GARDEN GROVE

CITY OF

GARDEN GROVE

PUBLIC WORKS DEPARTMENT

STANDARD PLANS
2007 EDITION
AND
SPECIFICATIONS

KEITH G. JONES
PUBLIC WORKS DIRECTOR

G.G./COVER.DWG

City of Garden Grove
Public Works Department
ENGINEERING DIVISION
P.O. Box 3070
Garden Grove, CA 92842-3070
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STREET PERMIT REQUIREMENTS
24 HOUR NOTICE IS REQUIRED PRIOR TO THE START OF ANY WORK TO BE PERFORMED
714.741.5887

General Conditions

1. All work shall conform to the City of Garden Grove Standard Plans and Specifications, as well as the Standard Specifications of the State of California Department of Transportation dated 2006.

2. Compaction testing of native material and aggregate base shall be furnished by the permittee to the City Engineer for longitudinal and transverse trenches located within the public right-of-way. The use of a two sack of cement per cubic yard of mix slurry backfill (and in limited cases one sack) may be substituted for native backfill.

3. The contractor shall be responsible for protecting in place all existing utility lines, infrastructure, or landscaping and shall bear any expense for repair to said facilities.

4. The contractor shall be responsible for existing landscaping in public rights-of-way. Notify the Department of Public Works at (714) 741-5887, 24 hours prior to excavation in medians or landscaped areas.

5. Contractor shall submit a certificate of insurance for worker's compensation, general liability and automobile liability. General liability and automobile liability shall each be in the amount of one million dollars and the general liability must include an endorsement designating the City of Garden Grove as additional insured.

6. Permittee must notify Underground Service Alert (USA) at 1-800-227-2600 at least 48 hours prior to start of work. USA ticket must be available at job site.

7. All new utility cable, conduit, or pipe shall not be installed within 5 feet horizontal nor 1 foot vertical spacing of any proposed or existing water or sewer main and their appurtenances. Any type of above ground utility structure shall not be allowed within 5 horizontal feet of any water or sewer related facility. Variations to these minimum clearances require approval of Water Services on a case – by – case basis.

8. All utilities shall be installed at a minimum cover of 30 inches below flow line of adjacent curb and gutter.

9. The contractor shall be responsible for shut down of fire hydrants. Notify the Department of Public Works Water Operations Superintendent at (714) 741-5348, 24 hours prior to excavating within ten feet of a fire hydrant.

10. All permitted work shall be initiated and completed within 6 months from the date of issuance; otherwise the permit shall become null and void. No street lane closures will be allowed during the Christmas season, from December 18 through January 1.

11. For any vertical obstruction (including utility cabinets, power poles, street light poles, sign posts, etc.) the minimum clearance from the curb face shall be 18 inches.

Concrete Replacement

12. Permittee shall replace in-kind broken pavement, curb, gutter, or other concrete improvements adjacent to the work, which are undermined, damaged, or displaced due to the contractor's performance of the work. A permit to do work in the right-of-way is not authorization to cut a street unless the approval to cut the street is specified on the permit.

13. Tunneling of curbs, gutters, sidewalk, or other structures where air voids may be created will not be permitted. Jacking, pushing, and boring are acceptable.

14. The contractor shall replace full width to the nearest score mark for excavations in sidewalk areas.

15. A licensed Land Surveyor shall restore any survey reference points or monuments after the work is complete.

16. New concrete, which is vandalized or marked prior to acceptance by the City, shall be replaced to the satisfaction of the City Engineer. Grinding, patching, or other remedies will not be permitted.

Street Resurfacing and Backfill

17. All trenches shall be neatly saw cut to a minimum depth of 1-1/2 inches. Existing asphalt pavement shall be cut by a device capable of making a neat, straight and smooth cut. For cuts greater than 600 feet in length, the entire area of work may be subject to additional resurfacing requirements as determined by the City Engineer.

18. Minimum pavement replacement sections shall be 5 inches asphalt concrete over 10 inches of class II 3/4 inch aggregate base for arterial streets. Pavement replacement sections for residential streets shall match existing pavement using a minimum criteria of 3 inches AC over 6 inches AB. The final one inch shall be machine laid to achieve minimum 95% relative density compaction and meet a smoothness standard of no more than one eighth of an inch plus or minus deviation in ten feet. Narrow longitudinal trenches located outside travel lanes, which exceed 6 inches wide shall be milled one inch to adequate width to allow use of a paving machine. A "T" Top will be utilized on all streets where the excavation affects a travel lane pursuant to City of Garden Grove "Standard Street Resurfacing and Trench Backfill Detail No. B-134, Case A.

19. Base asphalt shall be 3/4 inch APWA Type III B-2 with 5.5% AR4000 asphalt. Cap shall be 1/2 inch APWA Type III C-3 with 6.0% AR4000, or 3/8 inch APWA Type D with 7% AR4000. Tests for compaction, gradation, and oil content shall be supplied by permittee as required by the City Engineer.

20. For longitudinal trenches, no section of asphalt pavement between the trench line and lip of gutter, which is three feet, or less shall remain. The asphalt in this area shall be removed and capped with the adjacent trench paving.

21. There is a four (4) year moratorium on any trenching / street work once a street has been resurfaced. Street rehabilitation projects are often federally funded and mandate such a restriction.

22. All excavations must be backfilled by the end of each workday as directed by the City Engineer. Temporary paving shall be compacted and installed at the end of each day. Steel plates are acceptable provided the plates are sized to support traffic

loading and anchored per the WATCH manual. **These steel plates shall remain in place a maximum of five (5) days; after which time the plates shall be removed and the trench backfilled**. For trenches exceeding 600 feet, a permanent hot-mix asphalt patch shall be placed beginning within two (2) working days of completion of backfill.

23. No excavation within five (5) feet of the traveled way shall remain open longer than is necessary to perform the work.

    At the end of each working day, if a difference in excess of 0.33 foot exists between the elevation of the existing pavement and the elevation of any excavation within five feet of the traveled way, material shall be placed up and compacted against the vertical cuts adjacent to the traveled way.

    The material shall be placed to the level of the elevation of the top of existing pavement and tapered at a slope of 4:1 or flatter to the bottom of the excavation.

    During excavation operations, native material may be used for this purpose; however, once the placing of the structural section commences, structural material shall be used.

24. Samples shall be taken from the material delivered to the site. Material not conforming to the specifications shall be removed and replaced at the contractor's expense.

25. These street permit requirements do not preclude emergency street cuts by utility companies to restore service or eliminate hazardous conditions. In case of emergency work, notify the Department of Public Works Permit Supervisor at (714) 741-5185.

26. All temporary paving shall have a minimum 2 inches of A.C. on residential streets and 3 inches on non-residential.

Traffic Control

27. Temporary traffic control during construction shall conform to the latest edition of the Uniform manual on Traffic Control Devices, the WATCH Manual, and the requirements of the City Traffic Engineer.

28. A traffic control plan shall be submitted for approval prior to construction for work affecting arterial streets. The plan shall detail lane lines, islands or medians, street intersections, and driveways. A licensed civil or traffic engineer may be required to sign the plans as directed by the City Traffic Engineer.

29. The contractor shall be responsible for protection of traffic signal detector loops. Notify the City Traffic Engineering Division at (714) 741-5190, 24 hours in advance prior to excavating within 600 feet of a signalized intersection.

30. All traffic control devices shall remain in effect during construction.

31. A Caltrans Type I flashing arrow board is required for each lane closure on an arterial or major street.

32. All damaged raised pavement markers; traffic striping, legends, or traffic loops shall be replaced to the satisfaction of the City Traffic Engineer.

33. Working hours where a lane closure involves a major or arterial type street will be limited to the hours between 9:00a.m. and 3:30p.m or as modified by the City Traffic Engineer.

34. Maximum spacing of delineators in a taper area shall be 25 feet. Maximum spacing of delineators in a tangent area shall be 35 feet.

35. All businesses and property owners affected by work shall be notified at least 24 hours prior to start of construction. Access to businesses shall be maintained at all times.

36. Failure to adhere to working hours or traffic control requirements shall result in suspension of work until adequate arrangements can be set in place to ensure public safety and convenience.

revised 8/02/07

Click one of the links below to download the specifications needed:

Series B-99 to B-128
(http://www.ci.garden-grove.ca.us/pdf/pw/b-99_b-128.pdf)

Series B-129 to B-312
(http://www.ci.garden-grove.ca.us/pdf/pw/b-129_b-312.pdf)

Series B-501 to B-723
(http://www.ci.garden-grove.ca.us/pdf/pw/b-501_b-723.pdf)

Series B-724 to B-780
(http://www.ci.garden-grove.ca.us/pdf/pw/b-724_b-780.pdf)

Series S-100 to S-118
(http://www.ci.garden-grove.ca.us/pdf/pw/s-100_s-118.pdf)

WATER SERVICES DIVISION STANDARD SPECIFICATIONS

CITY OF GARDEN GROVE
PUBLIC WORKS DEPARTMENT

AUGUST 2007

13802 NEWHOPE STREET
GARDEN GROVE, CALIFORNIA 92843
(714) 741-5395

CITY OF GARDEN GROVE

PUBLIC WORKS DEPARTMENT
WATER SERVICES DIVISION

STANDARD SPECIFICATIONS FOR CONSTRUCTION OF DOMESTIC WATER SYSTEMS

Approved By:

_____

David E. Entsminger Date
Project Engineer

Approved By:

_____

Richard B. Mathis Date
Water Services Manager

Approved By:

_____

William E. Murray Jr. Date
City Engineer

Approved By:

_____

Keith G. Jones Date
Public Works Director

INTRODUCTION

These Standard Specifications are to be used as a guide by Private Engineers and Contractors in the design and installation of all additions or modifications to the City of Garden Grove's Public Water System.

It is the intent that these Standard Specifications will provide uniformity in materials and installation of piping, valves, fire hydrants, service laterals and other appurtenant equipment. The Standard Specifications will also provide for construction methods and controls to be used by Contractors to construct, pressure test, chlorinate and place into service domestic water systems in the City of Garden Grove.

CITY OF GARDEN GROVE

PUBLIC WORKS DEPARTMENT

WATER SERVICES DIVISION

STANDARD SPECIFICATIONS

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SECTION 1 - GENERAL PROVISIONS

1-01 PLANS AND SPECIFICATIONS

Construction of all water system improvements intended to be dedicated to the City will be governed by plans and specifications approved by the Water Services Division. All plans and specifications must be prepared by, or under the supervision of a current registered engineer licensed to practice in the state of California. All work shall be subject to fees as provided for in the City's Water Rates, Rules and Regulations and shall be inspected by the Water Services Division to ensure conformity to these specifications.

In cases of conflict of information, the following documents will have precedence in the order listed:

1. Permits and licenses from affected agencies issued for the improvements.
2. Special provisions for the improvements.
3. Construction plans for the improvements.
4. City of Garden Grove Public Works Department Water Services Division Standard Specifications (WSDSS).
5. Standard Specifications for Public Works Construction (SSPWC), “Green Book”.
6. Manufacturer’s recommendations of product use and installation.

Conflicts and discrepancies noted by the Contractor shall be brought to the attention of the Director, Public Works Department, or his designated representative. The Director, Public Works Department, or his designated representative will review the conflicts or discrepancies and determine the appropriate course of action to follow, if any. Unless otherwise determined by the Engineer, the most stringent/restricted condition shall govern over all. Contractor/Developer shall check with zoning code and/or local ordinances for special requirements and color schemes on all above ground facilities.

Provisions of reference specifications noted in these specifications and plans shall have the same effect as if written herein, unless expressly modified by these specifications. Any reference specification in the absence of designation to the contrary, shall be understood to refer to the latest revision at the time of the beginning of work.

1-02 DEFINITIONS

Whenever the following terms or corresponding pronouns are used in these specifications or plans, the intent and meaning shall be interpreted as follows:

a. City	The City of Garden Grove, California.
b. Engineer:	The Project Engineer or his authorized representative.
c. Water Services Division	The Director, Public Works Department, Water Services Division, City of Garden Grove or his designated representative.
d. Planning Services Division	The Director, Community Development Department, Planning Services Division, City of Garden Grove or her designated representative.
e. Fire Department	The Chief, Fire Department, City of Garden Grove or his designated representative.
f. Developer:	The person or organization having legal responsibility for construction of water systems in conjunction with development of property.
g. Contractor:	The agent of the developer or independent contractor who furnishes labor, material, equipment, method, etc. to perform the requirements of these specifications in the construction of water systems.
h. Superintendent:	The field representative of the Contractor, present on the job site at all times during work, who is authorized to receive and fulfill instructions from the City.
i. Private Engineer:	The agent of the developer, City of Garden Grove, or independent engineer who has responsibility for the design and drawing of construction documents.
j. Or approved equal:	An equivalent product to that specified in these standard specifications, approved by the Water Services Division before beginning of construction. No approved equal product is intended, unless so stated in these standard specifications.

k. Drawings: The words "DRAWINGS" or "CONTRACT DRAWINGS" or "PLANS" shall mean those drawings accompanying the specifications which show the location, nature, extent and form of the work, together with applicable details.

1-03 ABBREVIATIONS

Whenever the following abbreviations are used in these specifications, the meaning shall be interpreted as follows:

ASTM:	American Society for Testing and Materials
AWWA:	American Water Works Association
ANSI:	American National Standards Institute
UNI-BELL	Uni-Bell PVC Pipe Association
DIPRA:	Ductile Iron Pipe Research Association
CAL-OSHA:	California Occupational Safety and Health Administration
SSPC:	Steel Structures Painting Council
SSPWC:	Standard Specifications for Public Works Construction. (Green Book)- Latest Edition
CBC:	California Building Code, 2001 Edition
CFC:	California Fire Code, 2001 Edition
UPC:	Uniform Plumbing Code
WSDSS:	Water Services Division Standard Specifications (Garden Grove Public Works Department)
NSF:	National Sanitation Foundation

SECTION 2 - MATERIALS

2-00 GENERAL

All materials and equipment installed in City of Garden Grove's water system shall meet all state and federal standards, as well as standards developed by nationally recognized organizations such as AWWA, ANSI and NSF. In order to protect human health, all materials, chemicals, lubricants, and products in contact with drinking water shall be tested and certified as meeting ANSI/NSF 60-2001/ Addendum 1.0-2001 (Drinking Water Treatment Chemicals- Health Effects) and ANSI/NSF Standard 61-2001/Addendum 1.0-2001 (Drinking Water System Components- Health Effects).

2-01 DUCTILE IRON PIPE

2-01.01 GENERAL

Ductile iron pipe (DIP) shall conform to the requirements of the AWWA Standard C151. Unless otherwise specified, DIP shall only be used for pipe larger than twelve-inch (12) and shall be Special Thickness Class 51.

2-01.02 PIPE JOINTS

Ductile iron pipe shall be furnished in eighteen-foot (18′) or twenty-foot (20') nominal laying lengths and shall have a push-on joint employing a single rubber gasket in accordance with AWWA Standard C111, ("TYTON" Joint as manufactured by U.S. Pipe, or approved equal).

Where restrained joints are indicated on the Drawings, push-on joints shall be restrained in accordance with the requirements of Section 2-12.02.

2-01.03 COATING AND LINING

All pipe shall have the interior cement-mortar lined with a seal coat in accordance with AWWA Standard C104, and the outside coated with a bituminous material as specified in AWWA Standard C151.

2-01.04 POLYETHYLENE PROTECTIVE WRAPPING

Polyethylene protective wrapping ("Polywrap") shall conform to the requirements of ANSI/AWWA C105/A21.5 and be eight (8) mil thick tubing of virgin polyethylene (Dupont Alathon, U.S. 1. Petrothene resin, or approved equal) or four (4) mil thick high-density, cross-laminated (HDCL) polyethylene. The color shall be (a) natural (where exposure to sunlight will be less than 48 hours); or (b) black, containing 2.0 to 2.5% well dispersed carbon black with stabilizers (where exposure to sunlight may be up to 10 days). Tubing shall be taped and secured with general purpose polyethylene tape, 2 inches wide and 10 mils thick (Scotchrap No. 50, Plicoflex No. 340, Protecto Wrap No. 200, Polyken No. 900, or approved equal).

2-02 POLYVINYL CHLORIDE PIPE

2-02.01 GENERAL

Polyvinyl chloride (PVC) pipe shall conform to the requirements of the AWWA Standard C 900, DR 14, (CL. 200), and molecularly oriented polyvinyl chloride (PVCO) pipe shall conform to the requirements of the AWWA Standard C 909, (CL 200). Unless otherwise specified, PVC or PVCO shall only be used for pipe sizes, 4 inch through 12 inch. PVC or PVCO Pipe for pipes larger than twelve-inch (12") require special approval from Engineering Services. All PVC Pipe shall be colored white, and all PVCO pipe shall be colored blue. A number 14-gauge, solid, soft drawn insulated copper tracer wire is required per Standard Drawing B-781 on all PVC and PVCO installations.

2-02.02 PIPE JOINTS

PVC or PVCO pipe shall be furnished in twenty-foot (20') nominal laying lengths and have bell-end push-on joints employing a single elastomeric gasket in accordance with AWWA Standard C900 and/or C909.

2-02.03 PIPE SERVICES AND APPURTENANCES

All service saddles, sleeves, fittings, restraining devices, and other appurtenances used on PVC and PVCO Pipes shall be approved by the Water Services Division prior to use.

2-02.04 RESTRAINED JOINT PVC PIPE

Restrained joint non-metalic couplings for Poly-Vinyl Chloride (PVC) or Molecularly Oriented Poly-Vinyl Chloride (PVCO) pipe shall be CERTALOK^{TM} C900 RJ system, as manufactured by CertainTeed Corporation, or approval

equal.

See sections 2-12 for additional thrust restraint systems for PVC and PVCO pipes.

2-02.05 INSTALLATION CURVATURE

Where the pipeline is a non-restrained joint and to be installed in a curved alignment, the radius of curvature and specific alignment shall be as shown on the plans and shall be accomplished by means of deflecting the pipeline at the joints with couplings. Couplings in any of the curved alignment for this project where required deflection is between 1 and 5 degrees shall be High Deflection Couplings, Class 200 manufactured by CertainTeed or approved equal.

Contractor shall not exceed the manufacturer's recommendation for deflection for the couplings. Bending of the PVC and PVCO is not allowed.

The cost of providing pipe material and specialized tools to achieve the required curvature shall be included in the unit cost for the pipeline and no additional compensation will be allowed.

2-02.06 MARKINGS

Pipe shall be legible and permanently marked in ink with the following information.

- Manufacturer and Trade Name
- Nominal Size and DR Rating/Pressure Class
- Hydrostatic Proof Test Pressure
- [NSF-61]
- Manufacturing Date Code

2-02.07 WORKMANSHIP

The beveled end of any PVC or PVCO pipe shall be cut off before the pipe is inserted into a mechanical joint fitting.

2-02.08 FITTINGS FOR PVC MAIN LINE

Main line PVC or PVCO pipe fittings shall be as called for on the construction plans. All fittings shall be ductile iron fittings per Section 2-08.

2-03 COPPER TUBING

2-03.01 GENERAL

This specification shall cover the requirements for 1-inch and 2-inch seamless, annealed, Type "K", copper water tube. Copper tubing shall meet the requirements of ASTM B-88, "Specifications for Seamless Copper Water Tube". The 2-inch copper water tube shall be of the rigid type.

2-03.02 DIMENSIONS

Copper tubing shall be furnished in coils or straight lengths, as follows:

SIZE	FORM	LENGTH
1"	Coils	60′ to 100'
2"	Straight Lengths (rigid)	20'

Coils shall be wound in a single layer flat with a minimum 24-inch inside diameter.

2-03.03 TEMPER

Copper tubing shall be furnished in the annealed condition in accordance with the technical property requirements of ASTM B-88. Straight lengths shall be annealed after being drawn.

2-04 RED BRASS PIPE

Brass pipe shall conform to the requirements of the "Specifications for Seamless Red Brass Pipe, Standard Sizes" ASTM Specification B-43 and referenced in the appendix to AWWA Standard C800.

Fittings shall be of bronze conforming to the requirements of ASTM B-62, "Specifications for Composition Bronze or Ounce Metal Castings".

2-05 MAIN LINE VALVES

2-05.01 GENERAL

Valves shall be iron-body fusion bonded epoxy lined, non-rising stem, butterfly or fully encapsulated resilient wedge disk type and shall not have more than two internal moving parts. All valves shall open by turning the wrench nut counter-clockwise. Operating nut for butterfly valves shall be placed at the north or east side of the water line.

When required, above ground installations shall be resilient seat/wedge disk type valves with outside screw and yoke.

All bronze parts shall contain not more than 7% zinc, nor more than 2% aluminum.

Stems shall be low zinc bronze, and equipped with a 2-inch operating nut conforming to AWWA C509. The valve manufacturer shall employ a positive physical means of indicating the specified stem material to insure ready recognition during inspection.

