for permanent surfacing shall be Class II Aggregate Base as specified in Section 26 of the Standard Specifications. The aggregate base shall be placed to a depth as shown on the Typical Sections.

The wearing surface for permanent surfacing shall be asphalt concrete "Type A" conforming to the requirements of Section 39 of the Standard Specifications and placed to a depth as shown on the Typical Sections.

**1.08. SHORING, SHEETING, AND BRACING:**

Where necessary, trenches or other excavations shall be properly sheeted and braced, to finish acceptable working conditions. The bracing shall comply in all respects to the rules, orders and regulations prescribed by the Division of Industrial Safety of the State of California. The bracing shall be so arranged as not to place any stress on portions of the completed work until the general construction thereof has proceeded far enough to provide ample strength. Any damage to structures occurring through settlements, water or earth pressures, slides, caves or other causes, due to failure of lack of sheeting or bracing or improper bracing, or through negligence or fault of the Contractor in any other manner, shall be repaired by the Contractor at his own expense. Sheet piling and other timbering shall be withdrawn in such a manner as to prevent caving of the walls or excavations or damage to piping or other structures.

**1.09. CONTROL OF DUST:**

The Contractor shall at all times keep the streets sufficiently watered and swept of all loose material produced by his operations in order that traffic and construction does not raise an objectionable amount of dust. When directed by the Engineer, the Contractor shall apply a suitable dust palliative to control dust.

**1.10. STATE HIGHWAY OR COUNTY ROAD:**

Whenever the work to be done under these Specifications includes encroachment upon State or County rights-of-way, easement or other property owned by the State or County, an Encroachment Permit shall first be obtained from the applicable jurisdiction. The Contractor shall comply with all requirements imposed in the Encroachment Permit in addition to those set forth in these Specifications, in connection with performance of the work and shall give such notice as is required before beginning work. Contractor shall post any bond required in order to obtain permit.

**1.11. CARE OF EXISTING STRUCTURES AND UTILITIES.**

(a) Contractor shall call Underground Service Alert (USA) Toll Free (800) 642-2444 at least 48 hours prior to any excavation.

(b) Existing power, telephone and cable television lines, trees, fences, water pipes, gas lines, sewers or other conduits, embankments, and sundry structures, in the vicinity of the work shall be supported and protected from injury by the Contractor during the construction and until the completion of the work. The Contractor shall be liable for all damages done to such structures, as herein provided, and shall save and keep the Owner harmless from any liability or expense for injuries, damages or repairs to same.

A thorough attempt shall be made to show the type, size, location, and number of all utility mains and services on the plans; however, no guarantee is made as to the true type, size, location and number of such mains and services. The information was taken from various maps and transferred to the drawings as accurately as possible. Neither the Owner nor the Engineer shall in any way be responsible for the omission on the drawings of any mains or services of whatever nature nor shall they be responsible for any misrepresentation of size, type, numbers, location or depth. The Contractor shall repair, in a manner satisfactory to the Engineer, all mains or services damaged in the progress of his work. The Contractor shall notify all owners of utilities when his work is in progress and shall make such arrangements as are necessary to make any emergency repair. The Contractor shall be prepared at all times with labor, equipment and materials to make repairs on damaged mains or utilities.

No extra compensation will be made for the repair of any services or mains damaged by the Contractor's labor forces or equipment, nor for any damage incurred through the neglect or failure of providing protective barriers, lights or other devices or means required to protect such existing utilities.

The Contractor shall restore and/or replace curbing, sidewalks, gutters, shrubbery, fences, sod or other disturbed structures or surfaces to a condition equal to that before the work began and to the satisfaction of the Engineer and shall furnish all labor and material incidental thereof.

#### 1.12. MAINTAINING DRAINAGE:

The Contractor shall provide and maintain temporary drainage for all excavations, drains, sewers, ditches, trenches, and structures. The Contractor shall keep the excavations dry throughout the construction operations. Whenever necessary, in order to provide proper drainage, the Contractor shall, at his own expense, install underdrains, furnish and operate all necessary pumping equipment, drainage sumps, well point systems and other drainage facilities. The laying of pipe or the placing of concrete in water will not be allowed under any circumstances.

