SECTION 18

STORMWATER PIPELINES

18-1 GENERAL

A. Reinforced concrete pipe or High Density Polyethylene Pipes used for storm drains shall conform to the provisions of Section 65, Reinforced Concrete Pipe, and Section 64, Plastic Pipe, of the Caltrans Standard Specifications, except as modified herein.

B. Polyvinyl Chloride pipe, ductile iron pipe (DIP), and High Density Polyethylene Pipe shall be used for storm drains where the usage of reinforced pipes or High Density Polyethylene Pipes are constrained and only if approved by the Engineer. Comply with provisions specified herein.

C. Storm drain pipes within the public right-of-way shall be a minimum of twelve (12) inches in diameter unless otherwise approved by the Engineer.

18-2 RELATED WORK

A. Field Quality Control

1. Perform leakage tests and Mandel tests on the project site before backfilling the trench when the City inspector is present. Acceptance of materials shall be subject to strength and quality testing in addition to inspection of the completed product.

18-3 PRODUCTS

A. Reinforced Concrete Pipe (RCP)

1. All reinforced concrete pipe shall be Class III unless otherwise specified on the drawings.

B. Polyvinyl Chloride Pipe (PVC)

1. Pipe sizes are nominal inside diameter unless otherwise noted. PVC pipe and fittings for three (3) to twelve (12) inches in diameter shall meet requirements of AWWA C900, PR 200, DR 14. Three-inch pipes shall only be used for curb-outlets. For pipe and fittings with diameters between fourteen (14) to twenty-seven (27) inches, they shall meet the requirements of AWWA C 905, PR 235, DR 18.

2. Pipe and fittings shall be bell and spigot type PVC manufactured in a one-piece mold with injection PVC compound conforming to ASTM D1784, class 12454 B. Elastomeric-gasketed couplings will be allowed for use at tie-ins or other locations

where standard bell and spigot pipe cannot be used. Bells shall conform to ASTM D3139 as measured in accordance with ASTM D2122 and gaskets shall conform to ASTM F477.

3. Each length of PVC pipe and fittings shall be marked with:

    a. The nominal size and OD base

    b. PVC

    c. Dimension ratio number (for example DR 14)

    d. AWWA pressure class or rating (for example PR 200)

    e. AWWA designation number (for example AWWA C900)

    f. The manufacturer's name or trademark and product record code.

C. Ductile Iron Pipe (DIP)

1. Pipe shall comply with AWWA C151 while the joints are push-on type complying with AWWA C111 with Chloroprene gaskets. Fittings shall be ductile iron or cast iron push-on joints complying with AWWA C110.

2. Special fittings not available in ductile iron or cast iron pipe may be fabricated of welded steel pipe (Type M-2 Pipe) with a design pressure of 450 PSI. Design and wall thickness shall be submitted to the Engineer for review.

3. For the following pipe sizes, use the corresponding thickness class:

Pipe Size (inches)	Thickness Class
3-4	51
6-24	50
30-54	51

4. Pipe and fittings shall consist of standard thickness cement mortar lining for pipe and fittings per AWWA C104

5. For corrosion protection, use polyethylene encasement per AWWA C105. Double wrap flanged fittings, mechanical joints, or other appurtenances with significantly different outside diameters from the pipe.

6. For bonding, use Bond T.N-1.P. to provide electrical continuity. Copper jumper strips shall be one-sixteenth (1/16) inch thick by three-quarters (3/4) inch wide.

D. High Density Polyethylene Pipe and Fittings (HDPE)

1. Manufacturer: Hancor BLUE-SEAL, water tight pipe and fittings, or approved equal.

2. Pipe shall meet AASHTO M294, Type S or ASTM F2306 standards.

3. Virgin material for pipe and fitting production shall be high density polyethylene conforming with the minimum requirements of cell classification 435400C as defined and described in the latest version of ASTM D3350, except that carbon black content shall not exceed 4%. Virgin pipe material shall comply with the notched constant ligament-stress (NCLS) test as specified in Section 9.5 and 5.1 of AASHTO M294 and ASTM F2306 respectively.

E. Storage and Handling

1. Great care shall be exercised to prevent damage to the pipe during handling, transportation or storage. Pipe shall not be stored on rough ground and rolling of the pipe on the coating will not be permitted. Any damaged pipe sections shall be repaired or replaced at the expense of the Contractor as satisfactory to the Engineer.