The bolts and nuts on the bonnet shall be stainless steel type 304 or 316 with an anti-seize lubricant.

The ductile iron interior and exterior of all valves shall be protected with 10 mils (nominal) fusion bonded epoxy. Coating shall conform to AWWA Standard C-213 and C550, and shall be certified to NSF 61.

For above ground or vault installation, exterior coating to valves shall be as per Section 2-14 for coating on above ground or vault installation.

Resilient wedge type valves with a flanged end may be used as “tapping valves”.

All valves shall be provided with a stem extension if depth of valve nut exceeds 4 feet. All valve extensions shall be centered in the valve well by use of a guide and shall operate freely without binding after installation.

2-05.02 GATE VALVES

Gate valves shall conform to the requirements of AWWA Standard C509 “Resilient-Seated Gate Valves for Water Supply Service” with fully encapsulated disk and guide lugs and as supplemented herein.

All gate valves shall be full wall ductile iron body, resilient wedge gate valves equipped with double O-ring stem seals. If the resilient seats are bonded to the gates, the gates shall be totally encapsulated with the material, with the exception of any guide tabs or slots. All valves shall have non-rising stems.

The design of the non-rising stems shall be such that if excessive input torque is applied, stem failure shall occur above the stuffing box at such a point as to enable the operation of the valve with a pipe wrench or other readily available tool.

Valves shall be suitable for frequent operation as well as service involving long period of inactivity, and capable of operating satisfactorily with flows in either direction.

Guide caps of an Acetal bearing material shall be placed over solid guild lugs to prevent abrasion and to reduce the operating torque.

All exterior fasteners, including all bonnet and seal plate bolts and nuts shall be 300 series 18-8 stainless steel or approved equal corrosion resistant material.

Valve stem seals shall be O-rings in conformance with AWWA C509 and shall be designed so that the O-ring above the stem collar can be replaced while the valve is under pressure and in the fully open or fully closed position. Valves shall be supplied with stems having a minimum yield strength of 38,000 psi and a minimum elongation in 2 inches of 12%. Valve stem, stem nuts and stem collar shall be made of low zinc bronze or approved equal material.

Valves 3" and 4" in diameter shall be designed for an input torque of 300 foot pounds at the fully opened or fully closed positions, without any distortion of any kind to the valve or its components.

Valves 6" through 12" in diameter shall be designed for an input torque of 450 foot pounds at the fully opened or fully closed positions, without any distortion of any kind to the valve or its components.

Each valve shall be tested in accordance with AWWA C509 and certified to NSF 61 after shop assembly.

2-05.03 APPROVED GATE VALVE MANUFACTURERS

Mueller A-2362
Or approved equal

2-05.04 BUTTERFLY VALVES

Butterfly valves shall conform to the requirements of AWWA Standard C504. Valves shall have a minimum working differential pressure across the valve disc of a 150-psi for class 150B valves and 250 psi for class 250B valves. Valves shall be flanged short-body or restrained mechanical joint as indicated per the Construction Drawings. Flanges shall be drilled per ANSI/B16.1, 125-pound standard bolt template. Valves shall be designed for buried installation.

Component	Material	Specification
Body	Ductile Iron	ASTM A-536, Grade 65-45-12
Valve Shaft	Stainless Steel	Type 304 or Type 316

Exposed body, cap screws, bolts and nuts including squeeze-pins	Stainless Steel	ASTM A-276, Type 316
Disc	Cast Iron or Ductile Iron	ASTM A-48, Class 40 or ASTM A-536, Grade 65-45-12
Valve Seat	EPDM rubber	ASTM D-412
O-Rings	Synthetic Rubber	ASTM D-2000

Valve seat material shall be peroxide cured EPDM rubber seat and shall be fastened integrally with the valve body. The valve disc shall be furnished with a stainless steel seating edge to mate with the rubber seat in the valve body. Valves with the seat located on the disc shall not be accepted.

The ductile iron interior shall be shop coated with NSF 61 approved fusion bonded epoxy or coated with NSF 61 approved 12 mils DFT high solids 2 part epoxy of not less than 65% conforming to AWWA standard C550. Interior shall be holiday free. External surfaces shall be shop coated with two coats of asphalt varnish per Federal Specification TT-C-494A.

Valve operators shall be the manual type. All valves and actuators shall be supplied by the valve manufacturer. Gear actuators shall be for buried service applications and shall come furnished with a standard 2" AWWA operating nut. The operators shall be of a worm gear or traveling nut type with adjustable stops to limit the disc travel and shall be totally enclosed and self locking. The actuator shall be capable of withstanding 300 ft-lb (worm gear) and 450 ft-lb (travel nut gear) at the stops. The actuator shall be sized for bi-directional maximum pressures and flow rate per AWWA valve classification 150B (250B when specified). All external bolts on the actuator shall be furnished with 316 stainless steel. The operator shall be of the size required for opening and closing the valve in accordance with AWWA C-504. All valve operators shall be factory packed with grease, fully gasketed and sealed for permanent installation and operation.

Factory signed and dated affidavit of compliance shall accompany all submittals. Affidavits shall include "holiday free" paint, actuator stops compliance of 450 foot pounds, proof of design per AWWA C504 latest version for valves and actuator, and bi-directional seat leak test. Signatures of agents or distributors of the factory will not be accepted.

2-05.05 APPROVED BUTTERFLY VALVE MANUFACTURERS

Mueller	B-3211 (Lineseal XP)
Pratt	Ground hog
DeZurik	BAW

2-05.06 END CONNECTIONS & GASKET MATERIAL

Valves shall have mechanical joints or flanged ends, or a combination of both. Gaskets shall conform to the requirements of Section 2-08.03 of these specifications.

Unless otherwise shown on plans, all valves installed at fittings shall be flanged by mechanical ends, with the flange abutting the fitting.

2-05.07 VALVE BOXES & CAN ASSEMBLY

Valve boxes and can assembly shall be provided per Standard Drawings B-752 and B-753. Valve box lid shall be ductile iron, and shall include a skirt for a close fit inside the upper portion of the can assembly. Lids shall be cast with the word "WATER". Lids and boxes shall be Brooks 4TT or approved equal.

2-06 AIR AND VACUUM, AIR RELEASE, AND COMBINATION AIR VALVES

Air and Vacuum, Air Release and Combination Air Valves shall conform to AWWA C512 and be designed for a working pressure of 150 psi, unless otherwise specified. Float, linkage and all internal parts shall be 8-18 stainless steel. Interior coating for cast iron body shall be NSF 61 approved fusion bonded epoxy. Valves shall be APCO as manufactured by Valve and Primer Corporation, Crispin by Multiplex Manufacturing Co., Cla-Val, or approved equal.

	APCO	CRISPIN	CLA-VAL
Air/Vacuum	Series 140	Series AL	Series 35
Air Release	50/200A	Series AR/PL	Series 34
Combination Air	Series 140C	Series UL	Series 36

2-07 FIRE HYDRANTS

2-07.01 GENERAL

Fire hydrants shall be of the wet-barrel type, conforming to AWWA C503, and as supplemented herein. The Engineer may require a break-off check valve with the wet-barrel type due to location, terrain, available drainage area, and/or system pressure.

2-07.02 MATERIALS AND PARTS

Fire hydrants shall have two 2 1/2-inch hose outlets and one 4-inch pumper outlet. Outlet threads shall conform to ANSI-B26 "National Standard Fire-Hose Coupling Screw Threads".

Fire hydrants shall be furnished with a pentagon shaped operating nut 1-1/8 inch per side, and opening shall be counterclockwise. Fire hydrants shall be furnished with hollow break off bolts or an equivalent break off device at the ground level flange.

Fire hydrants shall be equipped with cast iron or bronze outlet nozzle caps attached to the body of the fire hydrant with non-kinking electro-galvanized steel chains and fitted with appropriate neoprene rubber gaskets.

All fire hydrant burys shall be cast iron, asphalt coated and cement lined. Fire hydrant burys shall be provided with a Mechanical Joint-end at the shoe.

Wet barrel type fire hydrants shall have a nominal six-inch (6") base flange with a six-hole bolt pattern. All internal working parts, including stem, shall be bronze containing no more than seven percent (7%) zinc or two percent (2%) aluminum or 316 stainless steel. The inside of the Cast Iron or Ductile Iron body shall be epoxy lined.

2-07.03 APPROVED FIRE HYDRANT MANUFACTURERS

Clow	F – 860 and F-865

Or approved equal

2-08 MAIN LINE PIPE FITTINGS

2-08.01 GENERAL

Main line pipe fittings shall conform to the requirements of AWWA Standard C110, "Ductile Iron and Gray-Iron Fittings, 3-inch Through 48-inch, for Water and Other Liquids".

Short body type fittings conforming to AWWA Standard C153 may be used for sizes 4-inch through 24-inch.

All fittings shall be made of ductile iron. Fittings up to 24-inch size shall be 350 psi pressure ratings and over 24-inch size shall be 150 psi pressure rating. Fittings shall be cement mortar lined in accordance with AWWA Standard C104, "Cement Mortar Lining for Ductile-Iron Pipe and Fittings for Water".

2-08.02 END CONNECTIONS

2-08.02.1 MECHANICAL JOINTS

Mechanical Joints shall conform to the requirements of AWWA Standard C111 "Rubber-Gasket Joint for Ductile Iron Pressure Pipe and Fittings". Glands shall be made of ductile iron.

2-08.02.2 FLANGED FITTINGS

Flanged fittings shall conform to the requirements of AWWA Standard C110 or C153. Flanges shall be drilled to ANSI B16.1, 125 lb. standard bolt template. The 250 lb. flanges, when required, shall be drilled to ANSI B16.1, 250 lb. standard bolt template.

2-08.03 GASKETS

Gaskets for flanged fittings shall be 1/8-inch thick ring type Non-Asbestos, vulcanized styrene butadiene rubber (SBR), or Neoprene rubber gaskets. Non-Asbestos type gaskets shall be manufactured from a non-asbestos material that meets the pressure ratings, drilling, and dimensional requirements as per section 2-08.02.2. The synthetic fiber content shall be aramid, bound by Nitrile (Buna-N) Rubber (NBR) and have a non-stick coating. Color shall be Green. In lieu of rubber gaskets, the 1/16-inch polytetrafluoroethylene (PTFE) GORE-TEX GR sheet gasketing material, applied full-faced, is an approved equal.

2-08.04 BOLTS AND NUTS FOR MECHANICAL JOINTS AND FLANGED FITTINGS

Tee-head bolts and hexagonal nuts for all mechanical joints shall be high strength, low alloy steel, meeting the current provisions of American National Standard ANSI/AWWA C111/A21.11, "Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings", and must be Cor-Ten as manufactured by NSS Industries, or approved equal.

Hexagonal bolts, nuts and washers for flanged fittings shall be zinc plated, high strength, low-carbon steel conforming to the chemical and mechanical requirements of ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength, Grade A.

Stainless Steel nuts and bolts are required for above ground installations, for steel pipe installations, for stainless steel tapping sleeves and for all other construction as required. The Contractor shall strictly follow the torque limitations and shall use Anti-Cease as manufactured by Loc-Tite or approved equal with the stainless steel nuts and bolts.

All exposed nuts and bolts shall be coated after assembly with an approved mastic as described in Section 2-09.01.

2-08.05 TAPPING SLEEVES

All Tapping Sleeves for tapping a water main under pressure shall conform to the following requirements:

2-08.05.1 DUCTILE IRON, GRAY IRON AND ASBESTOS-CEMENT PIPE

Tapping sleeves shall be of the mechanical joint type or the full circle stainless steel type with a pressure testing port. All tapping sleeves specified in this Section must withstand a 150 psi minimum working pressure and shall provide a positive seal around the pipe at each end of the sleeve. Tapping sleeves that seal only around the opening in the pipe may not be used. For working pressures above 150 psi, special approval must be obtained from the Water Services Division.

Mechanical joint type tapping sleeves shall be made of ductile iron and conform to the requirements of AWWA Standard C110 "Ductile-Iron and Gray-Iron Fittings, 3-inch through 48-inch, for Water and Other Liquids" and AWWA Standard C111 "Rubber Gasket Joints for Ductile-Iron Pressure Pipe and Fittings". All interior surfaces of ductile iron sleeves shall be lined with a fusion bonded epoxy coating. Approved mechanical joint type tapping sleeves are listed in Section 2-08.05.2.

Stainless steel type tapping sleeves shall be made of 18-8 stainless steel, with a flange piece conforming to the requirements of AWWA Standard C207 "Steel Pipe Flanges for Waterworks Service, Sizes 4-inches through 144-inches". Approved stainless steel type tapping sleeves are listed in Section 2-08.05.3. Size on size stainless steel type tapping sleeves is not permitted unless approved otherwise by the Engineer.

2-08.05.2 APPROVED DUCTILE IRON TAPPING SLEEVE MANUFACTURERS

Mueller	Model H-615 (Used on DIP or CIP)
Mueller	Model H-619 (Used on AC Pipe)
Tyler	Ductile Iron MJ Tapping Sleeve
Or approved equal	

2-08.05.3 APPROVED STAINLESS STEEL TAPPING SLEEVE MANUFACTURERS

JCM	Model 432
Ford	Style FAST or FTSS
Romac	Style SST or SST III
Mueller	Model H-304
Power Seal	Model 3490
Smith -Blair	Model 663
Or approved equal	

2-08.05.4 APPROVED STAINLESS STEEL TAPPING SLEEVE MANUFACTURERS FOR PVC PIPE

JCM	Model 432
Ford	Style FAST or FTSS
Romac	Style SST or SST III with stainless steel flange
Mueller	Model H-304 SS
Power Seal	Model 3490 AS
Smith -Blair	Model 663
Or approved equal	

2-08.05.5 SPECIAL APPLICATIONS AND PIPE LARGER THAN 12-INCHES IN DIAMETER

Tapping sleeves for special applications, including Belgium cast iron pipe, and pipe larger than 12-inches in diameter shall be of the full circle split body, fabricated steel type or all stainless steel type. The body shall be fabricated steel conforming to ASTM A36 and fusion bonded epoxy coated after fabrication, or shall be all 18-8 type 304 stainless steel for total corrosion control. Nuts, bolts and washers shall be stainless steel, type 18-8. Tapping sleeves shall be rated for a working pressure of 150 psi. For working pressure above 150 psi, special approval must be obtained from the Water Services Division.

2-08.05.6 APPROVED TAPPING SLEEVE MANUFACTURERS - SPECIAL APPLICATIONS AND PIPE LARGER THAN 12-INCHES IN DIAMETER.

Fabricated Steel Type

JCM	Model 412
APAC	Model 512

Or approved equal

Stainless Steel Type

JCM	Model 432
Ford	Style FAST or FTSS
Romac	Style SST or SST III
Smith Blair	Model 663
Mueller	Model H-304
Power Seal	Model 3480 or 3490

Or approved equal

2-08.05.7 CONCRETE CYLINDER PIPE

At the sole discretion of the Water Services Division, tapping sleeves for concrete cylinder pipe may be required to be of the weld-on type, provided that welding is performed by a State certified pipe welder. For concrete cylinder pipe with a steel cylinder wall thickness of 13 gauge or thinner, the Water Services Division may require a full circle, split body, fabricated steel type tapping sleeve, conforming to the provisions of Section 2-08.05.5 of these specifications.

2-08.05.8 APPROVED TAPPING SLEEVES MANUFACTURERS FOR CONCRETE CYLINDER PIPE

Full Circle Two-Piece Type:

Koppl	Model AS-150
APAC	Style 503

Or approved equal

Weld-On Type:

Koppl	Model CN-100
APAC	Style 504
Superior	Style 826

Or approved equal

2-09 MAIN LINE COUPLINGS

2-09.01 SLEEVE TYPE COUPLINGS

Sleeve type couplings shall provide a flexible, watertight connection between two plain ends as described on the construction drawings. For ductile iron and gray iron pipe, all couplings shall be ductile iron solid sleeve type couplings conforming to AWWA C 110, with mechanical joint ends and body not less than 12 inches long. For steel or asbestos cement pipe, all couplings shall be standard steel couplings, with body not less than 7 inches long. Bolts for exposed steel couplings shall be hot-dip galvanized. Bolts for buried steel couplings shall be of type 316 stainless steel. All sleeve type steel couplings shall be fusion bonded epoxy lined with Scotchkote 206N, as manufactured by 3M/Corrosion Protection Products, or approved equal. Steel couplings shall be epoxy primed with a minimum thickness of 3.0 mils prior to shipment.

Steel sleeve type couplings which are to be buried, shall be coated with a mastic after they are assembled. Coal-tar mastics shall be Protecto-Wrap No. CA1200 coating as manufactured by Protecto-Wrap Company, Denver, Colorado or an approved equal.

2-09.01.1 APPROVED SLEEVE TYPE COUPLINGS MANUFACTURERS FOR DUCTILE IRON, GRAY IRON PIPE AND PVC PIPE

Clow - MJ Solid Long Sleeves
Tyler Corporation - 5-144L Long Solid Sleeves
Or approved equal

2-09.01.2 APPROVED FLEXIBLE COUPLING MANUFACTURERS FOR STEEL

Smith Blair, Inc. - 411 Steel Couplings
Romac Industries, Inc. – Model XR501
Or approved equal

2-09.01.3 APPROVED FLEXIBLE COUPLING MANUFACTURERS FOR TRANSITION TO ASBESTOS CEMENT PIPE AND BELGIUM CAST IRON PIPE

Smith Blair, Inc. – OMNI 441 Steel Couplings
Or approved equal

2-09.02 MECHANICAL GROOVED-TYPE COUPLINGS

Mechanical grooved-type couplings shall provide a positive thrust restraint by locking two grooved or shouldered ends of pipe together. The couplings shall be Style 77 for steel pipe and Style 31 for ductile iron pipe as manufactured by Victaulic Company, or approved equal. These couplings shall have Grade H rubber gaskets and the interior shall be lined with fusion bonded epoxy. Mechanical grooved-type couplings shall be used in above ground or vault installation only.

2-09.03 DISMANTLING JOINTS

Dismantling joints shall be a self-contained flanged restrained joint fitting, including both flanged components and sufficient harness bars to withstand the imposed thrust. The dismantling joint shall be designed to provide no less than 5 inches of longitudinal adjustment and shall be installed with 4 inches of inward adjustment and 1 inch of expansion. The pressure rating will be determined by the flange configuration, and all commonly used flanges shall be available. As standard, flanges conforming to AWWA C207 class D shall be used.

The dismantling joint shall be furnished as a complete assembly consisting of spigot piece, flange adapter, tie bars and gasket.

The spigot piece and the flange adapter shall be steel per AISI C1010-C1015. All exterior fasteners including tie bars shall be 304 or 316 stainless steel. Stainless steel fasteners and tie bars shall not be painted. Gasket material shall be EPDM or Buna-S. The dismantling joint shall be coated inside and out with a fusion bonded Epoxy coating applied to a thickness of 5 -10 mils. The epoxy shall comply with the requirements of NSF 61 and AWWA C550.

The dismantling joint shall comply with AWWA C219 where applicable, and the manufacturer shall operate an accredited Quality Management System to ISO 9001. The design pressure rating shall be equal to or greater than the mating flanges. The gasket seal and compression stud and nut arrangement shall be separate and independent of the tie bar restraint system. Seals between companion flanges and dismantling joint flanges shall made by full faced or drop in ring-style gaskets. Tie bar diameter shall be equal to the corresponding bolt diameter of the mating flange and shall not extend outside the diameter of the flange diameter.

The dismantling joint shall be Dresser Industries, Style 131, Romac Industries, Inc. Style DJ400, Smith Blair 900 Series or approved equal.

2-09.04 FLANGE ADAPTERS

Flange Adapters shall be manufactured from ductile iron per ASTM A536 and shall have bolt circles and bolt holes to meet ANSI B16.1 - Class 125 or Class 250 if required and shown on the plans. Flange Adapters shall be Series 2100 Megaflange as manufactured by EBAA IRON, Inc., 912 Flanged Coupling Adapter by Smith Blair with anchor studs unless otherwise specified, Romac Industries Inc. model RFCA Restrained Flange Coupling Adapter, Uni-Flange® adapters by Ford Meter Box Company, Inc., Tyler/Union Adapter Flange or approved equal.

Flange adapters are approved only for above ground ductile iron pipe installations.

2-10 SERVICE LATERAL INSTALLATION

2-10.01 GENERAL

All valves and fittings for use in the buried service line from the main to the meter setting appurtenance shall conform to the requirement of AWWA standard C800 "Underground Service Line Valves and Fitting" and meet the California Health and Safety Code section 116875. Materials in contact with potable water shall be made from copper alloy No. C83600, in accordance with ASTM B-62. This alloy contains nominally 85 percent copper and 5 percent each tin, lead and zinc. All corporation stops and angle meter valves used for copper installations shall have compression connection of copper tubing. Approved manufacturers are James Jones, Ford, Mueller, and A.Y. McDonald.