The Contractor shall dispose of the water from the work in a suitable manner without damage to adjacent property and in such a manner as not to be a menace to the public health. No water shall be drained into work built or under construction without prior consent of the Engineer.

1.13. MAINTENANCE OF TRAFFIC:

A schedule of operations affecting traffic on existing street shall be approved by the Engineer prior to initiation of construction. Notice shall be given to the Engineer at least 24 hours in advance of the closing of a traffic lane and the Contractor shall post suitable signs, where directed by the Engineer, indicating that the street is closed and the location of necessary detour routes.

Two-way traffic must be maintained at all times on the State Highway. Flagmen must be available at any time one-way traffic is in force. Parking may be restricted as desired to facilitate construction, subject to the requirements of the Encroachment Permit.

1.14. CONSTRUCTION STAGING:

Staging area for storage of construction materials and equipment shall be established to the satisfaction of the Public Works Superintendent. No storage of materials or equipment is permitted on City streets.

1.15. MAINTENANCE:

Following the certification of completion by the Engineer and final acceptance by the Owner, the Contractor shall, unless otherwise stipulated by the Owner, maintain the surface of trenches for a period of one year after said final acceptance. All material and labor required for the maintenance of the trench surfaces and structures shall be supplied by the Contractor, and the work shall be done in a manner satisfactory to the Engineer.

## SECTION 2 - PIPING AND PIPELINES

### 2.01. SCOPE OF WORK:

1. **WORK INCLUDED:** All labor and materials to complete all work as shown on the drawings, or herein specified, or both, including the following:

- a. Gravity Sewer.
- b. Manholes.
- c. Pressure line.

### 2.02. MATERIALS - GRAVITY SEWER:

1. **GENERAL:** Gravity sewers, unless otherwise designated on the drawings, shall be VCP, P.V.C., SDR 35 or Ductile Iron. Note joint deflection specification, Section 2.03.

2. **VITRIFIED CLAY PIPE (VCP):** Shall be new, first quality bell and spigot, extra strength conforming to ASTM Designation C700-71T. Joints shall conform to ASTM Designation C425-71. Where new work is joined to existing pipe that joint shall conform to ASTM C-594 Compression Couplings for plain end pipe.

3. **POLYVINYL CHLORIDE (PVC) PIPE:** Shall conform to ASTM D3034-SDR35 specifications. Joints shall conform to ASTM D3212 specifications.

4. **DUCTILE IRON (DI) PIPE:** Shall conform to latest revision ANSI A21.51 (AWWA C151) and Federal Specification WW P-421C. Joints shall be Tyton, Mechanical Joint or Flange as indicated on plan. Pipe shall be cement mortar lined in accord with AWWA specifications.

### 2.03. INSTALLATION OF GRAVITY LINES:

Pipe laying shall proceed upgrade without break from structure to structure with the socket or bell end forward. All pipe shall be laid to conform to the prescribed line and grade, as shown on the drawings, and each pipe length shall be checked to grade line by establishing from the survey stakes a grade line above the trench. This grad line will not be over 50 feet in length and shall be established before any pipe is laid in the trench.

The deflection in the joint between any two successive pipe sections shall not exceed 80 percent (80%) of the maximum deflection as recommended in writing by the pipe manufacturer. Short lengths of pipe if needed to meet this requirement shall be fabricated by the manufacturer.

Each length of pipe shall be laid on a firm bed and shall have a true bearing for its entire length between bell holes. An adequate bell hole shall be dug at the end of each pipe. Adjustment of

pipe to line and grade shall be made by scraping away or filling in and tamping, under the body of the pipe. No wedging or blocking to support the pipe will be permitted.

Both bell and spigot shall be clean before the joint is made, and care shall be taken that nothing but the joint making materials enters the joint.

Place Class I material to the spring line of the pipe and compact by hand or mechanical tamping. However, in the initial stage of placing this material, take care to ensure that sufficient Class I material has been worked under the haunch of the pipe to provide adequate side support. Take precautions to prevent movement of the pipe during placing of the material under the pipe haunch. Place initial backfill material in two stages: one to the center of the pipe and the other to a point at least 6 inches over the top of the pipe. Compact each stage of haunching and initial backfill by hand or mechanical tamping to a minimum of 95 percent density. If the remaining backfill material contains large particles which could damage the pipe from impact during placement, increase the second stage of initial backfill to a point of at least 12 inches over the top of the pipe.