2. Store PVC pipe under opaque covers which do not transmit ultraviolet light.

3. Each pipe section shall be carefully inspected before installation, and all damaged areas patched in the field or replaced as satisfactory to the Engineer.

18-4 EXECUTION

A. Trench excavation and backfill shall conform to the provisions in the City of Palo Alto Standard Drawings and Specifications Section 17, “Boring, Trenching and Potholing” and Drawing numbers 401, “Trenches – Typical Cross Sections” and 403, “Trenches – Limits of Restoration.”

B. Lay each length of pipe on a firm bed with a true bearing for its entire length between bell holes. Excavate holes of only sufficient size to accommodate the bell at each joint location. Adjust line and grade by scraping away, filling in and tamping the earth to provide true grade to fit the barrel of the pipe. No wedging or blocking up of the pipe will be permitted. The trench and bell holes shall be kept free from water during the laying of the pipe.

C. All dirt and foreign matter shall be removed from the pipe interior prior to installation and all joints shall be thoroughly cleaned before joining.

D. Plug open ends of pipe when construction is not underway.

E. Lay pipe upgrade with bell end forward, unless specifically shown otherwise.

F. After making each joint, rigidly secure the pipe in place by backfilling to the top of the pipe at the center. Keep fill clear of bell hole so it does not interfere with the next jointing operation.

G. Polyvinyl Chloride Pipe (C900 and C905) Installation

1. Install pipe in accordance with the manufacturer's instructions. Place pipe within the installation areas at least twenty-four (24) hours prior to installation to permit temperature equalization.

2. Pipe ends shall be cut squarely, reamed and deburred inside and out. Clean pipe ends and bells of dirt, grease and other foreign materials prior to making the joint.

H. Ductile Iron Pipe Installation

1. Install buried pipe in accordance with AWWA C600. Support and brace encased pipe to support the pipe and to prevent movement during testing and placement of the concrete encasement. The braces and supports shall be erected of materials and by methods which will prevent any future contact of the pipe with the environment surrounding the encasement.

2. Wrap buried pipe with 8 mil polyethylene film in accordance with AWWA C105. Continuously seal seams and overlaps with tape. Seal circumferential overlaps with two turns of tape, half lapped. Gather excess polyethylene on top of pipe so as not to block backfill material from getting under bottom of pipe. Use caution so as not to rip or cut the polyethylene film. Seal any rips or cuts in the film with tape.

3. Pull the slack out of restrained joints after they are made up.

I. High Density Polyethylene Installation

1. HDPE pipe shall be installed in conformance with all applicable local and state codes and regulations. The methods employed in the handling and placing of pipe, fittings, and equipment shall be such as to ensure that after installation and testing they are in good condition. Should damage occur to the pipe, fittings, or equipment, repairs satisfactory to the City shall be made at no additional cost to the City.

2. Installation shall be in accordance with ASTM D2321 and manufacturer's recommended installation guidelines. Pipe and fittings shall be installed as shown on the plans, according to manufacturer's recommendations.

3. Minimum cover in traffic areas shall be three (3) feet, all exceptions require prior approval from City Engineer. Backfill for minimum cover situations shall consist of Class 1 material.

4. Thoroughly clean pipe and fittings of dirt, dust and moisture before installation. Installation and joining methods shall be as recommended by the pipe and fitting manufacturers.

J. Cleaning

1. After installation and prior to any testing, the inside of the pipe shall be thoroughly cleaned of all dirt, loose scale, sand and other foreign material. Cleaning shall be by flushing with water or balling as appropriate for the size and type of pipe.

2. Video Inspection: After installation, pipe and structures shall be cleaned and video inspected as direct by the Engineer. If video inspection shows the cleaning to be unsatisfactory, the Contractor shall be required to re-clean and re-inspected the lines at no additional cost to the City.

K. Permanent Plugs and Pipe Removal

1. Existing pipes that are no longer in use shall be removed completely.

2. Clean interior contact surfaces of all pipes to be cut off or abandoned. Construct a concrete plug in the end of all pipe eighteen (18) inches or less in diameter.

3. Minimum length of concrete plugs shall be eight (8) inches. For pipe twenty-one (21) inches and larger, the plugs may be constructed of common brick or concrete block.

4. The exposed face of block or brick shall be plastered with mortar. All plugs shall be watertight and capable of withstanding all internal and external pressures without leakage.

END OF SECTION