2-10.02 FITTINGS

2-10.02.1 CORPORATION STOPS

Corporation stops shall have inlet threads per AWWA tapered threads as specified by AWWA Standard C800 "Underground Service Line Valves and Fittings". Outlet shall be compression connection for copper tube.

2-10.02.2 ANGLE METER VALVES

All angle meter valves shall be full port "ball" type, have a locking wing on the key operator, and with full 360-degree rotation of tee head. All valves for 5/8 x 3/4 inch and 1-inch meters shall have a compression connection inlet and a meter swivel nut outlet. All 2-inch valves shall have a compression connection inlet for 2-inch copper tubing and a meter flange outlet slotted to accommodate 1½-inch and 2-inch meters. Slot should not extend to the outside edge – open slot will not be accepted.

2-10.02.3 COUPLINGS AND SOLDER

Couplings required in 2-inch service laterals shall be made with copper tube fittings in accordance with ANSI B16.22. The diametrical clearance between the tube and fitting shall be .004 to .010 inches. Solder shall be 95/5 (tin-antimony) or an approved equal. Solder with a lead content of 0.2% or greater will not be accepted.

2-10.02.4 BOLTS AND NUTS FOR METER FLANGE CONNECTIONS

All bolts, nuts and washers for flanged fittings shall be Type 316 stainless steel per ASTMA 276-88A, or of an approved similar metal as the flanges, to resist corrosion and for easy removal after lengthy service.

2-10.03 SERVICE SADDLES

All service saddles shall be bronze conforming to ASTM B-62, double strap, and tapped for AWWA taper thread as specified by AWWA Standard C800 "Underground Service Line Valves and Fittings".

2-10.03.1 SERVICE TAPPING TO CONCRETE CYLINDER PIPES

Service tapping to concrete cylinder pipes shall only be made under special approval by the Water Services Division. Unless specified otherwise, tapping shall be a minimum of 2-inch NPT with bushing, as needed. Service saddles shall be Rockwell 362, or approved equal.

2-10.03.2 SERVICE TAPPING TO PVC PIPE

For dry tapping ¾", 1", and 2" services on PVC pipe, the hole shall be bored into the pipe with a hole saw that retains the coupon and allows the shavings to fall clear of the hole. A Ford 202 BS or approved equal service saddle shall be centered over the hole, seated, and tightened then the corp installed using pipe thread sealant.

2-10.04 METER BOXES

Meter boxes shall be precast concrete or polymer concrete having a compressive strength of 4000 psi. Meter boxes shall have a polymer concrete cover and hinged reading lid. Body of the meter box shall be constructed with a "ring" at the top to prevent settlement.

Where required, meter boxes shall have traffic load rating covers. Meter boxes shall be manufactured by Armorcast Products Company, J&R Concrete Products, Inc., Eisel Enterprises, or approved equal, as indicated below.

Meter Size	Armorcast Box/Cover	J&R. Box/Cover	Eisel Box only
5/8" X 3/4" and 1"	A6000485/ A6000484R	W4 ½ or P-W4 ½/ P-W4 ½	437 437
1 ½" and 2"	A6001419/ A6001420R	W5 ½ or P-W5 ½/ P-W5 ½	655½ 655½

2-11 SMALL METERS

2-11.01 POSITIVE DISPLACEMENT TYPE

2-11.01.1 GENERAL

Meters 2-inch or less in size are classified as small meters and shall conform to AWWA C700, Standard Specifications for "Cold Water Meters – Displacement Type, Bronze Main Case". All meters shall consist of a bronze main case with serial numbers stamped on the main case. All meters shall be read in cubic feet.

2-11.01.2 APPROVED POSITIVE DISPLACEMENT TYPE METER

MANUFACTURERS

Neptune Technology Group:

5/8" x 3/4"	Model T-10
1"	Model T-10
1 ½"	Model T-10
2"	Model T-10

Sensus Metering Systems:

5/8" x 3/4"	Model SR
1"	Model SR
1 ½"	Model SR
2"	Model SR

2-11.02 TURBINE TYPE

2-11.02.1 GENERAL

Where specified 1½-inch and 2-inch turbine type meters shall be installed. All turbine meter installations shall include a strainer and shall conform to AWWA C701.

2-11.02.2 APPROVED TURBINE TYPE METER MANUFACTURERS

Neptune Technology Group:

1 ½"	Model HP Turbine
2"	Model HP Turbine

Sensus Metering Systems:

1 ½"	Model W-120 DRS
2"	Model W-160 DRS

2-12 THRUST RESTRAINING MATERIALS

All mechanical thrust restraining devices shall be ductile iron except as noted for Field Lok gaskets. All devices shall withstand a working pressure of at least 250 psi with minimum safety factor of two.

2-12.01 MECHANICAL JOINT RESTRAINT

2-12.01.1 FOLLOWER GLAND TYPE

Restraining devices for mechanical joint fittings shall be incorporated with design of the follower gland and shall include a restraining mechanism which when activated, imparts multiple wedging action against the pipe, increasing its resistance as the pressure increases. The joint shall maintain flexibility after burial. Glands shall be manufactured of ductile iron conforming to ASTM A536. The mechanical joint restraint shall be Megalug® Series 1100 as manufactured by EBAA Iron, Inc., Uni-Flange Series 1400 as manufactured by Ford Meter Box, Inc., RomaGrip as manufactured by Romac Industries Inc., Stargrip as manufactured by Star Pipe Products, Inc., or approved equal.

For PVC and PVCO pipes, the mechanical joint restraints for 4 inch through 12 inch sizes shall be Megalug® restraint Series 2000PV as manufactured by EBAA Iron, Inc., or approved equal.

A coating system shall be applied to the body and wedge assembly and related parts to provide corrosion, impact and UV resistance. The Coating for restraint body shall be electrostatically applied to ensure complete coverage. The coating system shall be MEGA-BOND by EBAA Iron, Inc., E-Coat by Ford Meter Box, Inc., epoxy or approved equal. Requests for approved equal must submit coating material and process details for review prior to bid.

2-12.01.2 GASKET TYPE

Where gasket type restraints are indicated on the Construction Plans, mechanical joint pipe and fittings shall be restrained with the MJ FIELD LOK® Gasket as manufactured by US PIPE or approved equal. The restraint system shall be completely integral to the gasket, requiring only standard mechanical joint assembly techniques. The gasket type restraint shall fit mechanical joints conforming to ANSI/AWWA C111/A21.11 "Rubber Gasket Joints for Ductile-Iron Pressure Pipe and Fittings".

For mechanical joint restraints on PVC C900 and PVCO C909 pipes, 4-inch through 12-inch sizes, the Series PV MJ FIELD LOK® Gasket restraint as manufactured by US PIPE or approved equal, shall be used.

2-12.02 PUSH-ON PIPE BELLS FOR DUCTILE IRON PIPE

Where restrained joints are indicated on the Construction Drawings, push-on joints shall be restrained with FIELD LOK® 350 as manufactured by U.S. Pipe or approved equal. TR FLEX® restrained joint pipe as manufactured by U.S. Pipe or approved equal is also an acceptable option for restraint of push-on joints. Restrained push-on joint pipe shall be capable of being deflected after assembly.

2-12.03 CONCRETE

Concrete for thrust blocks shall conform to Concrete Class 420-C-2000. If thrust block is to be disturbed or backfill is to be placed prior to developing its required strength, additional mechanical thrust restraining devices approved by the Water Services Division shall be installed. Concrete for anchor and Gravity Anchor Blocks shall conform to Class 560-C-3250.

2-13 SHOP DRAWING AND MATERIAL SUBMITTALS

The Contractor shall furnish to the Water Services Division such working drawings, data on materials, certifications of materials, and equipment and samples as are required for the proper control of the work, including, but not limited to, those working drawings, data and samples specifically required in Subsection 2-5.3 of the SSPWC and on the Drawings. All working drawings, data and samples shall be subject to review by the Water Services Division for conformity with the drawings and specifications. The shop drawings shall be submitted at least ten (10) working days before such drawings will be required for commencing the work. Cut sheet submittals having more than one size, type, or model shall

be clearly highlighted with a yellow marker to indicate specific items to be reviewed. Shop drawings having multiple sizes or items without highlighting will be rejected.

2-14 PAINTING - ABOVE GROUND INSTALLATIONS

After ALL Testing and Disinfection has passed, but prior to Final Acceptance by the Water Services Division, all above ground installations shall be painted in accordance with the following:

Remove ALL dirt, oil, grease, rust, bituminous coating, and other contaminants from surfaces to be painted by sand-blasting, pickling, or wire brushing as required. Clean all surfaces with solvent then apply primer to all surfaces to be painted. Allow primer to dry, then apply intermediate coat to all surfaces; allow intermediate coat to dry, then apply finish coat.

The underlined generic terms in the above paragraph shall be considered together as a painting system and shall be supplied by a single manufacturer selected from the list of Approved Painting Systems at the end of this section.

The above specified work shall be accomplished per the appropriate sections of Steel Structures Painting Manual, Volumes 1 and 2, published by the SSPC of Pittsburgh, Pennsylvania AND strict adherence to the manufacturer's recommendations.

Approved Painting Systems by Manufacturer:

Manufacturer	Carboline	Tnemec	Dunn Edwards
Solvent	Surface Cleaner No. 3	Xylol (Xylene)	GMA 571 Bio-degradable Cleaner
Primer	891 High-Gard @ 4-6 mils DFT	Series 69 @ 3-5 mils DFT	670 HS @ 4-8 mils DFT
Intermediate Coat	891 High Gard @ 4-6 mils DFT	Series 69 @4-6 mils DFT	670 HS @4-8 mils DFT
Finish Coat	134 Carbonthane @ 2-3 mils DFT	Series 73 @ 2-3 mils DFT	990 UHS @ 2-3 mils DFT

(DFT = Dry film thickness)

From the following approved list, use the semi-gloss top coat color that corresponds with the application or as directed by the City.

Approved Finish Coat Colors:

	Carboline	Tnemec	Dunn Edwards
Backflow Prevention Devices > 2-inches	Offshore Green D337	Hunter Green 08SF	10-18 Woodlawn Green
*****Fire Line Assemblies	Offshore Green D337	Hunter Green 08SF	10-18 Woodlawn Green
Fire Hydrant	Safety Yellow 6666	Bright Yellow 03SF	10-14 Hi-VIS Yellow
Guard Post	Safety Yellow 6666	Bright Yellow 03SF	10-14 Hi-VIS Yellow
Air Vents Type I	Lt. Gray C705	Lt. Gray 32GR	10-215 Grey Pearl
Air Release Valve Cover	Offshore Green D337	Hunter Green 08SF	10-18 Woodlawn Green
Water Sampling Station	Offshore Green D337	Hunter Green 08SF	10-18 Woodlawn Green
Isolation Valves:			
• Inline Gate	Safety Yellow 6666	Bright Yellow 03SF	10-14 Hi-VIS Yellow
• Fire Hydrant or Fire Service	Safety Red 5555	Safety Red SC09	10-221 Safety Red
• Inter-tie	Safety Orange 4444	Inter. Orange 05SF	10-17 Alert Orange
• Production	Safety Blue S150	True Blue 11SF	10-22 Precaution Blue
• Large Domestic Service & Bypass	Offshore Green D337	Hunter Green 08SF	10-18 Woodlawn Green

***** Where the assembly can be placed close to the building the color shall compliment the building. Alternate colors for unique situations shall be reviewed and approved by the Planning Services Division. **Top of FDC shall be painted Safety Red** per the Fire Department.

2-15 ACCESS TO MANUFACTURING AND TEST FACILITIES

The Water Services Division shall at all times have access to the manufacturing and test facilities, and the right to inspect the work, and materials. The manufacturer shall furnish the Water Services Division with reasonable facility access for obtaining such information as necessary to assess the progress of the work, and the character and quality of materials used. When requested by the Water Services Division, the manufacturer shall submit a certificate of compliance that the product meets the requirements of these specifications.

SECTION 3 - CONSTRUCTION METHODS AND CONTROL

3-01 INSPECTION

The construction of any water system improvement intended for dedication to the City and used by the Water Services Division for public water service shall be subject to inspection by the Water Services Division. Such inspection will assure the Water Services Division that all phases of the work are in compliance with these specifications. The inspector will be the representative of the Director, Public Works Department and shall coordinate the various responsibilities of the Water Services Division throughout the work. Inspection costs will be paid by the Developer or Contractor at a rate prescribed by City Council resolution.

The Water Services Division shall have access to the work and shall be furnished with every reasonable facility for ascertaining full knowledge of the progress, material, and workmanship used to complete the work. The Water Services Division shall be given 48-hours advance notice of major phases of construction for purposes of inspection unless noted otherwise on the construction drawings. All material shall be inspected prior to placement and all workmanship shall be visually inspected prior to backfilling. Reasonable aid shall be given to ascertain the exact location of all work.

The inspection of the work shall not relieve the Contractor of any obligation to complete the work as prescribed by these specifications. Defective work shall be made good, and unsuitable materials may be rejected not withstanding the fact that such defective work and unsuitable materials have been previously accepted by the Water Services Division.

The Water Services Division shall have the authority to suspend the work wholly, or in part, for such time as it may deem necessary due to the failure of the Contractor to perform any provisions of the plans or specifications. The work can only be continued when the defective material or method is recognized as corrected by the Water Services Division.

3-02 PRE-CONSTRUCTION DETAILS

3-02.01 PERMITS AND LICENSES

The Contractor shall have a Class “C-34” or Engineering “A” Contractor’s License valid in the State of California and shall meet all the applicable requirements of the Garden Grove Municipal Code. The Contractor shall have a current, valid City of Garden Grove business license. The Contractor shall obtain all necessary permits, licenses, or agreements required by any legally constituted agency. An excavation permit from the City shall be required for excavation in the public right-of-way within the City. A copy of all licenses and permits required for the project shall be provided to the City prior to starting work. The Contractor shall observe all safety procedures as required by

CAL-OSHA. All provisions of these permits, licenses, or agreements shall be binding upon the Contractor as though stated herein. Water Services Division will not be responsible for actions involving the agencies controlling such permits, licenses, or agreements.

3-02.02 TRAFFIC CONTROL

The Contractor shall furnish all materials, labor and traffic controls necessary to safeguard the work and the public safety.

Traffic and pedestrian control shall comply with the applicable provisions as contained in the latest edition of the Work Area Traffic Control Handbook (WATCH) as sold by Building News, Inc., 1612 S. Clementine Street, Anaheim, CA 92802, (888) BNI-BOOK. All traffic control plans shall be reviewed and approved by the City.

3-02.03 SURVEYING

The Contractor shall provide equipment, method, and labor to locate accurately all proposed water facilities. The Contractor shall further guarantee the accurate location of all water facilities by constructing curb and gutter prior to the beginning of any water improvements. If, in the opinion of the Water Services Division, this sequence of construction cannot be followed, the Contractor will sign a "Waiver of Curb and Gutter Requirements" and assume all responsibility and costs for correcting any resulting errors or omissions.

3-02.04 POLLUTION PREVENTION & BEST MANAGEMENT PRACTICES

Storm water and non-storm water discharges resulting from municipal construction activities (less than 1 acre) are currently governed by the Santa Ana Regional Water Quality Board NPDES Permit No. CAS618030. The permit applies to municipal activities within the County of Orange. A Municipal Activities Procedures Manual has been developed by the County of Orange to assist with permit implementation. A copy of the permit, the Municipal Activities Procedures Manual, and the Local Implementation Plan are available from the City of Garden Grove, Department of Public Works Records Office, located in the City Hall, 11222 Acacia Parkway, Garden Grove, CA 92842. These documents provide guidance and requirements regarding proper pollution control practices at construction sites. They include a list of Best Management Practices (BMPs) to be implemented where applicable. The BMPs can also be found on line at http://www.cabmphandbooks.com.

3-03 REMOVALS AND TRENCH EXCAVATION

3-03.01 REMOVAL OF PAVEMENT

Asphalt and concrete paving shall be removed after saw cutting. All edges shall be as straight as possible. Contractor shall dispose the pavement off the work site to a permitted facility.

3-03.02 REMOVAL OF UTILITIES

Utilities shall be removed only as stated on the construction plans. Structures or piping not shown on the construction plan shall be brought to the attention of the Water Services Division. Disposition of these structures shall be determined by the Water Services Division prior to proceeding with the work.

The Contractor shall notify and coordinate with representatives of any utility which must be removed or relocated.

3-03.03 TRENCH EXCAVATION

Trench excavation shall include any excavation in which the depth is greater than the width at the bottom of the excavation. Such excavations as required for pipe lines, vaults, thrust blocks, boring pits and service laterals shall be considered as trench excavations. All earthen material and water that will interfere with the placement of the pipe shall be removed. Contractor shall use sufficient means to protect any existing utilities from damage during trench excavation. Contractor shall also use Best Management Practices (BMP) to prevent silt, mud, or other pollutants from entering storm drains or catch basins as a result of trenching or excavating activities.

The maximum length of open trench shall be 500 feet or the length of pipe installed in one day, whichever is less. An open trench of up to 1,000 feet is permissible only in areas not subject to public traffic. The width of the trench at the bottom of the excavation shall not exceed 10 inches on either side of the pipe. Bell and coupling holes shall be used as required to complete a satisfactory pipe joint.

Water main installation will not be permitted until subgrade is established and the storm drain and sewer installation have been completed. Pipe shall be placed to the grade and depth specified on the construction drawings. When not specified, pipe shall be placed as follows:

a. 42-inch standard cover to finished surface of primary and secondary streets, (64 feet right-of-way and greater).

b. 36-inch standard cover to finished surface of collector and interior streets (less than 64 feet right-of-way).

c. 12-inch standard vertical clearance from any crossing utility or structure.

In all cases pipe shall be installed so that there is a minimum of 24" cover between top of pipe and bottom of pavement structural section.

The minimum cover and clearance herein stated applies to construction where there are existing underground facilities. These minimums are not intended as "design minimums" where all new underground facilities or two or more conflicting facilities are installed at the same relative time. The design shall attempt to maximize clearance between conflicting facilities and provide standard cover as the minimum.

The trench bottom shall be graded to provide a smooth, firm, and stable foundation which is free of rocks and other obstructions. All soft, spongy, and unstable material shall be overexcavated to a depth of two feet, replaced with backfill material per Section 3-09 of these specifications, and compacted to provide a firm and stable foundation. All rocks or cobbles two inches or greater in any dimension shall be removed to a depth of six inches below pipe grade and replaced with compacted backfill material.

3-04 CONNECTION TO EXISTING FACILITIES

3-04.01 GENERAL

The Contractor shall make connection to the existing public facilities as shown on the construction drawings. All connections must be made under inspection of the Water Services Division's representative. The inspector shall consider the means of chlorinating those sections of main, fittings, or valves in contact with the public system. When such connection provides a direct closure between the existing public system and that under construction, such valves shall become the property of the Water Services Division and shall be operated only by the Water Services Division.

3-04.02 PRESSURE TAPPING

Cast iron, ductile iron, PVC, or asbestos cement pipe can be tapped under pressure by the Contractor. The exterior surface of the pipe shall be cleaned to provide a smooth surface for the tapping sleeve. The tapping sleeve shall be secured to the pipe to prevent movement during the tapping process. Concrete cylinder pipes shall be tapped under pressure by the Koppl Company, Montebello, International Flow Technologies, Inc., Anaheim, California, or approved contractor by the Engineer. Tapping nozzles shall be bolted or welded on as determined by the Water Services Division based on steel cylinder thickness.

3-04.03 SHUTDOWN OF MAIN

All work necessary to shut down an existing public water main for the benefit of a Contractor shall be by Water Services Division personnel and shall require prior approval by the Water Services Division. Unless at the direct supervision of the Water Services Division Inspector, under no circumstances shall the Contractor operate valves, hydrants, and other appurtenant equipment on the existing public system. It shall be the Contractor's responsibility to coordinate the necessary shutdown schedules through the Water Services Distribution Supervisor. Scheduled shutdowns shall require sufficient time to allow operations personnel to review, approve, and develop an appropriate Operation Program. The Contractor shall be responsible for maintaining all schedules current and coordinating all deviations which may occur from time to time with the Water Services Division Inspector.

The City will make a concerted effort to isolate the system as planned with the Contractor. However, the Contractor shall be prepared to employ pumping equipment if a water tight seal cannot be achieved. City will not be responsible for any delays due to system shutdown and isolation.

All emergency situations shall be reported immediately to the Water Services Division (714-741-5395 during business hours and 714-741-5704 after business hours). When extensive main shutdown is required, the Water Services Division will determine what temporary service connections may be required. The Contractor shall furnish all necessary hose, piping, valves, water trucks and associated labor required to provide such temporary service. All piping, hoses and associated equipment used in temporary service connections shall be flushed and disinfected in accordance with Section 3-11, TESTING, DISINFECTION, AND FLUSHING.