When the pipe being installed is provided with elastomeric seal joints, bell holes shall be excavated in the bedding material to allow for unobstructed assembly of the joint. Care should be taken that the bell hole is no larger than necessary to accomplish proper joint assembly. When the joint has been made, the bell hole should be carefully filled with bedding haunching material to provide for adequate support of the pipe throughout its entire length.

Provide at least 30 inches of cover over the top of the pipe before the trench is wheel-loaded, and 48 inches of cover before utilization of a hydrohammer during compaction.

Take care to avoid contact between the pipe and compaction equipment. Compaction of haunching, initial backfill, and backfill material should generally be done in such a way so that compaction equipment is not used directly above the pipe until sufficient backfill has been placed to ensure that such compaction equipment will not have a damaging effect on the pipe.

If sheeting or other trench protection is removed, take care so as not to disturb previously constructed foundation bedding, haunching, and initial backfill. If it has been necessary to place or drive sheeting or other trench protection below the top of the pipe, consideration should be given to leaving in place this portion of the sheeting or trench protection, since its removal could jeopardize the side support necessary for "flexible conduits".

When pipe laying is not in progress, the forward end of the pipe shall be kept effectively closed with an approved temporary barricade.

#### 2.04. MANHOLES:

1. **GENERAL:** Manhole construction and location shall be shown on the Drawings and as herein specified.

2. **MANHOLE BASE:** Shall be Class "B" Portland Cement concrete poured in place conforming to Section 90 of the July, 1995 Standard Specifications. The invert shall be shaped to provide an adequate channel between the inlet and outlet pipes. The channel and shelf shall be steel troweled to a smooth dense surface. Adequate care must be taken to prevent displacement of the sewer pipe from line or grade during construction of the base.

The Contractor shall have the option of laying pipe through the manhole, shaping the upper half of the channel and the shelf, and later breaking out the pipe above the spring line, in which case he will be require to patch and smooth up with mortar the broken edges of pipe, or he may stop the pipe at the inside face of the manhole and construct the channel to the shape and size of the pipe. The invert shall follow a straight line between the inlet and outlet pipe, or a smooth curve on an even grade, if changing direction.

3. **MANHOLE SHAFT:** Precast concrete pipe sections, adjustment rings, steps and eccentric tapered section shall conform to the requirements of ASTM Designation C478.

4. **MANHOLE STEPS:** Three quarter inch iron bars, galvanized after bending, as shown on the Drawings, shall be firmly embedded in the wall of the manhole.

5. **JOINTS:** Shall be filled with mortar consisting of one (1) part cement to three (3) parts sand by volume before placing each section, and after the shaft is in place the joints inside and outside shall be neatly stuck and outside joints shall be banded to insure waterproofing the completed structure. RAM-NEK or approved equal will be allowed for jointing.

6. **RING AND COVER:** Casting shall be first-class grey iron, tough, and of even grain, and shall be dipped after they have been thoroughly cleaned in asphalt that has been heated to not less than 200 degrees F.

After castings have seasoned sufficiently so that there will be no further distortion due to temperature changes, the cover and ring seat shall be machined so that the tops are flush and the entire area of the seat is in contact with the cover in any position of the cover on the seat. Ring and cover shall be Phoenix Iron Works P-1090 or approved equal with closed pick hole.

7. **P.V.C. OR D.I. SEWER ADAPTER GASKET:** When P.V.C. or D.I. pipe is used, sewer coupling shall be used with gasket. The coupling shall be grouted into the wall of manhole or poured in the manhole base.

8. **V.C.P:** When V.C.P. is specified, a PVC C-900 bell with gasket shall be cast into the Manhole at both inlet and outlet. A 2' maximum length of D.I. pipe shall then be installed at inlet and outlet. The D.I. plain end pipe shall then be connected to V.C.P. plain end pipe with a flexible coupling.

9. **FLEXIBLE COUPLINGS:** Flexible couplings shall be as manufactured by Mission

Rubber Company or equal.

2.05. CLEANING AND TESTING GRAVITY SEWERS:

1. GENERAL: Sewer lines shall be cleaned of all foreign matter and tested, unless otherwise specified, in the presence and to the satisfaction of the Engineer. Leakage shall be brought within the allowable limit.