3-05 LAYING OF DUCTILE IRON PIPE WATER MAIN

3-05.01 GENERAL

Installations of pipe and fittings shall be in accordance with AWWA Standard C600, "Installation of Ductile-Iron Water Mains and Their Appurtenances" and the pipe manufacturer's installation manual. The DIPRA Publication "Guide for the Installation of Ductile Iron Water Mains" shall be used for details of pipe installation practice except as follows and where noted otherwise on plans. Maximum deflection per joint for greater than 12-inch pipe shall conform to allowable values shown in "Installation Guide for Ductile Iron Pipe" by DIPRA.

Water mains shall be installed to provide a 10-foot minimum horizontal separation between the outside wall of the water main and the outside wall of any sanitary sewer. In addition, installation shall comply with Standard Drawings B-760 and B-761.

Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in the trench. If the pipe-laying crew cannot put the pipe into the trench and in place without getting soil into it, the Engineer may require that before lowering the pipe into the trench, a temporary plug be placed over each end and left there until the connection is to be made to the adjacent pipe. During laying operations, no debris, tools, clothing or other materials shall be left in the pipe.

At times when pipe laying is not in progress, the open ends of pipe shall be closed by watertight plug or other means approved by the Engineer. This provision shall apply during the lunch-hour breaks as well as overnight. If water is in the trench, the seal shall remain in place until the trench is pumped completely dry.

The cutting of pipe for inserting tees, fittings or closure pieces shall be done in a neat workmanlike manner without damage to the pipe or cement lining and so as to leave a smooth end at right angles to the axis of the pipe. No pipe shall be laid in water or when, in the option of the Engineer trench conditions are unsuitable. Field welding of Ductile Iron Pipe for repair or for joining is prohibited.

Service saddles are required for all corporation stops 2-inch diameter and less.

3-05.02 THRUST RESTRAINT

The Contractor shall be responsible for anchoring the pipe and fittings against movement due to water pressure. The materials specified in Section 2-12 will be used for restraining any movement of underground piping systems. Concrete thrust blocks shall be poured in place against an undisturbed earth bearing surface. Concrete shall be placed so as not to interfere with the fitting joint. Concrete shall be per Section 2-12.03. Thrust block locations and dimensions shall be per Standard Drawings B-710 through B-711, Section 6 of these specifications.

3-05.03 STANDARD ASSEMBLIES

Fire hydrants shall be constructed per Standard Drawings B-701 and B-702, Section 6 of these specifications. Fire Hydrants shall be placed at a location shown on the construction drawing or as directed by the inspector. The determination will be based on specific locations which, in the opinion of the inspector, could result in potential hazard from the fire hydrant being hit and broken, such as closeness to overhead power lines or water damage to property. Where required by the construction drawing, guard posts shall be installed per Standard Drawing B-703, Section 6 of these specifications.

Water valves shall be installed at locations shown on the construction drawing, or as directed by the Water Services Division. Valves shall be set plumb, and shall be stabilized and supported separately from the pipeline. Information regarding size, type, make, and number of turns to close shall be supplied to the Water Services Division by the Contractor in accordance with Section 2-13. All valves shall be covered with a valve box assembly. Valve boxes shall be plumb, centered over the valve nut, and supported separately from the valve body per Standard Drawing B-752 and B-753. Valve boxes shall be lowered to below paving grade level prior to street paving, and after final grade has been established by the final grade. In any event, Contractor shall ensure that all valve boxes will provide access to the operation of the valve by the Water Services Division's personnel.

Valve boxes shall be flagged or barricaded during construction to divert traffic around their location.

3-05.04 PROTECTION AND CLEANING OF PIPE AND FITTINGS

The Contractor shall take extreme care to insure cleanliness and protection of the inside coatings of all piping and fittings. The interior surfaces of all pipe, fittings and other appurtenances shall be kept free of dirt or foreign matter at all times. All lumps, blisters, excess lining and coating materials shall be removed from the

flanged end or bell and spigot end of each pipe or fittings. The outside of the spigot and the inside of the bell shall be wire brushed and wiped clean, and free from oil and grease before the pipe is laid.

3-05.05 HANDLING PIPE AND OTHER MATERIALS

Proper implements, tools and facilities satisfactory to the Engineer shall be provided and used by the Contractor for the safe and convenient prosecution of the work. All pipes, fittings and valves shall be carefully lowered into the trench in such a manner as to prevent damage to water main materials and protective coatings and linings. Under no circumstances shall water main materials be dropped or dumped into the trench.

3-05.06 PROTECTION OF METAL SURFACES

All exposed surfaces of the valves, flanges, bolts, nuts, tie-rods, turn buckles, etc. in contact with the earth and backfill materials shall be coated with a minimum of 30 mils of bitumastic coating prior to backfilling. In addition to this bitumastic coating, all iron or steel surfaces such as valves, flanges, bolts, nuts, couplings, shall be encased in 8 mil polyethylene wrapping in accordance with AWWA C-105 and Sections 2-01.04 and 3-12.03 of the WSDSS.

3-06 LAYING OF PVC PIPE WATER MAIN

Installations of pipe, bends, and fittings shall be in accordance with Section 2-08 for ductile iron bends and fittings, and AWWA C605 “Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water” and the pipe manufacturer's installation manual. PVC bends and fittings are not allowed. The Uni-Bell Handbook of PVC Pipe-Design and Construction shall be used for details of pipe installation practice except as follows and where noted otherwise on plans. Longitudinal bending of pipe sections is prohibited. Any directional change shall be accomplished through manufacturer approved 1º deflection of push on joints, 5º deflection with CertainTeed - couplings, or ductile iron bends capable of withstanding 250 psi loads. A number 14-gauge, solid, soft drawn insulated copper tracer wire is required for PVC pipe installation. The tracer wire and warning identification tape shall be installed per Standard Drawing B-781.

Service saddles are required for all corporation stops 2-inch diameter and less.

Point load set screws in retainer glands and flanges are prohibited, whereas those devices with pads or full circle are acceptable.

Water mains shall be installed to provide a 10-foot minimum separation between the outside wall of the water main and the outside wall of any sanitary sewer. In addition, installation shall comply with Standard Drawings B-760 and B-761.

Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in the trench. If the pipe-laying crew cannot put the pipe into the trench and in place without getting soil into it, the Engineer may require that before lowering the pipe into the trench, a temporary plug be placed over each end and left there until the connection is to be made to the adjacent pipe. During laying operations, no debris, tools, clothing or other materials shall be left in the pipe.

At times when pipe laying is not in progress, the open ends of pipe shall be closed by watertight plug or other means approved by the Engineer. This provision shall apply during the lunch-hour breaks as well as overnight. If water is in the trench, the seal shall remain in place until the trench is pumped completely dry.

The cutting of pipe for inserting tees, fittings or closure pieces shall be done in a neat workmanlike manner without damage to the pipe and so as to leave a smooth end at right angles to the axis of the pipe. The beveled end of any PVC pipe shall be cut off before the pipe is inserted into a mechanical joint bend or fitting. No pipe shall be laid in water or when, in the opinion of the Engineer, trench conditions are unsuitable.

3-07 REPAIR, REMOVAL AND DISPOSAL OF ASBESTOS CEMENT PIPE (ACP)

Contractor shall be responsible to remove and dispose Asbestos Cement Pipe indicated on the project plans.

Asbestos Cement Pipe (ACP) is a mixture of cement and asbestos fibers. ACP is no longer manufactured or allowed for new installations due to health and safety hazard. ACP is defined under the National Emission Standard for Hazardous Air Pollutants (NESHAP) as a Category II, non-friable, non-regulated material in its intact state but which may become friable upon removal, demolition and/or disposal. ACP repair and removal due to the damage of the existing pipe is defined as Class II asbestos work. Any repair, removal, disposal and handling of ACP shall comply with NESHAP, CAL-OSHA and all other applicable regulations and procedures.

Only the personnel who are trained/qualified for Class II asbestos work shall be allowed for any repair, removal, disposal and handling of ACP.

Contractor shall provide the Water Services Division a manifest of properly disposed ACP material.

3-08 SERVICE LATERALS

3-08.01 GENERAL

One-inch and two-inch diameter service laterals shall be installed per Standard Drawings B-721, B-722 and B-723. The service lateral shall consist of the double strap service saddle, polywrap per Section 3-12.03 if ductile iron main, insulated corporation stop, angle meter valve, meter, meter box and lid, and copper tubing. Service laterals shall be installed perpendicular to the centerline of the street and a three inch "plus" symbol will be marked, with Z-marker or equal, on to the curb face opposite the location of the corporation stop.

Meters and meter boxes shall be supplied and installed by the Contractor at such time and place as directed by the Water Services Division. Meter boxes located in areas subject to traffic loading, or located behind a rolled curb, shall be installed with an approved Traffic bearing lid.

Special consideration shall be given to backfill and compaction in the area adjacent to the copper tubing that is "snaked" in the trench. The area adjacent to the tubing shall be considered to extend not less than 4-inches below and 4-inches above the copper tubing and shall include the entire width of the trench. Bedding and backfill shall conform to Section 3-09 of these specifications. Backfill material shall be compacted under the service lateral so as to create a firm laying bed prior to placing and compacting any material over the top of the lateral. Compaction of backfill material by mechanical means directly over the exposed service tubing shall not be allowed.

The Contractor, under the direction of the Water Services Division, shall be responsible for proper abandonment, including cut and cap at the main, of all existing active and inactive services and laterals not intended for reuse.

Prior to any modification of service laterals 4-inches or larger and within 20-feet from the existing valve, the Contractor shall expose the valve on the service lateral to ensure the lateral including the valve is adequately restrained to the main pipeline. The exposed valve is to be witnessed by the Water Services Division for verification of restraint. Inadequately restrained valve shall be properly restrained by the Contractor.

All water service connections may require the installation of a backflow device in accordance with Section 5 of these specifications.

3-08.02 IRRIGATION SERVICES

Services installed for the primary purpose of providing irrigation of landscapes or commercial crops, and which may have booster pumps downstream of the meter, shall conform to the following requirements:

1. A hydraulically actuated, slow open/close valve shall be provided immediately downstream of the pump or a surge tank, properly sized and approved by the Water Services Division.

2. A Reduced Pressure Principle Device (RPPD) type backflow preventer will be required immediately downstream of the flow meter.

3-09 PIPE BEDDING AND BACKFILLING OF TRENCH

The Contractor shall backfill the pipe trench as soon after placement of pipe as practical with due regard of the requirements in this Section. All fittings, valves, utility crossings, and assemblies shall be visually inspected by the Water Services Division prior to backfilling. Pipe bedding shall be defined as that material supporting, surrounding and extending to a minimum of 12 inches above the top of pipe and shall consist of imported or native free draining material having a sand equivalent (SE) of not less than 30 or other material approved by the engineer. Bedding and backfill shall be placed in accordance with the Sections 306-1.2.1 and 306-1.3 of the "Standard Specifications for Public Works Construction" and as supplemented herein. All backfill for pipe or conduit shall be densified to a minimum relative compaction of 90% by water densification, mechanical tampers, rollers or other mechanical means.

All buried valves and fittings shall be backfilled with clean sand. The sand shall be installed in such a manner that after compaction no earth or other backfill will be less than 6-inches from any part of the valve, fitting, flanges, bolts, or nuts. The sand shall be compacted as specified for other backfill.

3-10 REPAVING AND FINISHING

The Contractor shall replace all removed or damaged pavement with a section equal to that removed, but not less than four inches of asphalt concrete (A.C.) over the subgrade. All pavement replacement with the exception of temporary shall be hot-mix A.C. as specified in the Plans or Specifications. Cold-mix A.C. shall only be allowed for temporary pavement replacement. The Contractor shall place pavement following final compaction of the backfill. The Contractor shall not wait for completion of the full length of pipeline installation to begin resurfacing; the pavement shall be repaired and/or replaced, flush with existing road surface, within five working days of damage or removal of the pavement. Valve boxes shall

be located after final paving and adjusted to finished grade. The Contractor shall remove the paving section down to the valve box, raise the valve box top section to finished surface, install the gate valve can assembly per Standard Drawing B-752, and patch the annular space with hot-mix A.C. The top six(6) inches of backfill below the street structural section shall be compacted to 95% relative compaction.

3-11 TESTING, DISINFECTION, AND FLUSHING

3-11.01 GENERAL

All required testing shall be performed and certified by a third party agency hired by the Contractor and approved by the City. All tests shall be made in the presence of the inspector, except that bacteriological tests shall be performed at laboratories certified by the California Department of Health Services. All constructed facilities shall be isolated from the existing public system while being tested.

3-11.02 HYDROSTATIC PRESSURE TESTING

After all thrust blocks have been placed for at least two days in the particular portion to be tested, a pressure test shall be conducted by a hydrostatic testing agency hired by the Contractor and approved by the City. Each section of main, up to but not exceeding 1,200 feet in length, and all fire hydrants and fittings connected thereto, shall be subjected to a hydrostatic pressure in accordance with AWWA Standard C600 and C605 and as modified herein, while all pipe, fittings and joints are inspected for leakage. Test pressure shall not exceed rated working pressure of the gate or butterfly valves. The section of pipe under test shall be allowed to stand at 40 psi minimum pressure for one (1) hour prior to the beginning of the test. The pressure shall then be increased to 1.5 times the local static pressure, or 150 psi, whichever is greater, to a maximum of 300 psi. Pressure shall be measured at, or corrected to, the lowest point in the portion of the line being tested. After the entire section under test has been inspected and no leaks have been found, or if found, have been repaired and re-subjected to the test pressure, the pressure shall be maintained for four hours, during which time the amount of leakage shall be determined by measuring the quantity of water which must be added to maintain the test pressure. The following table lists the maximum allowable leakage per 1,000 feet of pipe, in gallons per hour, in conformance with AWWA Standard C600 and C605:

Maximum Allowable Leakage per 1,000 feet of Pipe, Gallons per Hour		
Static	Test	Nominal Pipe Diameter, in.

Pressure, psi	Pressure	4	6	8	10	12	16	18
100 or less	150	0.33	0.50	0.66	0.83	0.99	1.32	1.49
110	165	0.35	0.52	0.69	0.87	1.04	1.39	1.56
120	180	0.36	0.54	0.73	0.91	1.09	1.45	1.63
130	195	0.38	0.57	0.75	0.94	1.13	1.51	1.70
140	210	0.39	0.59	0.78	0.98	1.17	1.57	1.76
150	225	0.41	0.61	0.81	1.01	1.22	1.62	1.82
160	240	0.42	0.63	0.84	1.05	1.26	1.67	1.88
170	255	0.43	0.65	0.86	1.08	1.29	1.73	1.94
180	270	0.44	0.67	0.89	1.11	1.33	1.78	2.00
190	285	0.46	0.68	0.91	1.14	1.37	1.83	2.05
200	300	0.47	0.70	0.94	1.17	1.40	1.87	2.11

If the pipeline under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each size.

3-11.03 DISINFECTION

3-11.03.1 GENERAL

All water mains, water services, attached appurtenances and connections shall be disinfected in accordance with AWWA Standard C651 "Disinfecting Water Mains", and as modified herein.

Contractor shall furnish all equipment, labor, materials, safety requirements, and water necessary for chlorinating and flushing the pipeline. Disinfection of new mains, including all chlorination, chlorine residual measurements, collection of samples, and certification shall be conducted by a third party testing agency approved by the City. Gauges and apparatus used for chlorine injection shall bear the current State certification. An independent State Certified laboratory or authorized agent shall collect the samples and a State Certified laboratory shall perform the bacteriological tests. All costs for disinfection, including laboratory fees, shall be paid by the Contractor.

At no time shall personnel other than the authorized third party testing agency be in charge of injecting chlorine into the water pipeline, the residual testing of the chlorine, or obtaining bacteriological samples.

Contractor shall ensure that all pipe, fittings, and appurtenances are kept free from dirt and foreign matter at all times. During construction all open pipe ends and fittings shall be fitted with a water tight plug. At the end of the work day the open pipe in the trench shall be plugged in an equally suitable manner.

The Contractor shall swab the interior surfaces of the new valves, pipes and appurtenances as well as interior surfaces of existing main, both upstream and downstream of the new pipe section, with a minimum five percent concentration of hypochlorite disinfection solution before installation. During the chlorination or chlorinating process, all valves shall be operated, and the chlorine solution shall be drawn through all laterals and appurtenances. Disinfection of mains and appurtenances, hydrostatic testing, and chlorine retention may run concurrently for the required minimum 24-hour period only if prior approval is obtained from the Water Services Division.

In the event of leakage or where repairs are necessary, added disinfection shall be made only by injecting chlorine into the line whereby adequate mixing is assured. If the test results are not satisfactory, the Contractor shall provide additional disinfection, as required. Such additional disinfection shall be at the Contractor's expense.

Disinfection of pipelines 4-inch or larger and in excess of 100-feet in length shall be accomplished by direct chlorine gas as specified herein, unless otherwise approved by the Engineer.

3-11.03.2 CHLORINE GAS FEED

The new system which is being disinfected shall be thoroughly pre-flushed, utilizing a minimum velocity of 2.5 feet per second throughout the entire system. The chlorinating agent shall be applied at a point not more than ten feet from the beginning of the section to be chlorinated and shall be injected through a corporation stop, a hydrant, or other approved connection to ensure treatment of the entire system being disinfected. All required corporation stops and other plumbing

materials necessary for chlorination or flushing of all parts of the main being disinfected shall be installed by and at the expense of the Contractor.

Chlorine gas shall be fed directly from the chlorine cylinder equipped with a suitable device capable of regulating the rate of flow and diffusion of gas within the pipe. Water shall be concurrently fed into the pipe at a rate which produces a residual of not less than 50 (parts per million) PPM and not to exceed 100 PPM of chlorine in all sections of the pipeline and appurtenances being disinfected. Chlorinated water shall be retained in the system for a minimum duration of 24 hours, and shall produce at the end of the retention period not less than 25 PPM of chlorine in all sections of the pipeline being disinfected.

3-11.03.3 CALCIUM HYPOCHLORITE TABLETS

This method may be used, except in case of PVC pipe, under the direction of the Engineer for pipe lengths 100 feet or less if the pipes and appurtenances have been maintained in a clean and dry condition during construction. The number of tablets used shall produce a residual of not less than 50 PPM and not to exceed 100 PPM of chlorine in all sections of the pipeline and appurtenances being disinfected when filled with water. During construction, five-gram calcium hypochlorite tablets shall be placed in each hydrant, hydrant branch, and other appurtenances.

All tablets shall be attached, using an approved adhesive, on the inside and at the top of the main, with approximately equal numbers of tablets at each end of a given pipe. Adhesive shall be a type that will not impart detrimental compounds to the water supply. The following table may be used as a guideline for the number of five-gram tablets needed to achieve 50 PPM chlorine residual for each 18-foot length pipe section, based on 3.25-g available chlorine per tablet, and with any portion of tablet rounded to next higher integer.

Pipe Dia. (In.)	Suggested Number of 5-g tablets
4	1
6	2
8	4
10	5
12	7

The fill rate when using tablets shall be regulated so that the velocity does not to exceed one foot per second through the smallest main line being disinfected. If required by the Water Services Division, water used to fill the new main during the application of chlorine shall be supplied through a temporary connection that shall include an appropriate cross-connection control device, consistent with the degree of hazard, for backflow protection of the active distribution system.

Chlorinated water shall be retained in the system for a minimum of 24 hours, and shall produce at the end of the retention period not less than 25 PPM of chlorine in all sections of the pipeline being disinfected.

3-11.03.4 FINAL FLUSHING

Following the chlorination period of 24 hours, the newly laid line shall be thoroughly flushed to remove any foreign material. A suitable connection shall be provided by the Contractor at the end of each new line at the invert large enough to achieve a flushing velocity in the line of at least 5 feet per second.

Water shall be flushed from the line at its extremities and at all outlets until the chlorine residual of the water system being flushed is equal to or less than the distribution system level. When Calcium Hypochlorite tablets are used, the system shall be flushed thoroughly utilizing a minimum velocity of 2.5 feet per second.

3-11.03.5 BACTERIOLOGICAL TESTS

After the system has been flushed, the Contractor shall have tests conducted for chlorine residual by a State Certified Laboratory approved by the City. Should the chlorine residual in any part of the disinfected system be higher than the distribution system level, the Contractor shall repeat the flushing procedure. If the chlorine residual after flushing is equivalent to or less than the distribution system level, the Contractor may proceed with the bacteriological sampling. Samples shall be taken at the direction of the Water Services Division with at least one set of samples collected at 1,200-foot intervals along the new water main, plus one set at each dead-end main section, and at least one set from each branch (i.e., laterals 4-inch and larger). Two consecutive bacteriological samples are required for water quality evaluation. The first bacteriological sample shall be taken immediately after final flushing and the second sample shall be taken at least 24

hours later. If bacteriological test results fail to pass the requirements, the Contractor shall take corrective actions and daily bacteriological sampling shall be continued until two (2) consecutive negative samples are demonstrated. All samples shall be collected by certified laboratory personnel and tested for bacteriological quality in accordance with *Standard Methods for the Examination of Water and Wastewater*, and shall show the absence of coliform organisms.

The following tests are required to provide information for water quality evaluation:

1.) Presence/Absence of Total Coliform by any of the three methods: Multiple Tube Fermentation, Membrane Filtration or Colilert/Colisure.
2.) Heterotrophic Plate Count.

Report shall include:

a. Presence/Absence of Coliform Bacteria Count per 100 ml.
b. Heterotrophic Plate Count per ml.
c. Total and Free Chlorine Residual, taken at time of sample collection by certified laboratory personnel.

All coliform test results must be negative. The heterotrophic plate count shall be 500 or less per ml.

The results of these tests must be approved in writing by the Water Services Division's Water Inspection Supervisor prior to activating any new water facilities. Should the test results from the State certified laboratory disclose that the water from the new line does not meet the above standards, the disinfection process shall be repeated until it meets the required standards.

3-11.04 DISPOSAL OF TEST WATER

All water used in testing and disinfecting the portions of pipeline or water system component, including that used for retesting, shall be disposed of following such testing, retesting, and disinfecting by the Contractor at his sole expense. The disposal of water shall, in all cases, be carried out in compliance with the water quality objectives and discharge permit restrictions established by the California Regional Water Quality Control Board - Santa Ana Region, 3737 Main Street, Suite 500, Riverside, California 92501, Tel. (909)782-4130.

For contracts administered by the City, the Contractor will be authorized to discharge test water to the storm drain under the National Pollution Discharge Elimination System (NPDES) permit issued to the City if all requirements and procedures per such permit are followed. For all other projects, including Developer projects, Contractor or Developer shall obtain an NPDES permit and comply with that permit.

Disposal of test water or chlorinated water used for disinfection will require the Contractor to apply a reducing agent (i.e. sodium thiosulfate, or ascorbic acid, etc.) to the test water in order to neutralize residual chlorine or chloramine to meet the discharge limitation. Additionally, the flow of water from the portions of pipeline shall be controlled to prevent erosion of surrounding soil, damage to vegetation, and altering of ecological conditions in the area and shall not contribute to silt, mud, debris, or other contaminants entering storm drains or surface waters.

The Contractor's attention is directed to the portion of the pipe with a low elevation. All water used in testing and disinfecting in that portion of the pipe shall be pumped out by the Contractor, at his expense, as specified in the paragraph hereinbefore. The Contractor shall furnish and operate all necessary pumps, pipelines, valves, hoses and all other appurtenances needed for pumping out water from the said low portion.

3-12 SPECIAL CONDITIONS

3-12.01 SHEETING AND SHORING

All trench excavation shall be adequately protected to provide a safe working condition, and protection to adjacent facilities and structures. The Contractor shall work in such a manner and install such protective devices, shoring, and bracing to comply with all rules, regulations, and orders of CAL-OSHA, Division of Industrial Safety.

Prior to any trench excavation where the depth is more than five feet, the Contractor shall submit a detailed plan to the Water Services Division showing the design of shoring, bracing, sloping, or other provisions to protect the workers from the hazard of caving ground during the excavation of such trench. If the plan varies from the shoring system standards, the plan shall be prepared by a Civil or Structural Engineer registered in the State of California. No excavation shall start until the Engineer has accepted the plan and the Contractor has obtained a permit from CAL-OSHA, Division of Industrial Safety. A copy of the permit shall be submitted to the Engineer and available at the job site at all times.

Sheeting and shoring shall not place any undue strain on existing utilities or structures, nor on completed sections of construction. Sheeting and shoring may be removed during backfilling, provided adequate protection is provided at all times. The Contractor shall be responsible for any damage to existing utilities or structures due to placement, removal, or failure of any sheeting and/or shoring system. The Contractor shall repair or have repaired any damage as soon as practical.

3-12.02 JACKING OF STEEL CASING

Steel casing shall be placed at the location, elevations, and limits shown on the construction drawings. Known existing utilities shall be shown on the construction drawings. Any utilities or structures encountered which will interfere with construction shall be brought to the attention of the Water Services Division. Only new steel casing shall be used for jacking. Jacking shall be at a rate that will not over stress the casing, causing failure. Any damage to the casing during placement of the pipe shall be brought to the attention of the Water Services Division. The jacking and receiving pit shall be sheeted and shored as required by CAL-OSHA and as provided in Section 3-12.01 of these specifications. The excavated area ahead of the casing shall not be larger than 0.1 foot greater than the outside diameter of the casing. Over excavation beyond the above described limits shall be sanded or pressure grouted as directed by the Water Services Division. Sluicing or jetting ahead of the jacking casing shall not be permitted.

3-12.03 POLYETHYLENE PROTECTIVE WRAPPING

Unless otherwise noted on the plans, polyethylene protective wrapping (Polywrap) for ductile iron pipe shall be furnished and installed on all buried water lines, except where water lines are within a steel casing pipe, in accordance with the requirements of AWWA C105, Section 2-01.04 of these specifications, and as specified herein. Polywrap shall be installed so as to prevent any section of the pipe, fittings, valves, services, or appurtenances from contacting the soil.

The 'polywrap' shall be taped to provide a snug fit along the pipe. Minimum tubing size shall allow for an overlap of 12 inches; i.e., flat tube width in inches = (3.14 X Diameter) + 12 inches. An additional 3 layer wrap of polyethylene shall be made at all tapping locations a minimum of 12 inches in width. Openings for service taps, blowoffs, or similar appurtenances shall be cut in the 'polywrap' during backfilling of the trench. Corporation stops and copper service lines shall be wrapped with polyethylene protective wrapping for a minimum clear distance of 3 feet from the water main.

Any punctures, tears or other damage shall be patched with polyethylene wrap and tape in accordance with the requirements of AWWA C105 and manufacturer's instructions. Rocks or other material that could damage the wrapping shall not be included in the backfill.

3-13 DEDICATION OF IMPROVEMENTS TO THE CITY

The Water Services Division may serve temporary construction water through facilities installed by the Contractor. This use shall be permitted following written confirmations from the laboratory conducting bacteriological tests that all samples meet the requirements of the Water Services Division. This use does not constitute acceptance of these facilities by the Water Services Division.

The Water Services Division will serve domestic water through facilities installed by the Contractor after the following items are received.

1. Written confirmation from the laboratory conducting bacteriological tests that all samples meet the requirements of the Water Services Division.

2. Confirmation by the Water Services Division that all water improvements have been constructed per applicable specifications and plans. Contractor shall be responsible to maintain accurate records of any changes made during the course of construction and shall submit such information to the Water Services Division.

3. Public Utility Easements dedicated to the City, as required to gain access to public water facilities located on private property.

4. Such agreements, fees, or other items as required by the Water Services Division.

Prior to serving domestic water through the installed facilities, the Developer shall present all deeds or instruments of conveyance to the Water Services Division and shall dedicate all water system improvements intended for public use to the City.

The Contractor shall warrant the quality of all material and workmanship for a period of one year from the date of acceptance of these facilities by the City. The Contractor shall make all repairs to facilities due to defect in material or construction method. Such repair shall not be the responsibility of the Water Services Division. If the Water Services Division's representative should deem the repair of such defective work an emergency situation, the Contractor shall be held liable for all costs required to correct such defective work.

3-14 AS-BUILT DRAWINGS

The Contractor shall provide and maintain a complete, legible, and accurate As-Built record set of prints. Such prints shall be kept up to date as work progresses and shall be maintained at the job site during construction. Progress payments for City of Garden Grove projects will not be processed until the As-Built drawings are reviewed and approved by the City.

As-Built drawings shall be prepared and shall show all changes in the work constituting deviations from the original contract drawings. All conceptual or major design changes shall be approved by the City before implementing the change in the construction contract.

Upon completion of the work, all required information, dimensions and adjustments to the original contract drawings shall be submitted to the City to be transferred to the record drawings. Facilities and items to be located and verified on the record drawings shall include the following:

a. Point of connections.

b. Utility locations.

c. Water mains: where deviations along installed water mains are more than ½ foot vertically and more than 1 foot horizontally, actual location (line and grade) shall be noted on the plans at intervals of 100 feet.

d. Services: where service tie-in differs from the plan station by more than 2 feet or when meter box is not perpendicular from the main, corporation stops shall be stationed. For all service lines that have directional changes, such as in the case of cul-de-sacs, the actual installation shall be noted regardless of field changes, and shall be adequately referenced to the satisfaction of the City Inspector.

e. Any material changes, including additions, deletions and substitutions.

f. Other related facilities, as required by the City Inspector

g. Contractor shall write on all sheets where the water improvements were built per plan that the construction was made “Per Plan”.

The City’s receipt and acceptance of As-Built drawings shall be a condition precedent to the release of the Contractor’s retention/final payment. For projects constructed by Developers, the Water Services Division will not give final acceptance until approved “as-built” plans have been received.

SECTION 4 - LARGE SERVICES AND FIRE LINES

4-01 GENERAL

All services larger than 2 inches in diameter installed for the purpose of obtaining water from the public system for domestic, irrigation, commercial or industrial consumption, or for fire protection shall be defined as large services. Large services installed for the purpose of providing fire protection only shall be further defined as Fire Lines.

Unless otherwise specified on the plans approved by the Water Services Division, all materials, construction methods and controls shall conform to the applicable sections of the Water Services Division Standard Specifications (WSDSS), which this section is a part thereof, including, but not limited to, Testing, Disinfection and Flushing.

4-02 DESIGN

The Developer or his Private Engineer or Contractor shall be responsible for preparation of the necessary design drawing showing the proposed large service installation together with meter and appurtenances. The drawing shall be prepared by a Registered Professional Civil Engineer licensed by the State of California, shall be submitted to the Water Services Division for review and must be approved prior to beginning construction.

The drawing shall be prepared on an 8 ½" X 11" Standard Plan sheet furnished by the Water Services Division. The drawing shall show, but not be limited to, the following major items:

Street Name and Cross Street Name
Station from C/L of Street Intersection
Size, Type and Location of Street Main
Public and Private Utilities
Above and Below Ground Improvements and Cultures
Scale and North Arrow
Width of Street, Location of Curb, Sidewalk and Property Line
Location and Size of Proposed Assembly
For Vault installations identify Type of Vault and Cover Required (Traffic Bearing or Pedestrian)
Easement, if required
Size of Service Lateral and Meter
Reference to Standard Detail Drawings

4-03 FEES

The Water Services Division will require the payment of plan check and inspection fees concurrently with filing the application and submission of the drawing for review. A fee for checking, preparing and recording of easement documents, when applicable, will also be required prior to drawing approval. Fees shall conform to the latest revision of the User Fee Schedule prescribed by City Council resolution.

4-04 CONSTRUCTION AND INSPECTION

Upon approval by Water Services Division of the Service Application and Drawing for Large Service Installation, the Developer may proceed to award the work to a contractor of his choice.

The Contractor shall have a Class "C-34" or Engineering "A" Contractor's License valid in the State of California and shall meet all the applicable requirements of the Garden Grove Municipal Code. The Contractor shall be responsible for obtaining all construction permits and licenses as may be required by those agencies having jurisdiction over the work area.

The Contractor shall notify the Water Services Division, Inspection Section, of his intent to commence work at least five (5) working days prior to starting construction. Inspection shall be provided by Water Services Division in accordance with Section 3-01 of these specifications.

4-05 EASEMENTS

The Water Services Division will advise the Developer at the time the application and drawings are first reviewed, if an easement for water utilities is required. Should an easement be required, the Developer or his Private Engineer shall be responsible for preparing a drawing and legal description on the appropriate form. The easement drawing and description shall be prepared by a Professional Land Surveyor licensed by the State of California and shall be submitted along with a copy of the property owner's last deed of record to the Water Services Division for checking and preparation of the Easement Deed. Execution of the Easement Deed, by the property owner, shall be required prior to drawing approval. A written waiver may be requested by the owner of the property on which the easement is required. In which case, the execution of the easement deed, by the property owner, shall be required prior to final inspection and rendering of service by the Water Services Division.

4-06 METERS

All Large Service installations shall include a meter and shall be located outside of the public right of way on private property. Meters shall conform to size, type and manufacturer as shown on the Standard Drawings. Meters shall be compound type unless otherwise approved by the Water Services Division. The Water Services Division reserves the right to specify the type of meter if, in its sole opinion, a specific type of meter is best suited for the proposed application. Meters shall be provided with direct reading registers with a full circle sweep hand, a leak indication dial, and shall read in cubic feet.

Minimum registration shall be as follows for the meter sizes stated:

2-3 inch meters	CF X 10
4-8 inch meters	CF X 100
10 inch and greater	CF X 1,000

All Large Service installations, except Fire Lines, shall include provisions for a temporary bypass line per Standard Drawing B-724 or B-725. All valves and fittings on the bypass line shall be flanged and shall conform to Sections 2-05 and 2-08 of these specifications, respectively.

The Water Services Division, at its sole discretion, may require the bypass line to have OS&Y valves with handwheel operators and a permanent bypass spool. When OS&Y gate valves and spools are required by the Water Services Division on the bypass line, the hand wheel operators shall be secured in the closed position by a lock and chain.

4-07 VAULT INSTALLATIONS

All Large Services installed underground shall be installed in a concrete vault with an aluminum cover or as otherwise specified on the construction drawings. The dimensions of the vault, location of knock-out sections and the cover details shall be in strict conformance with this section and the application Detail Drawings contained in Section 6 of these specifications or as otherwise specified on the construction drawings.

The vault cover shall consist of one or two doors in one channel frame and shall open over the entire length and width of the vault. Door leaf shall be 1/4-inch aluminum diamond pattern plate to withstand a live load of 300 pounds per square foot. Channel frame shall be 1/4-inch aluminum. Door shall be equipped with heavy forged brass hinges, stainless steel pins, spring operators for easy operation, and an automatic hold open arm with release handle. A snap lock with removable handle shall be provided. Unless noted otherwise on the plans, hardware shall be mill finish with bituminous coating applied to the exterior of the frame. Stainless steel hardware may be required for installations in a highly corrosive environment. Manufacturer shall guarantee against defects in material and workmanship for

a period of at least five years.

An access ladder shall be provided for safe access in and out of vaults. An access ladder shall be constructed of Fiberglass Reinforced Plastic (FRP). The construction and installation of an FRP ladder shall meet all applicable requirements of CAL-OSHA.

All vaults installed in areas subject to incidental vehicular traffic shall be steel reinforced concrete with an aluminum cover designed to meet a minimum traffic bridge loading of H-20, as defined by the American Association of State Highway Officials. As to type, materials, and hardware, traffic covers shall conform to the requirements specified in the preceding paragraph. In certain situations, guard posts may be required to prevent vehicular traffic from passing over the vault.

When vaults are installed in areas subject to pedestrian traffic, the cover shall consist of non-skid materials as approved by the City Engineer.

4-08 THRUST RESTRAINT - VAULT INSTALLATION

A positive means of thrust restraint shall be provided on the inlet line to a vault installation so that the pipe at the last joint, prior to entering the vault, is physically restrained from movement in the direction of the vault. See Standard Plan B-713.

4-09 PAINTING - ABOVE GROUND INSTALLATIONS

After ALL Testing and Disinfection has passed, but prior to Final Acceptance by the Water Services Division, all above ground Large Service installations shall be painted in accordance with Section 2-14.

4-10 AESTHETICS - ABOVE GROUND INSTALLATIONS

Above ground Large Services shall be screened from public view by landscape plants and/ or walls as per *Utility Equipment Screening Standards and Specifications for Above-ground Equipment on Private Property* or other appropriate means as directed by the Planning Services Division. Landscape plants shall be a minimum of 15-gallon each in size, and the same type as the existing landscape plants in surrounding area to blend with the local environment. If a screen wall is proposed, landscaping including clinging vines shall be planted to soften the wall and discourage graffiti. If such wall is adjacent to a structure, the wall may also be required to be painted to match the exterior of the structure, if determined necessary by the Planning Services Division. The above ground service shall be located and shielded from view per Standard Plan B-769. Whichever method of concealment is used, it shall not obscure or hinder access to the Fire Department's pumper connection.

Within the confines established by the Fire Department, Planning Services Division and Water Services Division, the owner/developer shall locate all above ground large services in

a manner that is aesthetically pleasing. Additional conditions may be required for specific projects in order to comply with local ordinances and zoning codes. The owner/developer shall submit the location and method of screening of the above ground services to the Fire Department, Planning Services Division, and Water Services Division for review and approval.

It shall be the owner's responsibility to irrigate and maintain planted landscape screening in a healthy state and to trim and prune them such that access to the device is not impaired. If owner fails to maintain landscape plants and paint in the desired state, the City will cause such work to be performed and owner will be billed for the actual cost of performing the work plus ten percent for overhead and administration. Failure to pay for said work, when due, shall be cause for termination of service.

SECTION 5 – BACKFLOW PREVENTION

5-01 BACKFLOW PROTECTION

All water services connected to the public water system may be required to include an approved backflow prevention device of the type designated by the Water Services Division. The type of device approved shall be based on the existing or potential degree or hazard which exists, in the opinion of the Water Services Division. All devices shall be approved by the Foundation for Cross-Connection Control and Hydraulic Research, University of Southern California, Los Angeles, CA 90089-2531.

The Developer or his Contractor shall be responsible for the installation, initial test and certification of all new or relocated backflow prevention devices. Thereafter, backflow prevention devices will be maintained and tested annually by the owner or water user.

The backflow prevention device installation shall be above ground, screened from view as approved by the Planning Services Division and Water Services Division, and shall conform to Sections 4-09, 4-10 and Section 6 of these Specifications.

When an existing backflow prevention device that is located in public right-of-way needs to be replaced, the property owner shall be required to install the new device above ground on private property. Unless otherwise approved by the Water Services Division, the entire section of piping between the water main and the new device shall be replaced with new pipe. In addition, design plans for the new device, and accompanying plan check and inspection fees shall be submitted to the Water Services Division for review and approval in accordance with Section 4 of these specifications.

Backflow prevention devices shall be located above ground and as close as practical to the meter or to the street right-of-way line, and subject to approval by the Water Services Division. The entire length of underground piping from the meter or the street right-of-way line to the Backflow Prevention Device shall be backfilled with one-sack slurry 12 inches minimum thickness over the top of the pipe zone (bedding).

5-01.01 APPROVED MANUFACTURERS

Any backflow prevention devices approved by the Foundation for Cross-Connection Control and Hydraulic Research, University of Southern California, Los Angeles, CA 90089-2531, as shown on the latest edition of "List of Approved Backflow Prevention Assemblies".

5-02 FIRE LINE ASSEMBLY

All fire line assemblies shall require a detector meter and backflow protection as may be determined by the Water Services Division. All fire lines shall be installed in conformance with Section 6 of these Specifications and/or as directed by the Fire Department and Water Services. Vault installation of fire line assemblies is prohibited.

For assemblies that require a detector meter, the meter shall be 5/8 or 3/4 inch nominal size with bronze case and shall have a straight read magnetic drive register capable of detecting increments of consumptive use in one cubic foot increments.

GARDEN GROVE SANITARY DISTRICT

Design Criteria
for
Sewer Facilities

Prepared for

GARDEN GROVE SANITARY DISTRICT
Garden Grove, California

Prepared by

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Irvine, California 92618

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LIST OF STANDARD PLANS

1. STANDARD REQUIREMENTS

The design and construction of all sanitary sewer system facilities to be operated and maintained by the Garden Grove Sanitary District (GGSD or District) shall be in accordance with these Design Criteria, and the latest edition of the following:

- The Garden Grove Sanitary District Standard Plans, latest edition (GGSDSP)
- The City of Garden Grove Public Works Department Standard Plans, latest edition (GGPWSP)
- Standard Specifications for Public Works Construction (Greenbook),
- Garden Grove Sanitary District's Sewer System Management Plan,
- Statewide General Waste Discharge Requirements issued by the State Water Resources Control Board (Order No. 2006-0003)
- Requirements of the jurisdictional agencies where the work shall be performed
- Cal-OSHA requirements

2. CALCULATIONS REQUIRED

Substantiating engineering calculations for design flows; pipe size; pump, motor, generator, wet well size and appurtenant equipment selection; structural design, and bedding/backfill designs shall accompany plan submittals to the District. All calculations shall be sealed and signed by a California registered professional engineer.