The contractor shall furnish an inflatable rubber ball of a size that will inflate to fit snugly into the pipe to be tested. The ball may, at the option of the contractor, be used without a tag line; or a rope or cord may be fastened to the ball to enable the contractor to know and control its position at all times. The ball shall be placed in the last cleanout or manhole on the pipe to be cleaned, and water shall be introduced behind it. The ball shall pass through the pipe with only the force of the water impelling it. All debris flushed out ahead of the ball shall be removed at the first manhole where its presence is noted. In the event cemented or wedged debris, or a damaged pipe shall stop the ball, the contractor shall remove the obstruction.

All sewers shall be tested for air leakage and each section between manholes shall be required to meet the minimum standards.

2. AIR TEST: The Contractor shall furnish test plugs, air compressor, test gauge, stopwatch, and personnel for conducting the acceptance test under the direction of the Owner. The Owner shall furnish the supervision of the test.

Immediately following the pipe cleaning described, the pipe installation shall be tested with low pressure air. Air shall be slowly supplied to the plugged pipe installation until the internal air pressure reaches 4.0 pounds per square inch greater than the average back pressure of any ground water that may submerge the pipe. At least two minutes shall be allowed for temperature stabilization before proceeding further.

The rate of air loss shall then be determined by measuring the time interval required for internal pressure to decrease from 3.5 to 2.5 pounds per square inch greater than the average back pressure of any ground water that may submerge the pipe.

The pipeline shall be considered acceptable, when tested at an average pressure of 3.0 pounds per square inch greater than the average back pressure of any ground water that may submerge the pipe, if: (1) the total rate of air loss from any section tested in its entirety between manhole and cleanout structures does not exceed 1.0 cubic feet per minute, or (2) the section under test does not lose air at a rate greater than 0.015 cubic feet per square foot of internal pipe surface.

The requirements of this specification shall be considered satisfied if the time required in seconds for the pressure to decrease from 3.5 to 2.5 pounds per square inch greater than the average back pressure of any ground water that may submerge the pipe is not less than that listed under Testing

Procedures.

If the pipe installation fails to meet these requirements, the Contractor shall determine at his own expense, the source or sources of the leakage, and he shall repair or replace all defective materials or workmanship. The completed pipe installation shall meet the requirements of this test.

Special care shall be exercised during testing to adequately secure test plugs. Also, equipment shall be so arranged that personnel checking plugs are not required to enter the danger zone behind the plug while the pipe is under pressure. Plugs shall not be removed until the pressure in the pipe has returned to zero.

3. TESTING PROCEDURE:

- (1) Clean pipe to be tested by propelling snug fitting inflated rubber ball through the pipe with water.
- (2) Plug all pipe outlets with suitable test plugs. Brace each plug securely.
- (3) If the pipe to be tested is submerged in ground water, 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 back pressure due to ground water submergence over the end of the probe. All gauge pressures in the test should be increased by this amount.
- (4) Add air slowly to the portion of the pipe installation under test until the internal air pressure is raised to 4.0 psi, greater than the average back pressure of any ground water.
- (5) Check exposed pipe and plugs for abnormal leakage by coating with a soap solution. If any failures are observed, bleed off air and make necessary repairs.
- (6) After an internal pressure of 4.0 psig is obtained, allow at least two minutes for air temperature to stabilize, adding only the amount of air required to maintain pressure.
- (7) After the two minute period, disconnect 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. This time interval should not be less than the following listed time for the size of pipe tested.
- (9) Minimum time for pressure drop in tested section of pipe. T = time, L = length.

Pipe Diameter (inches)	Length for Min. T (ft)	Min. T. (Min & Sec)	T for Longer L. (Sec)
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24"	99	22:40	13.674 L
21"	114	19:50	10.470 L
18"	133	17:00	7.692 L
15"	159	14:10	5.342 L
12"	199	11:20	3.474 L
10"	239	9:26	2.374 L
8"	298	7:34	1.520 L
6"	398	5:40	.854 L
4"	597	3:46	.380 L

4. **MANHOLES:** Each manhole shall be tested for leakage by plugging the sewer line between the manhole and the first joint. The manhole shall be filled with water and any drop in water level over a four hour period shall be carefully measured. A leakage rate in excess of 10 gallons per day shall be cause for rejection and the contractor shall repair the manhole until the leakage is within the limits specified.