Where flow from a new development or redevelopment is added to an existing sewer, and where the new development or redevelopment is in an area of questionable sewer capacity, the existing sewer shall be flow monitored by a qualified company acceptable to GGSD at the owner's cost for a minimum period of two weeks to verify the existing minimum, average, and peak dry weather flows. Two copies of the report shall be submitted to GGSD in the District's required format. The District will determine the adequacy of capacity in all the facilities that will convey the subject flow.

3. SIZE

Gravity Sewers

The minimum size gravity sewer shall be 8-inches in diameter. The Garden Grove Sanitary District may accept 6-inch diameter sewer lines if they must be used to provide adequate velocity. Sewer pipes shall not be constructed in a common trench with another utility. Adequate horizontal and vertical clearance shall be maintained in accordance with the State of California Department of Health Services "Criteria for the Separation of Water Mains and Sanitary Sewers", summarized on GGPWSP B-760, B-761, B-762, and B-763.

Force Mains

The size of sewer force mains shall be determined during the design phase of the project based upon a comparative study of the construction cost and pumping costs for several alternative sizes. In no case shall a force main be less than 4 inches in diameter. The capacity of the force main shall be the design peak flow from the pump station. The minimum design velocity for a force main shall be 3.0 fps, and maximum allowed 5.0 fps.

The discharge shall be into a manhole with a smooth flow transition to a gravity sewer. The force main terminal manhole shall be PVC lined.

All force mains shall have a tape attached to the pipe, identifying it as a sewer pipe.

4. MINIMUM AND MAXIMUM SLOPE

All sewers shall be designed and constructed to provide a mean velocity of not less than two (2) feet per second (fps) when flowing at the estimated average dry weather flow as calculated using Manning's formula with an "n" value of 0.013. Subject to the velocity limitations contained in this subsection, the slope shall be the maximum possible. Drop manholes shall not be used to reduce slopes to the minimum allowed.

The maximum allowable slope shall be the slope which generates a maximum flow velocity of 6 fps at the peak dry weather flow rate in vitrified clay pipe (VCP), and 5 fps in polyvinyl chloride pipe (PVC) as calculated using Manning's equation with an "n" value of 0.013.

The minimum slope on 6-inch sewer shall be 1% where the tributary area consists of less than 20 dwelling units (d.u.) or its flow equivalent.

Sewer pipes shall have a constant slope between the upstream and downstream manhole of each reach. Any reach of sewer containing sags of any amount shall be removed and reconstructed at the design slope at no cost to the Garden Grove Sanitary District. The total cost of inspection, administration, and retesting of improperly installed sewers shall be borne by the contractor. The Garden Grove Sanitary District shall not accept any sewer that does not meet these requirements. There shall be no exception to the proper slope requirement.

5. DESIGN FLOW CRITERIA

The average dry weather flow (Q_{adw}) rates for sewers shall be calculated using the unit flow factors contained in Table 1 and the tributary land uses. Where appropriate, and when required by the Garden Grove Sanitary District, the unit flow factors shall be evaluated by the design engineer based upon the specific land uses and densities proposed for new development or redevelopment.

Table 1
Unit Flow Factors

Land Use Designation	Land Uses	Unit Flow Factor	Units
R-1	Low Density Residential	1,450	GPD/AC
R-2	Medium Density Residential	2,750	GPD/AC
R-3	High Density Residential	3,000	GPD/AC
C-1	Neighborhood Commercial	1,500	GPD/AC
C-2	Community Commercial	1,500	GPD/AC
M-1	Light Industrial	2,000	GPD/AC
O-P	Office/Professional	1,500	GPD/AC
O-S	Open Space	10	GPD/AC
PUD	Planned Unit Development	1,000	GPD/AC
BCSP, CCSP, HCSP	Specific Plans	1,000	GPD/AC

The peak dry weather flow (Q_{pdw}) in cubic feet per second (cfs) shall be determined from Q_{adw} in cfs based upon the following equation:

$$Q_{pdw}=a\ Q_{adw}^{\ b}$$

Coefficients a and b shall be based upon a minimum of two weeks of flow monitoring where the tributary flow from a new development or redevelopment is added to an existing sewer. Where such information is not available, the following equation shall be used to determine the peak dry weather flow:

$$Q_{pdw}=2.0\ Q_{adw}^{\ 0.92}$$

The determination of the peak dry weather flow shall also consider other factors such as pumped flows and large sewer flow generators.

The peak wet weather flow (Q_{pww}) shall be based upon recorded historical information where available and applicable. Otherwise, the peak wet weather flow shall be calculated utilizing the following formula:

$$Q_{pww}=1.4\ Q_{pdw}$$

The peak dry weather flow rate in pipes 15-inches and smaller will be limited by the calculated depth to pipe diameter ratio of d/D = 0.5; and 18-inches and larger d/D = 0.62.

The pipe shall flow at a calculated depth to pipe diameter ratio of no more than 0.80 with the peak wet weather flow.

6. STANDARD LOCATION AND ALIGNMENT

In local residential and industrial streets, sewer pipes shall be located six (6) feet from the centerline of the street in the center of the driving lane. In major, primary, and secondary highways, the sewer pipes shall be located in the center of the driving lane nearest to the center of the street, but will **not** be located in the median strip or parking lanes. Any deviation from the standard location and alignment shall only be done with prior written approval of GGSD.

All-weather access roads capable of accommodating all required construction and maintenance equipment shall be provided for all sewers not located within a paved street.

In curved streets, gravity sewer mains shall be constructed in straight reaches between manholes. In no case shall the outside of the sewer main be closer than four feet to the closest curb face.

A maximum horizontal separation between sewer and domestic water mains shall be achieved by aligning the sewer on the opposite side of the street centerline from the domestic water main.

7. EASEMENTS

Permanent easements, where absolutely necessary, shall be a minimum of 30 feet in width and shall be shown on the plans. Temporary easements for construction only shall be shown on the plans including date of termination.

Where applicable, permanent public utility easements shall be recorded on the tract map, and granted to the Garden Grove Sanitary District. When applicable, separate easement documents for both permanent and temporary easements shall be prepared (on standard title company forms) and presented to the Garden Grove Sanitary District for acceptance and recording.

The District will accept sewers on private streets upon granting of a public utility easement to the District.

The District will not accept any easement for sewers if said easement cannot be accessed with a flush truck through its entire length.

Sewer easement shall be located entirely on one lot. Building set backs shall be minimum 20 feet from easement edges.

8. HORIZONTAL CURVES

Gravity sewer mains shall **not** be designed with horizontal curves.

9. STATIONING PROCEDURE

Centerline stations for sewers shall be shown on the plans. Sewer centerline stations shall be independent of street stationing. All manholes shall be numbered and the numbers noted on the plans (example: MH #1). Sewer stations shall start at 1+00.00 at the downstream point of connection and increase upstream to the last manhole on a sewer line. Intersecting sewer lines will be independently stationed from their downstream point of connection and increase upstream to the last manhole. Each line shall be independently labeled for identification as “Sewer Line A”, “Sewer Line B”, etc.

10. MINIMUM DEPTH

Minimum depth of cover from finish street grade to the top of sewer main pipe shall be seven (7) feet unless otherwise approved by the District Engineer.

Unless dictated otherwise by the elevation of an existing mainline sewer, house connections shall be installed so that there is a minimum of six (6) feet of cover from the top of the curb to the top of the pipe at the curb line. At the time of construction, stakes shall be provided for location and grade of each house connection.

11. SEWER PIPE MATERIAL

All gravity sewers shall be either extra strength VCP or SDR-26 PVC. Imperfections **shall not be allowed** in either type of pipe. Sewer service laterals shall be of the same material as the main line sewer-either extra strength VCP or SDR-26 PVC pipe.

All sewer force mains carrying domestic sewage and operating at pressures of less than 40 psi shall be PVC pipe meeting AWWA C-900 Class 200 pipe standards. All other force mains shall be 40 mil ceramic epoxy lined and properly coated ductile iron pipe.

All gravity sewers in industrially zoned areas or major commercial areas shall be extra strength VCP.

12. MANHOLES

12.1 Manhole Requirements

A manhole will be required at:

A. The upstream end of each line, change in grade or size, change in alignment, or intersection of two (2) or more sewers

B. At a lateral when it is the same size as the main line sewer

C. Along the sewer main at maximum distances of 300 feet for 6-inch sewers, 400 feet for 8-inch and larger sewers.

12.2 Manhole Type and Size

Manholes shall be precast reinforced concrete with eccentric cone in accordance with Garden Grove Sanitary District Standard Drawings S-100 through S-104. The summit manholes shall be precast reinforced concrete with concentric cone. Minimum diameter shall be 48 inches and larger sizes shall be required as shown in the following table:

Manhole Sizes

Sewer Main (inches)	Maximum Branch Size (inches)	Manhole Size (inches)	Frame and Cover (inches)
8-15	10	48	30
18-21	12	60	30
24-36	15	72	36

Extra Depth Requirements

Depth of Cover (feet)	Manhole Size (inches)
6 or less	60
6.5-12	48
12.5-16	60
16.5 and greater	72

All manholes shall be provided with at least all-weather vehicular access.

12.3 Manhole Covers

Manhole covers shall be cast iron in accordance with Garden Grove Sanitary District Standard Drawing S-103. The size shall be determined from the table in Section 12.2. Manhole covers shall have one (1) vent hole and one (1) pick hole.

Temporary covers may be necessary in new streets. In these cases, the manhole shaft shall be left six (6) inches, minimum, below subgrade. A heavy metal plate acceptable to the District Engineer shall be provided to cover the manhole opening. Cleats shall be provided in at least four (4) points for the underside of the temporary cover to prevent the temporary cover from moving. These cleats shall extend a minimum of 3 inches from the cover plate and shall be welded to the plate.

Plywood shall be cut to the shape and size of the manhole base and placed in the base before the temporary cover is placed on the shaft. At the completion of final paving, each manhole shall be raised to final grade by the installation of grade rings, as necessary, and the installation of the permanent frame and cover assembly. Plywood shall be removed from the manhole when the permanent frame and cover assembly is installed.

12.4 Manhole Linings and Coatings

The following manholes will be lined with PVC:

A. If the sewer has a slope of 5% or greater, all the manholes on the sewer

B. Where there is a change in slope, from steep to flat, of 3% or greater, the manhole at the grade change and the next manhole upstream

C. All force main terminal manholes

E. As required by the District Engineer

The approved PVC liners are Ameron T-Lock liner and Koroseal Lok-Rib by B. F. Goodrich. Refer to Orange County Sanitation District Standard Drawing S-065 for PVC liner details.

All other manholes shall be lined with Sancon 100 or equal.

Outer surfaces of precast and cast-in-place manholes and structures shall be given two coats of bituminous dampproofing applied at a rate in accordance with manufacturer's instructions. In no case shall the total bituminous coating be less than 16 mil dry film thickness.

12.5 Manhole Warning Signs

The entrance to every new manhole shall be fitted with a plastic warning sign, located 12 inches below the top of the manhole frame, with the inscription "CAUTION – VENTILATE BEFORE ENTERING" in letters no smaller than ½-inch in height. The sign shall be attached to the concrete with four Type 316 stainless steel screws and anchors. Signs shall be manufactured by W.H. Brady Company; Seton Nameplate Corporation, or equal.

13. CLEAN-OUTS

Use of clean-outs as shown in the Garden Grove Sanitary District Drawing S-105 shall be limited to the following instances unless approved otherwise by the District Engineer.

A. At the upstream end of short sections of sewer, less than 250 feet which will be extended within three months.

B. All sewer laterals at the property owner's side of the property line.

C. Special instances such as on a sewer lateral to a single family residential lot where the dwelling unit is set back more than 100 feet from the property line, where there is a large slope up to the building pad from the property line and a grade change in the

lateral is necessary, or where the sewer lateral enters the rear of the lot from a public right-of-way.

D. On a lateral where the overflow level of the lowest wastewater fixture in the building is below the rim elevation of the uphill sewer manhole on the main line. In this situation the rim elevation of the clean-out installed at the property line shall be at least 6-inches below the overflow elevation of the lowest wastewater fixture on the lateral. A backflow prevention device is required on the lateral.

14. SEPARATION BETWEEN SEWER AND WATER AND RECYCLED WATER LINES

Horizontal and vertical separation between sewer mains and water and reclaimed water lines will be provided in accordance with the State of California Department of Heath Services "Criteria for Separation of Water mains and Sanitary Sewers" and GGSD Standard Drawing No. S-118.

15. HOUSE LATERALS

Sewer laterals shall be constructed to the property line from the main line and there shall be a separate lateral for each individually owned building.

Sewer laterals shall have a minimum 4-inch diameter. Apartment and condominium developments shall have at least one (1) 6-inch, or one (1) 8-inch lateral to serve each building in the development which contains more than one dwelling unit.

Laterals shall have a minimum slope of 2%.

Laterals shall be located at the center of each lot and shall be constructed perpendicular or radial to the property line. If the developer must install a sewer lateral at a location other than in the center of a lot due to unavoidable interference, the improvement plans shall indicate the centerline station of the lateral on the sewer and show the distance from a property corner. In no case shall a sewer lateral be located within 12 feet of a property corner. Refer to Section 13 and Standard Plan S-105 for cleanouts on laterals.

Permanent visible monuments shall be set to indicate the locations of all sewer laterals. A 1½-inch high "S" shall be chiseled in face of curb where the lateral crosses under the curb or on the edge of alleys without curbs. The method used shall be indicated on the plans. A licensed Civil Engineer or Land Surveyor shall verify locations of set monuments.

The sewer laterals from the main to the building, and inside the buildings are governed by the Uniform Plumbing Code and enforced by the City of Garden Grove Building Official.

The sewer house laterals between the main sewer line and the property line are owned by the property owner, and **NOT** by the Garden Grove Sanitary District.

16. PRIVATE SEWER SYSTEMS

All plans submitted for review and approval for commercial/industrial developments and residential developments with private sewer systems shall show the plans, profiles, and details of private onsite sewer systems. The private sewer systems shall be planned,

designed, and constructed to the same standards as the Garden Grove Sanitary District's public sewer system.

Sewer pump stations on private property shall be designed, administered, and inspected by the Garden Grove Sanitary District or its designated representative. The private property owner shall be responsible for all costs associated with such design, administration, and inspection.

Each site shall be reviewed on an individual basis at the time plans are submitted. As a condition of service, the Garden Grove Sanitary District shall require the property owner to enter into an agreement with the District acknowledging that the onsite facilities are private and shall be properly maintained according to industry standards and the State Water Resources Control Board's General Waste Discharge Requirements 2006-0003. The property owner shall further agree to hold the District and the City of Garden Grove harmless from any claims on the design, maintenance and operation of the private onsite systems. The property owner shall prepare an Overflow Emergency Response Plan and a Preventative Maintenance Plan as required by Order No. 2006-0003.

All onsite sewer collection systems for commercial/industrial developments shall be private and shall be owned, operated and maintained by the property owner up to the District's sewer line in a public street. A cleanout or manhole shall be installed at the owner's side of the property line in accordance with District Standard Plans S-105 or S-100 through S-104. Each building onsite shall have an individual sewer lateral with a monitoring manhole. Monitoring manholes shall be installed in accordance with District criteria. All laterals from a building shall be connected to the main lateral upstream of the monitoring manhole for that building. No lateral connections are to be made downstream of the monitoring manhole.

17. SEWER PUMP STATIONS

17.1 General

All sewer pump stations conveying wastewater flows to the Garden Grove Sanitary District's collection system, including those from private systems, shall be designed, administered, and inspected by the Garden Grove Sanitary District, or its authorized representative.

The general criteria outlined herein shall apply to all sewer pump stations. The detailed design criteria for each sewer pump station will be established based upon the specific conditions of each installation on a case-by-case basis and documented in a preliminary design report. Sewer pump stations shall be designed according to the following criteria:

Small sewer pump stations, where the peak wet weather flow can be pumped with a maximum of two duty pumps of 1,500 gpm capacity, shall be the stainless steel slide-rail submersible type with a minimum of two recessed impeller or enclosed screw impeller centrifugal pumps, permanent standby generator/automatic transfer switch, and peak flow storage.

Larger sewer pump stations shall be wet well-dry well type with permanent standby generator/automatic transfer switch, and peak flow storage. The District Engineer may allow slide rail submersible pump stations if project conditions warrant it. Pumps shall be either the recessed impeller, or enclosed screw impeller type, as determined by the District Engineer.

17.2 Standards and Codes

Sewer pump station designs shall be based upon current codes and standards, including but not limited to:

- Statewide General Waste Discharge Requirements covered under Order No. 2006-0003 issued by the State Water Resources Control Board on May 2, 2006
- Hydraulic Institute Standards
- California Administrative Code, Title 8, Article 59-Electrical Safety Orders
- National Electrical Code
- NFPA 820 Fire Protection in Wastewater Treatment Plant and Collection System Facilities
- Uniform Building Code
- Uniform Plumbing Code
- Uniform Mechanical Code
- California Fire Code
- National Electrical Manufacturers Association (NEMA)
- American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE)
- Standard Specifications for Public Works Construction
- Standard Plans for Public Works Construction
- OSHA Construction Safety Orders
- American Water Works Association
- American Society for Testing Materials

17.3 Design Flows and Heads

The pump stations shall be designed with a firm pumping capacity equaling the greater of:

- Tributary peak wet weather flow
- Flow that will provide a minimum velocity of 3 fps in the force main.

The standby pump will have the same capacity as the largest pump in the pump station.

In selecting the number, capacity, and operating characteristics of the pumps, the minimum, average, peak dry weather and peak wet weather flows, as well as wet well size and operating band shall be considered. The selected design shall minimize pump cycling and odors.

The total dynamic head (the sum of static lift, velocity head, and frictional losses in the station piping/ valving and force main) shall be determined for all operating conditions, wet

well and discharge point water surface elevations, and a range of frictional coefficients (Hazen Williams C factor of 80 to 150).

Calculations documenting the determination of flows and head calculations shall be submitted along with pump curves and catalog information for the recommended pumps. Prior to final acceptance, the design engineer shall obtain written verification from the recommended pump manufacturers that the selected pumps shall perform throughout their operating range as designed at the published efficiencies free from cavitation, vibration, and premature failure.

17.4 Drivers

The pumps shall be driven by submersible or vertical dry pit immersible motors. All motors shall be Factory Mutual (FM) or Underwriters Laboratories, Inc. (UL) listed explosion proof type. Motors operated by variable frequency drives shall be inverter duty motors. Nameplate horsepower shall be at least 20 percent greater than the maximum brake horsepower needed within the operating range of the pump.

Variable frequency drives shall be provided with bypass contactors to operate the pumps at full speed.

Small pump stations may be designed with constant speed pumps. Larger pump stations may require the use of variable speed drives. The decision of the District Engineer of the Garden Grove Sanitary District shall be final as to the type of driver to be used.

17.5 Wet Well

The wet well shall be sized to

- Provide adequate submergence
- Provide adequate net positive suction head available (NPSHA)
- Prevent frequent pump cycling
- Provide emergency storage

Submergence provided shall prevent formation of vortices and air being drawn into the pump. It shall also prevent cavitation. The minimum submergence shall be at least one foot greater than that required by the pump manufacturer.

The net positive suction head available shall be calculated as:

$$NPSHA=2.24\ (P_a-P_v)-H_l \pm Z$$

Where

P_a= Atmospheric pressure (psia)

P_v= Vapor Pressure of liquid at the maximum expected temperature (use 0.59 psia)

H_l= Friction and minor losses between the wet well and the pump suction flange in feet of liquid

Z= Difference in elevation between the minimum wet well water level and pump datum, in feet. Use – when the pump datum is higher than the minimum wet well water level.

The minimum NPSHA shall be at least eight feet greater than the net positive suction head required (NPSHR) by the selected pump for the maximum expected flow through the pump.

The wet well shall be sized to provide the storage capacity which will preclude exceeding the following number of pump starts per hour:

Motor Horsepower	Maximum Starts per Hour	Minimum Cycling Time (Minutes)
Up to 20	6	10
25 to 50	4	15
60 to 75	3	20
100 and larger	2	30

Wet well bottom corners shall be sloped at 1:1 and slope to the suction pipe inlet to prevent the accumulation of debris on the wet well floor.

Influent pipe(s) shall not enter the wet well in a position which may cause pre-rotation of the flow into the pump suction, and turbulence in the wet well. The influent velocity into the wet well shall be no greater than three (3) feet per second.

For large pump stations, a partition wall(s) with sluice gates may be required to isolate a portion of the wet well for cleaning.

17.6 Emergency Storage

Emergency storage volume needed shall be evaluated for each pump station based upon the tributary area and expected ultimate wastewater flows. The minimum volume of emergency storage shall be 30 minutes of ultimate peak wet weather flow without surcharging the tributary collection system. The emergency storage volume may be provided in the wet well or in a separate adjacent PVC lined overflow structure.