5. **DEFLECTION TEST FOR PVC.** Thirty (30) days after completion of the backfill and compaction each pipe shall be checked for ring deflection by pulling a template or pig through the pipe. This template shall be cylindrical in shape. The diameter of which will be 5% less than the inside diameter of the pipe being placed. The length of the pig shall be a minimum of 2.5 times nominal pipe diameter. The pig shall be constructed so as not to hang up at the joints. If the template or big does not pass through the pipe it is assumed that the pipe deflection exceeds 5% of the inside diameter of the pipe and such pipe section or sections shall be removed and replaced to the satisfaction of the Engineer.

Pipe diameter for deflection testing is defined as average O.D. minus twice the minimum wall thickness.

Mandrel size shall be as follows:

Note: All measurements are in inches.

<u>Nominal Pipe Size</u>	<u>Average O.D.</u>	<u>2t</u>	<u>Pipe Diameter</u>	<u>5% Deflection Mandrel</u>
6	6.275	.360	5.915	5.619
8	8.400	.480	7.920	7.524
10	10.500	.600	9.900	9.405
12	12.500	.720	11.780	11.191
15	15.300	.874	14.426	13.705

## 2.06. MATERIALS - PRESSURE LINE:

POLYVINYL CHLORIDE (PVC) PIPE: Shall conform to AWWA C900-81 specifications (latest revision). It shall be rated for a pressure class of 150 psi and have a Dimension Ratio (DR) of 18. Pipe shall have elastometric gaskets compatible with pipe materials.

Fittings shall be cement mortar lined cast iron, 250 psi, with rubber ring joints compatible with PVC pipe being used. Fittings shall conform to AWWA C-110-64 for cast iron fittings and AWWA C-104-74 for cement mortar linings. Cement shall be Type V (sulfate resistant) manufactured in accord with ASTM Spec. C-150.

## 2.07. INSTALLATION OF PRESSURE LINES:

1. **GENERAL:** All pipe shall be laid true to line and grade as shown on the Plans or as directed by the Engineer to pass existing obstructions. Before any pipe is laid, it shall be carefully inspected for defects. No pipe or other material which is cracked or shows other defects shall be placed.

Each section of pipe and each fitting shall be thoroughly cleaned out before it is installed. All pipe, fittings, valves, etc, shall be carefully lowered into the trench by suitable tools or equipment in such a manner as to prevent damage to the pipe, lining, coating, fitting or other appurtenances.

Pipe must be given a solid uniform bearing in the bottom of the trench. Blocking or supporting pipe on earth mounds will not be permitted.

Wherever pipe laying is discontinued for short periods, or when work is stopped at the end of the day, the open ends of all mains shall be closed with water tight plugs or bulkheads. The plug or bulkhead shall not be removed unless or until the trench is dry.

When curved alignment is shown on the plans, the maximum deflection at any joint shall not exceed 80% of the manufacturer's recommendation for the type of pipe and joint being used.

Whenever it is necessary to use a short length of pipe at a fitting or valve, the minimum length shall be thirty two (32) inches. If it is necessary to cut pipe, said cut shall be made with an approved pipe cutter. The use of hammer and chisel for pipe cutting will not be permitted.

## 2. **INSTALLATION OF P.V.C. PIPE.**

a. **Clean ring groove.** Inspect the bell to be sure that no dirt or foreign material is in the groove. Dirt or foreign material could interfere with proper seating of the rubber ring and cause leakage. If necessary, wipe groove with a clean, dry cloth. **DO NOT LUBRICATE RUBBER RINGS OR THE RING GROOVE.**

- b. Clean and insert ring. Inert a clean ring in the groove with color marking facing toward the outside of the bell. Be sure the ring is seated evenly all around and is free from twists. **DO NOT LUBRICATE RUBBER RINGS.**
- c. Clean pipe end. Make sure the pipe end is clean. Wipe with a clean dry cloth around the entire circumference from the end of the spigot to 1 inch beyond the reference mark.
- d. Lubricate the spigot end of the pipe using manufacturer's recommended lubricant. Be sure to cover the entire circumference with particular attention paid to the beveled end of the spigot. The coating should be the equivalent of a brush coat of enamel paint. It can be applied by brush, cloth, sponge, or glove. Do not lubricate the rubber ring or the ring groove in the bell because lubrication could cause ring displacement. After the spigot end has been lubricated, it must be kept clean and free of dirt or sand. If dirt and sand adhere to the lubricated end, the spigot must be wiped clean and re-lubricated.
- e. Insert the spigot end into the bell so that it is in contact with the ring. Align the pipe sections and push the spigot end in until the reference mark on the spigot end is flush with the end of the bell. The recommended method for assembly is using a bar and a block; however, pullers such as the lever or come-along may also be used.

If undue resistance to insertion of the spigot end is encountered or the reference mark does not reach the flush position, disassemble the joint and check the position of the rubber ring. IF it is twisted or pushed out of its seat, clean the ring, bell, and spigot end and repeat the assembly steps. Be sure both lengths are in proper alignment during assembly.

3. **TRACER WIRES:** Tracer wire shall be installed and shall be No. 12 solid copper or aluminum National Electrical Code Type TW insulation, and shall form a mechanically and electrically continuous line throughout the length of the pipe. Conductors shall be spliced and insulated in accordance with the code. The wires shall be carefully placed so as not to be broken or stressed by the backfilling operations.

At gate valves and other pipeline appurtenances designated by the Engineer, the tracer wire shall be looped to the ground terminating at the underside of the valve box covers or manhole.

4. **THRUST BLOCK AND ANCHORS:** Concrete thrust blocks and anchors, for pressure line shall be constructed at all fittings, and dead-ends as shown on the drawings and at all other locations as directed by the Engineer. Thrust blocks will be required at all changes in horizontal and vertical alignment greater than 10 degrees.

Trenches at thrust block and anchor locations shall be carefully hand shaped from the standard trench so that thrust blocks and anchors can be poured against undisturbed earth. Concrete for thrust blocks and anchors shall be Class B as specified in Section 90 of the July, 1995, California Standard Specifications.

## 2.08. CLEANING AND TESTING OF PRESSURE LINES:

When the pipe line has been installed, it shall be cleaned of all dirt and construction debris before backfilling.

After the trench has been completely backfilled, the newly laid pipe or any valved section thereof, shall be subject to a hydrostatic pressure as specified herein.

The Contractor shall furnish all equipment for making tests including a suitable gauge for measuring the applied line pressure. The tank containing the water to maintain line pressure shall be of such a design that the volume of water used may be accurately measured.

Each section of the pipe to be tested shall be slowly filled with water, and all air shall be expelled from the pipe. After the system has been filled with water and air expelled, all the valves controlling the section to be tested shall be closed or the line plugged.

The pipe shall then be refilled, if necessary, and subjected to a pressure of not less than 150 pounds per square inch or the service pressure plus 50 pounds if pipe other than 150 psi class is specified, for a period of four hours.

The allowable leakage in the test section shall not exceed 15 gallons per mile, per day, per inch diameter of pipe tested.

If defects are found or the line does not meet the allowable leakage rate, the Contractor shall locate the leaks, make the necessary repairs at his own expense, backfill and repeat the pressure and leakage tests in the presence of the Engineer as specified above. No pipeline section shall be accepted until the leakage is within the specified allowance.

## 2.09. SEWER LATERALS:

1. **SCOPE OF WORK:** All labor and materials to complete all work as shown on the drawings, or herein specified, or both, for connection of existing sewer laterals to new main lines or for construction of new sewer laterals.

2. **MATERIALS (V.C.P. OR D.I. MAIN):** Sewer laterals shall be of the same material as mainline construction within the street right-of-way. Outside of right of way laterals may be V.C.P., D.I., or P.V.C. as specified in Section 2.02.

3. **MATERIALS (P.V.C. MAIN):** Sewer laterals shall be of the same material as main line construction as specified in Section 2.02.

4. **INSTALLATION OF SEWER LATERALS:** Sewer laterals shall be connected to the main sewer line by means of a wye or tee integrally cast into the main line sewer pipe. Installation

shall be in accord with the Standard Details. If lateral is to connect to an existing main, then connection shall be "Tap-Tite" or equal.