Where possible, the invert of the overflow structure shall be higher than the low water elevation of the pump station wet well to allow gravity drainage of the stored sewage to the wet well. There shall be a minimum of two connecting pipes between the overflow structure and the wet well. The connecting pipes shall be equipped with flap gates on the wet well side. The floor of the overflow structure shall slope to the connecting pipes.

All overflow structures shall be equipped with an access hatch, and three 30-inch diameter maintenance access holes. A 2-1/2 inch hydrant water connection shall be provided near the overflow structure for use in periodic cleaning. The water supply to the hydrant water connection shall have a reduced pressure backflow preventer.

The higher of the maximum storage level and overflow level shall be set at least one foot (1-ft) lower than the top of the lowest manhole in the system, basement or p-trap of the plumbing fixture connected to the system.

17.7 Dry Well

The dry well shall meet the following criteria:

A. Pumps shall be placed to provide minimum clear space of 3'-6"

B. The lowest level of the pump station dry well shall have a sump pit with duplex explosion proof submersible pumps controlled by float switches. The sump pumps shall discharge to the wet well above the maximum water level.

C. Discharge piping and the force main shall be placed in the dry well along the common wall with the wet well. The flow meter shall be placed inside the dry well sufficiently downstream of the last pump discharge pipe. If there is not sufficient room, the flow meter shall be placed in a below grade vault adjacent to the pump station structure.

D. Catwalks or mezzanine levels shall be provided to access the flow meters, valves, and other portions of the equipment

17.8 Standby Equipment

All pump stations shall have standby equipment capable of handling the ultimate peak wet weather flow during a commercial power outage and/or with the largest unit out of service. This criterion shall apply to all essential electrical and mechanical equipment including pumps/motors, fans, air compressors and sump pumps.

There shall be a minimum of one **standby main sewage pump** equal in size to the largest duty main sewage pump in the station.

All pump stations shall have a **permanent standby generator** and an **automatic transfer switch** sized to start and operate all the sewage pumps needed for ultimate peak wet weather flow, sump pump, ventilation fans, lighting, instrumentation, controls, and telemetry, with voltage dip not to exceed 16% when starting any motor.

Generators shall be skid mounted, permanently anchored to the foundation, and housed in an acoustically insulated enclosure. Exhaust mufflers shall be super critical grade designed for noise level not to exceed the noise level allowed within each particular area.

Load banks sized for 80% of the generator capacity shall be provided. Load banks shall be mounted in the vicinity of the generator and protected with adequate enclosure suitable for the location as required by NEMA Standards.

Portable trailer mounted generators are acceptable only for locations where installation of a permanent skid-mounted generator is not feasible. When a portable trailer mounted generator is furnished, a power receptacle shall be permanently installed for quick connection.

Standby generators shall be furnished with battery chargers and block heaters.

The standby generator shall be a diesel or natural gas powered generator. The diesel fuel powered generators shall be equipped with a sub-base fuel tank sized for a minimum of 12

hours of continuous full load operation. Standby generators shall be units pre-approved by the South Coast Air Quality Management District.

17.9 Pumps

Pumps shall be the enclosed screw-centrifugal or recessed impeller type. Wet well-dry well pumps shall be suitable for operation when the dry well is flooded. Pumping capacity and head shall be considered in the selection of the type of pump for the wet well-dry well pump stations.

RECESSED IMPELLER CENTRIFUGAL PUMPS

Recessed impeller centrifugal pumps are designed to handle stringy materials and up to 25 times the amount of solids of conventional non-clog pumps. Some recessed impellers are labeled by pump manufacturers as torque-flow, bladeless and sphere flow. However, all of these pump models follow the general design of placing the impeller away from the fluid stream in order to pass stringy material without clogging the hydraulic passages.

The recommended minimum design criteria in the selection of recessed impeller centrifugal pumps are as follows:

a. Pump impeller shall be selected with the best possible efficiency at design point or at the operating range of the pump.

b. Maximum Speed

1750 rpm or shall not exceed the limitation as recommended by the Hydraulic Institute Standards for Centrifugal Pump application

c. Materials of Construction

- NiHard (minimum of 550 Brinnell hardness) or stainless steel Type 316 impeller with a removable wear plate of the same material as the impeller
- NiHard (minimum of 550 Brinnell hardness) or cast iron casing, as determined by the District Engineer.
- Stainless steel Type 316 shaft.
- Tandem mechanical shaft seal system for the motor with two totally independent seal assemblies and Tungsten-Carbide seal faces

d. Upper and Lower Bearings

Radial and thrust bearings, grease lubricated with minimum B-10 bearing life of 60,000 hours for the operating range of the pump.

e. Slide Away Coupling

Foot mounted discharge elbow and adaptor, base plate, upper and lower rail supports, lifting yoke, and cable. All metal to metal interfaces where movement may occur shall be non-sparking.

f. Electric Motor

- For wet well installation, motors shall be FM or UL listed, and be designed for Class I, Group D, Division 1 explosion proof.
- NEMA Design B, heavy duty, high efficiency, non-overloading, with a nameplate horsepower at least 20% greater than the maximum horsepower required over the entire operating range.
- Thermal overload protectors imbedded in the motor windings.
- Dual moisture or leak sensors on the sealing chamber.

- Motors shall be immersible capable of operating continuously in air without the use of sewage pumped for cooling if installed in a dry well.
- Motors in damp locations and dry pits shall have two cycles of solid baked epoxy vacuum impregnation.
- Motors shall be inverter duty if operated by variable frequency drives.

g. Painting and Coating

All non-stainless steel wetted surfaces in contact with wastewater shall be coated with coal tar epoxy enamel. Surface preparation shall be in accordance with SSPC-SP5, white metal blast cleaning. Prime coat to DFT=l.5 mils, Amercoat 71, Engard 422 or equal. Two or more coats, DFT=16 mils, Amercoat 78HB, Engard 464 or equal. Total system DFT=17.5 mils.

All non-stainless steel external surfaces exposed to corrosive environment shall be coated and painted by amine-cured epoxy. Surface preparation shall be in accordance with alkaline cleaned, SSPC-SP1. Prime coat and finish coat shall be three or more, DFT=16 mils. Amercoat 395, Engard 480 or equal.

SCREW-CENTRIFUGAL PUMPS

The recommended minimum design criteria in the selection of the screw-centrifugal pumps are as follows:

a. Pump impeller shall be selected with the best possible efficiency at design point or at the operating range of the pump.

b. Maximum Speed

- 1750 rpm for pumps with discharge nozzle diameter up to 12-inch,
- 1175 rpm for pumps with discharge nozzle diameter from 14 to 16-inch,
- Shall not exceed the speed limitation recommended by the Hydraulic Institute Standards for Centrifugal Pumps.

c. Materials of Construction

- Cast iron with Hi Chrome suction liner or 316 Stainless steel where available
- Stainless steel Type 316 impeller and shaft.
- Tandem mechanical shaft seal system for the motor with two totally independent seal assemblies and Tungsten-Carbide seal faces and silicone carbide lower seal
- Minimum B-10 bearing life of 60,000 hours for the operating range of the pump.

d. Electric Motor

- For wet well installation, motors shall be FM or UL listed, and be designed for Class I, Group D, Division 1 explosion proof.
- Thermal overload protectors imbedded in the motor windings.
- Dual moisture or leak sensors on the sealing chamber.
- Motors shall be NEMA Design B, heavy-duty, high efficiency with Class B or F insulation. Motors shall be non-overloading over the entire operating range, with a nameplate horsepower rating a minimum of 20

percent greater than the maximum horsepower required over the operating range.

- Motors located in a damp environment and in a dry pit shall have 2 cycles of solid baked epoxy vacuum impregnation.
- Motors shall be inverter duty if operated by variable frequency drives.
- Motors shall be immersible, capable of operating continuously in air without the use of sewage pumped for cooling if installed in a dry well.

e. Painting and Coating

All non-stainless steel wetted surfaces in contact with wastewater shall be coated with coal tar epoxy enamel. Surface preparation shall be in accordance with SSPC-SP5, white metal blast cleaning. Prime coat to DFT=1.5 mils, Amercoat 71, Engard 422 or equal. Two or more coats, DFT=16 rails, Amercoat 78HB, Engard 464 or equal. Total system DFT=17.5 mils.

Non-stainless steel external surface exposed to corrosive environment shall be coated and painted by amine cured epoxy. Surface preparation shall be in accordance with alkaline cleaned, SSPC-SP1. Prime coat and finish coat shall be three or more, DFT=16 mils. Amercoat 395, Engard 480 or equal.

17.10 Valves and Gates

Pump stations are equipped with various types of valves to prevent backflow, to isolate the equipment from the system, to control hydraulic surges and to drain the piping system during scheduled repair and maintenance. Each valve type differs in construction, materials, and operation depending on the service and application. All valves shall be suitable for wastewater service.

All interior surfaces of valves in contact with wastewater shall be epoxy coated. All valves 10-inch diameter and larger shall be provided with motor operators. Manually operated valves located more than six feet above the operating floor shall be equipped with chain wheel operators, with the chain extended 36 inches above finish floor. Motor operated valves shall be provided with a manual hand wheel and manual push button station conveniently located below the valve, 5 feet above finished floor.

SLUICE GATES

Sluice gates shall be furnished with stainless steel frames and slides with embedded bronze seats, Type 316 stainless steel stem, and adjustable bronze bushed stem guides. Sluice gate manual operator shall have AWWA square nut; manual crank operator with floor stand and 2-speed gear reducer designed for opening time of not to exceed six minutes. Motor operator shall be provided when required by the District Engineer. Motor operated gates shall be designed for opening and closing times of one foot per minute.

Sluice gates shall be specified to be furnished with pattern wall thimbles to match the concrete thickness where the gate is to be installed.

Sluice gates shall be Rodney Hunt or approved equal.

ECCENTRIC PLUG VALVES

Non-lubricated eccentric plug valves shall be used as isolation valves. Valves shall have hard rubber (suitable for sewage service) resilient faced plugs and flanged ends. Valve seats and discs shall be stainless steel, Type 316. Bodies shall be semi-steel with raised seats. Valves shall be of the bolted bonnet design. Valve design shall allow repacking without removing the bonnet, and the packing shall be adjustable. All exposed nuts, bolts, springs, and washers shall be stainless steel, Type 316. Valves shall have permanently lubricated stainless steel bearings in the upper and lower plugstem journals.

Manual valves shall have a 2-inch square nut and lever actuator. Levers shall be field cut as required to be operable in their installed locations.

Eccentric plug valves may be used as pump control valve to alleviate hydraulic surges during normal starting and stopping of the pumps and as surge anticipators when required. These valves shall have hydraulic cylinder type operators with adjustable opening and closing times. Where the valve is used as a surge relief valve, emergency (upon failure of power supply) opening and closing times shall be specified.

Where space permits, all eccentric plug valves shall be installed with the shaft in the horizontal position. The orientation of the plug with respect to the fluid flow direction shall be as recommended by the manufacturer. The valve manufacturer's recommended installation instructions to prevent clogging of the valves during extended shutdown periods shall be strictly followed.

Valves shall have unobstructed port area of not less than 80-percent of total pipe area.

Eccentric plug valves shall be as manufactured by DeZurik Corporation, Keystone, Drum-Owens (Homestead), Milliken, or approved equal.

BALL VALVES

When required by the District Engineer, ball valves shall be used as pump control valves or for surge relief where flow characteristics require the valve trim that would match that of the ball valves.

Small diameter ball valves (3/4 inch to 2-1/2 inch diameter) shall be used as isolation shut off valves for potable or pump station water system.

All ball valves shall be in accordance with ANSI/AWWA C 507, with cast iron, ductile iron, cast steel, or stainless steel bodies, support legs or pads, flange ends, suitable for velocities up to 35 fps, temperatures up to 125 degrees F, and design pressures to 150, or 250 psi depending on the pressure range required by the system. The balls shall be cast iron, ductile iron, cast steel or stainless steel, shaft or trunion-mounted, with tight shut-off, single or double seat, and full bore. The valves shall be rubber, with stainless steel or monel shafts, and at least one thrust bearing. Except for stainless steel, ferrous surfaces of valves in contact with wastewater shall be minimum 16 mil epoxy-coated.

Ball valves shall be as manufactured by Jamesbury Corporation, Wm. Powell Company, or approved equal.

CHECK VALVES

Check valves shall be installed at each pump discharge piping to prevent backflow of wastewater which can cause severe damage to the pump impeller and shaft, and recirculation of flows back to the wet well in stations with multiple pumps. Valves shall comply with the requirements of AWWA C508.

Check valves shall be the outside lever and weight type swing check valves. They shall be installed in the horizontal position to prevent accumulation of solids downstream of the valve which can cause clogging of the valves.

Swing check valves shall have a flanged cover piece to provide access to the disc. The valve body, cover, and disk shall be cast iron conforming to ASTM A 126 Grade B. Disc facing shall be rubber conforming to ASTM D2000 2BG715. Seat ring and clapper arm shall be cast bronze conforming to ASTM B584 Alloy C 84400. Clapper arm shall be clamped to the hinge pin with stainless steel screws and jam nuts.

Ferrous surfaces of valves in contact with wastewater shall be minimum 16 mil epoxy coated.

Swing check valves shall be as manufactured by APCO (Valve and Primer Corp.), Kennedy, Crane Company, or approved equal.

SEWAGE SURGE RELIEF VALVES

The necessity for surge control devices shall be determined through a complete surge analysis of the pumping system. Although surge tanks are the most reliable means to alleviate damaging surges in the force mains, sewage surge relief valves may be required by the system. Where surge relief valves are required, the valve shall be installed in the discharge piping manifold and connected to the wet well. The valve shall be designed to open immediately when the system pressure exceeds the load setting of the counterweights and shall close slowly at an adjustable speed upon return of system pressure to normal.

The surge relief valve body shall be constructed of a heavy cast-iron or cast steel disc having rubber seating face; and corrosion resistant shaft and cushion chamber.

Sewage surge relief valves shall be as manufactured by APCO (Valve and Primer Corporation), Empire Specialty Co., Inc, or approved equal.

SEWAGE AIR RELEASE VALVES

Sewage air release valves shall **not** be used unless **absolutely necessary**. The design engineer shall endeavor to provide a system which rises continuously from the pump station to the discharge point. Where absolutely necessary, sewage air release valves shall be provided to vent accumulating air or gas during pumping operation or entrapped during initial operation. Air release valves shall be installed at high points of the piping systems. Entrapped air or gases can reduce pumping capacity of the pumping system or cause corrosion of the piping system with gases containing hydrogen sulfide. The air or gas vent located at the pump station plant shall be discharged to the wet well.

The valves shall have long float stems and bodies to minimize clogging. Each valve shall be furnished with backwashing accessories to remove solids accumulated inside the valve. Water supply and connection shall be provided with appropriate reduced pressure backflow preventer near the valve for backwashing.

Sewage air release valves shall be as manufactured by APCO (Valve and Primer Corporation), Val-Matic (Valve Manufacturing Corporation), or approved equal.

REDUCED PRESSURE BACKFLOW PREVENTERS

Backflow preventers shall be installed where utility water or plant water is connected to the potable water supply to prevent contamination of the potable water system. The valves shall be designed to operate on the reduced pressure principle. The valve assembly shall consist of two spring loaded check valves, automatic differential pressure relief valve, drain valves and shut-off valves. The body materials shall be bronze for working pressure of not less than 150 psi, with bronze and stainless steel trim. Drain lines and air gaps shall be provided. All backflow preventers shall be registered with County Health Department and must be approved for use in the Garden Grove Sanitary District.

Backflow prevention valves shall be as manufactured by Cla-Val Company or Febco.

PUMP CONTROL VALVES

The pump control valves shall be installed in the pump discharge pipe to minimize hydraulic surges during normal starting, stopping and emergency stopping of the pump during power failure or emergency stopping caused by system failures.

The pump control valve shall be operated by hydraulic (oil) or pneumatic operator with a reserve accumulator system as back-up energy source to operate the valve during power failure. The pump control system shall be designed to start the pump against a closed valve. Once the pump has developed pressure, the pump control valve shall start to open until it reaches the maximum open position. Stopping sequence shall cause the pump control valve to close. Complete closure of the valve shall signal the pump to stop. Emergency power failure shall cause the pump control valve to close.

The normal opening, closing, and emergency closing times of the pump control valve shall be independently adjustable. Range of adjustment shall be determined based upon the results of surge analysis. Final settings of closing and opening times shall be verified during pump station start-up. Settings shall be included in the Operation and Maintenance Manual.

17.11 Magnetic Flow Meters

Each pump station shall be equipped with metering equipment to measure outlet flow and provide flow signal for recording, totalizing and control of other equipment. In addition, the flow meter shall be used for pump field performance test to measure capacity and efficiency. The meter shall be magnetic type suitable for wastewater service.

Magnetic flow meters shall be provided at the pump station discharge manifold capable of metering the full range of flow with an accuracy of ±1 percent of flow rate from 10 to 100 percent of scale. At a velocity below 1 foot per second, the accuracy shall be ±0.1 percent

of the full scale. The meter shall be installed in the piping manifold with minimum straight approach of 4 and 2 diameters upstream and downstream respectively.

The size of the flow meter shall be selected to cover the entire velocity range expected.

The magnetic flow meter shall utilize characterized electromagnetic induction to produce a voltage linearly proportional to the average flow rate. The metering system shall consist of a sensor with field coils, transmitter and interconnecting cables to make a complete operating flow metering system. The meter shall be bipolar pulsed dc type with continuous automatic zeroing.

The sensor shall be flange tube with non-conductive liner. The tube shall be constructed of Type 316 stainless steel with carbon steel flanges AWWA Class D if the coils are external to the tube. The sensor rating shall be NEMA 4, and capable of withstanding accidental submergence in water to a depth of 30 feet for 48 hours. The meter shall include a positive zero feature for periods when the metering portion of the process pipe is not full.

Liner material shall be neoprene, except for liquids which may deposit non-conductive coatings, which shall have Teflon linings. The specific conductivity of the liquid shall not preclude meter operation.

Grounding electrodes shall be of the same material as the sensing electrodes and shall be furnished mounted on each end of all flanges.

Transmitters shall be provided for either local or remote indication as required for each particular project. Remote transmitters shall be NEMA-4X enclosures suitable for wall mounting. Transmitters shall produce a 4-20 ma-dc output signal into a minimum load of 800 ohms linear flow, and a scaled pulse for totalization. All electrical equipment furnished with the magnetic flow meter shall carry a UL label.

Magnetic flow meters shall be Tigermag manufactured by Sparling Instrument Co., Inc. or approved equal.

17.12 Piping and Support System

The pump station piping and supports system consists of the gravity sewer, pump suction and discharge piping, station water or utility water piping, potable water piping, air piping, sanitary drainage piping, fire protection, and sprinkler piping systems. Most of these piping systems are adequately specified by the applicable sections of the Uniform Plumbing Code, Fire Codes and the Standard Specifications for Public Works Construction.

This Section includes special requirements and recommended practices involving the design of piping and the support system.

A. Piping

1. Materials

Ductile iron pipe shall be used in pump station main piping, consisting of suction and discharge piping, discharge manifolds, force mains as specified in Section 11, and water piping 2-1/2 inch and larger. Ductile iron pipe shall

be in accordance with SSPWC, and ANSI A21.5l (AWWA C151). All internal surfaces of ductile iron pipe and fittings for water service shall be cement mortar lined and sealed with bituminous coating in conformance with AWWA C104. Internal surfaces of ductile iron pipe for sewer service shall be lined with polyurethane or glass.

Unless otherwise specified, all joints of ductile iron pipe shall be 125-lb flange in conformance with ANSI B16.1, B16.2 and A21.10 (AWWA C110). Sleeve or mechanical grooved type couplings shall be provided at the suction and discharge piping of the pump, and between the magnetic flow meter and the isolation valves to allow removal of the equipment for maintenance.

All bolts shall be of Type 316 stainless steel with bronze nuts or cap screws of copper—copper silicon alloy, conforming to ASTM B 98, Alloy C 65100, designation H04, or alloy C 65500, designation H04. Where anaerobic conditions are anticipated, Type 304 stainless steel shall be used.

Mechanical-type couplings (grooved) shall be used between the valves, pumps, meters and the piping system for the above ground installation. Groove type couplings shall not be used for underground installation. Mechanical-type couplings shall be cast as manufactured by Victaulic, Gustin Bacon or equal.

Sleeve-type couplings shall be of fabricated steel with steel bolts and with sizes to fit outside diameter of the ductile iron pipe. The middle ring shall not be less than 1/4-inch in thickness and minimum of 5 to 7-inches long. The follower shall be single piece contoured mill section welded and cold-expanded as required for the middle rings. The coupling shall be equipped with a gasket to make the joint water-tight. The coupling shall be factory epoxy coated suitable for sewer service.

Sleeve couplings shall be installed in the piping systems subject to differential settlement as in the force main that connects the piping inside the pump station building to the yard piping. Two sets of sleeve couplings shall be installed with spacing as recommended by the coupling manufacturer.

Where sleeve couplings are installed in the piping system subject to thrust loads, the coupling shall be provided with restraining bolts. The bolts shall be designed in conformance with AWWA Design Manual M-11.

Sleeve-type couplings shall be as manufactured by Rockwell (Smith-Blair), or Dresser.

2. Suction Pipe

The suction pipe shall meet the following requirements:

a. The suction pipe shall be sized to provide a minimum velocity of 3 feet per second, and a maximum velocity of 6 feet per second throughout the operational range of the pump.

b. The inlet velocity to the eye of the impeller shall meet the pump manufacturer's requirements. The largest suction inlet available shall be selected.

c. The suction pipe shall be flat, or slope up to the pump to eliminate the formation of air pockets. Reducers shall be the eccentric type, with flat top, matching the crown of the suction pipe.

d. There shall be a straight length of pipe of minimum 5 diameters before the suction elbow to provide uniform flow to the pump.

e. The inlet of the suction pipe shall be a long radius elbow with a flared bell. The inlet location shall be in accordance with the hydraulic institute standards. The velocity at the inlet to the suction bell shall be less than 2.5 feet per second.

f. The suction line isolation valve shall be full port eccentric plug valve located close to the wet well wall, allowing sufficient room for removal of the bolts and servicing of the valve.

g. A pressure gauge capable of measuring the entire range of pressures expected at the entrance to the pump shall be provided as close to the pump as possible. The gauge shall be installed on a ½ inch NPT pipe tap with a ball isolation valve and chem seal with snubber.

3. Discharge Pipe

The discharge pipe shall meet the following requirements:

a. Discharge pipes shall be sized for a minimum velocity of 3 feet per second and a maximum velocity of 6 feet per second.

b. The discharge nozzle for dry well installed pumps shall be directed towards the wet well and rotated 45 degrees from the suction line.

c. The discharge pipe shall be connected to the discharge header at an angle of 45 degrees.

d. A pressure gauge shall be installed on the discharge nozzle or as close to the pump as possible. The gauge shall be installed on a ½ inch NPT diameter pipe tap with a ball isolation valve and chem seal with snubber.

e. A 1-1/2 inch diameter pipe with a ball isolation valve shall be installed between the top of the pump casing and the wet well.

B. Pipe Support Systems

All piping systems, including connections to equipment, shall be designed with proper support to prevent undue deflection, vibration, and stresses on piping, equipment, and structures resulting from normal operation and seismic events. All

supports and parts thereof shall conform to the requirements of ANSI/ASME B 31.1 except as specified herein.

Ductile iron pipe of any size shall have a minimum of 2 supports per straight length not to exceed 10 feet of unsupported span. One of the supports shall be located at the joint.

Where the piping system is subject to thrust as a result of hydraulic surge or actuation of a surge relief valve, a thrust support or a hydraulic shock suppressor shall be provided.

All pipe supports shall be galvanized after fabrication. Pipe supports shall have a minimum of 1-1/2 inch thick dry pack between the floor and the support base.

17.13 Ancillary Equipment

Each pump station shall be designed to provide the necessary ancillary equipment to support the operation and maintenance of the facility. This equipment is essential to the operation and maintenance of the system. Ancillary equipment or systems that are discussed herein are commonly required equipment or systems in a wet well-dry well pump station.

A. Hoisting Equipment

Most pump stations are located underground to provide adequate submergence for the pumps. Therefore, the substructure and superstructure need to be designed to allow for installation and removal of equipment. The provisions for access hatches, lifting hooks, hoisting systems, roll-up doors and other means to provide ease of maintenance shall be carefully investigated and designed as required.

For wet well-dry well type pump stations equipped with either vertical non-clog dry well pumps or submersible pumps mounted in the dry well, a traveling bridge crane shall be provided. The bridge crane shall be designed to have a travel and span capable of reaching the pumps, meters and valves. Where the valves are located in areas which are inaccessible to the crane, lifting eyes attached to the ceiling shall be provided directly above the valve or equipment. A floor access hatch shall be provided when required.

Bridge cranes shall have a manually or electrically operated hoist, trolley and end trucks, all designed to conform to all applicable codes, and OSHA safety requirements. Where possible, monorail hoists may be used in lieu of the traveling bridge cranes.

Where space permits, a hoisting system shall be designed to allow direct transfer of equipment from the dry well to a flat bed truck. Traffic into the pump station building shall be given special consideration and necessary turning radius shall be provided.

B. HVAC and Odor Control Systems

A typical pump station consists of the wet well, dry well or the pump room, motor room, electrical and control room, and ancillary equipment rooms. Each of these

rooms requires different methods and degrees of heating, air conditioning and ventilation to provide the following conditions:

1. A safe and comfortable working environment for personnel;

2. To facilitate proper operation of equipment;

3. To minimize corrosion of equipment and building materials; and

4. To prevent accumulation of explosive and hazardous gases.

The heating, ventilating and air conditioning (HVAC) system and odor control systems shall be designed and controlled as one integrated system. Air distribution, building enclosures, wall penetrations, wind directions, building occupancies, and area classifications shall be carefully investigated. HVAC systems shall be designed in accordance with the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE), State of California Energy Conservation Standards Title 24 and the NFPA 820 Fire Protection in Wastewater Treatment Plants.

Equipment conveying corrosives shall be of material that is corrosion resistant, such as fiberglass reinforced plastic (FRP) or stainless steel. If FRP ductwork is used, it shall have flame spread of less than 25, and a smoke propagation of less than 400, and be of fire resistant rating. Air containing flammable and explosive vapors or toxic gases shall not be recirculated.

Air conditioning may be required for pump stations with VFD's.

Depending upon classification, motors for supply and exhaust fans shall be explosion proof, totally enclosed fan cooled (TEFC) units.

C. Wet Well Ventilation

The pump station wet well receives and stores wastewater before it is pumped to the force main. Corrosive and hazardous gases are normally present in the wet well. These gases can become a safety hazard to operating personnel or can cause corrosion of building materials and equipment in the wet well. In order to minimize accumulation of gases inside the wet well, the wet well shall be flushed with fresh air by an adequately sized ventilation system.

Ventilation rates shall be in accordance with:

1. NFPA 820 Fire Protection in Wastewater Treatment Plants

2. Occupational Health and Safety Act (OSHA)

Pump station wet wells are classified into two types depending on their use;

1. Accessible Wet Well.

2. Sealed Wet Well.

ACCESSIBLE WET WELLS

Wet wells which require routine access for maintenance shall be provided with adequate fresh air ventilation in order to provide a safe environment for maintenance personnel, to prevent accumulation of explosive gases, and to minimize corrosion of equipment installed in the wet well. The internal surfaces of the wet well shall be lined with PVC for corrosion protection.

The following minimum ventilation criteria shall be used:

1. All accessible wet wells shall be provided with continuous ventilation of a minimum of 15 air changes per hour.

2. Where intermittent ventilation is required, the ventilation rate shall be at least 30 air changes per hour.

All electrical equipment and fans inside the accessible wet well shall be explosion-proof designed and manufactured for Class I, Division I, Group D. All other design criteria shall be in accordance with NFPA 820 Fire Protection in Wastewater Treatment Plants.

SEALED WET WELLS

Sealed wet wells shall be designed to be low maintenance. The internal surfaces of the wet well shall be lined with PVC for corrosion protection.

Sealed wet wells shall be provided with static vents to accommodate air displacement due to the rise and fall of the water level in the wet well. The vent shall have a minimum diameter of one-half the diameter of the incoming sewer. The vent pipe shall be connected to the nearest sewer maintenance hole where possible. Where the pump station is located away from any sensitive area, vent pipe could be extended above the roof line with a minimum of 15 feet from any window or fresh air inlet.

All electrical equipment inside the sealed wet well shall be classified in accordance with NFPA 820, Fire Protection in Wastewater Treatment and Collection System Facilities.

C. Odor Control

The need for odor control systems shall be evaluated for each project. Such evaluation shall be based on a life cycle cost of 20 years with major consideration of the power and chemical consumption, first cost, maintenance cost, reliability and efficiency of the system.

Wet well odor control shall consist of a water misting system. Activated carbon scrubbers, chemical scrubbers utilizing a chemical absorption process for removal of odors, or chemical or air injection systems may be necessary for odor control in other parts of a pump station.

For the chemical scrubbing systems, foul air from the plant process facility is introduced into the scrubber vessel with an atomized mist chemical solution containing sodium hypochlorite. Oxidation of odorous compounds occurs upon contact with the scrubbing mist, and is removed in the condensate. The scrubber shall be designed to remove a minimum of 99 percent of hydrogen sulfide in the foul stream. Acceptable chemical scrubber manufacturers are Calvert Environmental Co., San Diego, CA, and Quad Environmental Technologies, Corp., Highland Park, IL.

All odor control and ventilation equipment shall be suitable for continuous exposure to saturated hydrogen sulfide gas, sodium hypochlorite mist, sodium hydroxide mist and sulfuric acid. Electrical equipment shall have explosion proof enclosure designed for hazardous condition for Class 1, Division 1, locations.

For air pollution permits, consult South Coast Air Quality Management District.

D. Dry Well Ventilation

The pump station dry well is normally located adjacent to the wet well to house the pumps, valves, meters and other ancillary equipment.

The dry well and equipment rooms shall be designed for a ventilation rate of at least 15 air changes per hour or ventilation rate equivalent to cool internal heat load from the equipment whichever is greater or not greater than 60 air changes per hour. The sensible cooling ventilation rate shall be calculated as follows:

$$H = cfm \times 1.09 \times t$$

where:

H	-	Internal heat gain from equipment, Btu per hour
cfm	-	Air flow, cu ft per minute
t	-	Change in internal temperature, degree F. Use 10 degrees F for change in internal temperature as adequate for sensible cooling.

Where a pump station is equipped with variable frequency drives (VFD), the VFD shall be installed in an air conditioned room with 90 percent efficient outside air filters. VFD units are inherently sensitive to temperature, dust, moisture and other corrosive elements in the air. For constant speed pump stations, the motor control center (MCC) and control rooms shall be equipped with a ventilation fan and 90 percent efficient outside air filters. Pump and equipment room air inlets shall be provided with 30 percent efficient outside air filters. All air filters shall be provided with differential pressure gages to indicate when the filters are clogged, and flow detection devices connected to alarm signaling systems to indicate ventilation system failure.

E. Fire Protection System

Where required by NFPA or by the Fire Department, necessary fire protection systems shall be provided in required areas. For areas housing electrical equipment such as the motor control centers, computer rooms and control rooms, an approved type fire protection systems shall be provided.

F. Gas Detection System

Combustible gas detection equipment shall be provided in the wet well and dry well, and other areas where hazardous gas may be present, to record, activate alarms and/or to operate the ventilation system. The stationary gas detection system shall be capable of measuring concentrations of hydrogen sulfide, methane gas and/or petroleum vapor in the air.

The combustible gas sensor shall be DET-TRONICS Point Watch Infrared Hydrocarbon Gas Detector Model PIR9400 or approved equal. The sensor shall be mounted in the wet well such that it can be removable externally for maintenance and calibration. It shall be connected to the programmable logic controller (PLC). The PLC shall monitor the combustible gas sensor through the 4-20 mA signal which shall be proportional to combustible gas concentrations of zero to 100%. Two (2) PLC adjustable alarms shall be provided. 6% lower explosion level (LEL) shall indicate a warning, and 10% LEL shall indicate an alarm. Alarm beacons shall be installed in the dry well and the electrical room.

An entry control station shall be provided in a NEMA 4X stainless steel enclosure with vandal resistant hardware, and amber and green NEMA 4 vandal resistant pilot lights at or near each entry. They shall indicate a potentially dangerous condition in the pump station based on the loss of the ventilation system, combustible gas, loss of positive pressure in the electrical room, or loss of negative pressure in the dry well. Both lights shall be dark if there is a component or power failure. A lamp test switch shall be provided, which will activate all entry control system lights for ten seconds for testing.

G. Compressed Air System

For pump stations using surge tanks, air operated valves; pneumatic tools for maintenance purposes, and instrument air, a compressed air system shall be provided. The air system for pneumatic tools shall consist of a lubricated type air compressor, receivers, air dryers and necessary piping system. For an instrument air system, a dedicated non-lubricated type air compressor, receiver, dryer and necessary piping system shall be provided. Where the valve operators are designed as pump control valves with the option to have controlled closing during power failure, the air receivers shall be sized to store compressed air capable of stroking the air cylinders three (3) complete cycles between the specified operating pressures during power outages.

H. Hydraulic System

Pump stations equipped with hydraulic operated valves shall be provided with hydraulic systems. The hydraulic system shall be either a package system supplied with each valve, or one complete package to operate multiple valves. The system shall consist of an oil reservoir, hydraulic pumps, control valves, hydraulic cylinders, limit switches and nitrogen gas-filled accumulators where the valves are required to operate during power outages. The valve opening and closing ranges shall be specified. Final field adjustments shall be made during pump station start-up.

I. Noise Control

The pump station shall be designed to meet the minimum noise level requirement of the Municipal Code of the local jurisdictional agency and the Occupational Safety and Health Administration (CAL/OSHA). All mechanical equipment and enclosures shall be acoustically treated to bring the noise level down to an acceptable limit. These attenuation devices may consist of exhaust mufflers, sound isolators or acoustical panels.

The pump stations shall be designed with noise levels not more than 5 dBA above the ambient noise level as measured at the property line of the nearest recipient (neighbor). A 24 hour noise level reading shall be measured at the pump station site as basis of the design.

In the absence of actual field measurements, the presumed ambient noise level shall be deemed to be the minimum ambient noise level for each zone as follows:

Sound Level "A" Decibels
(In this chart, daytime levels are to be used from 7:00 A.M. to 10:00 P.M. and nighttime levels from 10:00 P.M. to 7:00 A.M.)

Presumed Ambient Noise Level (dBA)

Zone	Day	Night
Residential	50	40
Public Facility, Commercial, Recreational	60	55
Industrial	65	65

At the boundary line between two zones, the presumed ambient noise level of the quieter zone shall be used.

J. Sump Pumps

A sump pit shall be provided in all underground structures such as dry wells, valve and electrical vaults. The sump pit shall be equipped with an adequately sized plus a standby unit, each having a minimum capacity of 50 gpm. Submersible sump pumps shall be used and controlled by a duplex type control, an automatic alternator and a float switch level control. The control system shall be designed to start the standby pump when the lead pump fails to start or when the water level continues to rise while the lead pump is operating. Both pumps are to stop at low water level.

Sump pump discharge pipe, fittings and valves shall be Schedule 80 PVC pipe, with minimum diameter of 2-inches. Each sump pump discharge pipe shall be provided with a swing check valve and isolation gate valve mounted above, both in the vertical position. A common discharge manifold shall terminate inside the wet well with the wall penetration above the highest surcharge elevation of the wet well.

K. Spare Parts

Pump station electro-mechanical equipment shall be provided with spare parts necessary to ensure continuous operation. The recommended spare parts shall be determined by the project design engineer with assistance from the District Engineer. The following shall be the minimum list of spare parts:

1. One set of pump and motor bearings for each size and model of pump unit.
2. One set of pump seals for each size and model of pump unit.
3. One set of pump and casing wear rings for each size and model of pump unit.
4. One set of pump and motor for each size and model of pumping unit.
5. One dozen fuses for each size of fuse.
6. A printed circuit board for each size and model of the variable frequency drives.

The spare parts shall be delivered to the project site no later than two (2) months prior to pump station start up. Spare parts required during testing and start-up shall be provided by the contractor.

17.14 Electrical Equipment

Electrical systems in the pump station consist of the power supply, power transformers, motor control centers, electric motors, electric variable speed drives, electrical wires and conduits, lighting fixtures, and other associated interface with the instrumentation and control systems.

A. Power Supply

The standard power supply to the pump station shall be 480 volts.

B. Motor Control Centers (MCC)

All motor starters and disconnect switches shall be installed in NEMA 3R Motor Control Centers (MCC). MCC rooms shall be located away from hazardous gas or other corrosive environments. Mechanical ventilation equipment shall be provided to maintain air circulation. All fresh air inlets to the MCC rooms shall be provided with 90 percent efficient inlet filters.

Where environmental problems exist in the pump station location, such as the presence of dust, moisture from sea water, or corrosive gas, the MCC room shall be designed to have adequate ventilation and provided with air cleaning equipment such as de-humidifiers, filters or carbon absorbers.

The MCC circuit breaker handles must be provided with safety interlocks.

C. Electrical Cables and Conduits

All electrical cables and conduits shall be designed in accordance with the NEMA Area Classification as required by the service area. All electrical conduits shall be

PVC coated galvanized rigid metallic conduits or Schedule 80 PVC. All conduits shall be sized for 100 year service. Spare conduits may be required. The minimum size conduit shall be 1-inch.

17.15 Instrumentation and Controls

The instrumentation and control system shall be designed to operate the pump station to match the flow characteristics of the service area. The control system shall consist of the wet well level control, flow metering equipment, pressure gages and switches, fire alarms and gas detection instruments.

A. Pump Control System

1. General

The pump control panel (PCP) provides manual or automatic control of the pumps, as well as visual indication of the pump station status and alarm conditions. The following status and alarm indicators are to be provided as a minimum:

Status	Alarms
Power ON Light	Wet Well HIGH LEVEL Alarm Light (from Ultrasonic)
Running Time Meter	Wet Well High High Level Alarm Light
Pump RUN	Pump FAIL Alarm Light
HAND-OFF-AUTO selector switch	Motor winding HIGH TEMP Alarm Light
Lights Test Pushbutton	Seal FAIL Alarm Light (for submersible pumps)
Seal Test Pushbutton (for submersible pumps)	FAIL RESET pushbutton
Flow Rate Indicator	
Wet Well Level Indicator	

Discharge Pressure Indicators

The pump(s) may be controlled either manually, or automatically, depending upon the position of the pump hand-off-auto selector switch. In the MANUAL mode, a pump is started by placing its hand-off-auto selector switch in the HAND position. In this mode, the pump will run continuously unless shut down by the “fail” interlocks.

In the AUTO mode, the pump is started and stopped by the wet well level, as measured by an ultrasonic level sensor. In the “Auto” mode, the pump will run until called to stop by wet well level, unless shut down by the “fail” interlocks.

In the AUTO mode, the pumps will alternate operation automatically after each pump down cycle. If the operating pump should fail, the next pump in the call sequence will start and operate each time the wet well level calls for a pump operation until the failed condition is cleared.

The pump controller shall be a solid state device, which provides operational set points, high level alarm, outputs to start and stop the pumps, and perform

pump alternation. The controller shall be a U.S. Filter D153U triplex controller/alternator or approved equal.

A float switch is to be installed in the wet well to provide an emergency high level alarm and a back up pump control system for the station. The emergency high level is to be indicated on the pump control panel and through the dialer. In this condition, the pump will operate for an adjustable time (0-5 minutes after emergency high level initiation), as set by the operator, and then will shut down. If the wet well level again rises to the emergency high level, the cycle will be repeated. The station can run indefinitely in this mode if necessary.

A "pump fail" alarm (for each pump) will be indicated at the pump control panel and transmitted to the automatic dialer system should any of the following conditions occur:

- Pump motor winding high temperature detected by sensors in the motor winding.
- Motor overload detected by the overload relay.

Each of the above "fail" conditions will lock-out the pump from operation. To reset a pump, the operator must visit the station, determine the cause of failure, correct the condition, and depress the "fail reset" pushbutton on the pump control panel.

For submersible pumps, a motor seal failure will also be detected and alarmed but will not stop pump operation.

2. Constant Speed Pump Control System

The operating sequence is applicable for multiple pump units installed in a smaller wet well. The pump station will start in sequence, pumps start and stop in the reverse order.

This sequence is recommended for the following reasons:

a. To maintain uniform flow into the receiving system

b. To provide smaller wet well storage volume and less number of motor starts per hour;

c. To reduce sewer gas emission to the atmosphere by maintaining a constant water level in the wet well.

3. Variable Speed Drives.

Variable speed (matched-flow) pumps shall be used for the following conditions;

a. Where more uniform discharge to the receiving system is required;

b. Where there is not enough space in the pump station to accommodate installation of multiple smaller unit constant speed pumps;

c. Where the wet well volume is limited to satisfy maximum starts per hour;

d. Where sewer gas emissions to the atmosphere should be limited;

The variable speed drive pumps shall be controlled as follows:

a. When the wet well level reaches the first set level, the lead pump will start and ramp to a minimum preset speed. As the flow increases, the pump speed will increase in proportion to the increase in flow in order to maintain the level in the wet well until the pump has reached its maximum speed.

b. When the inflow to the wet well exceeds the maximum capacity of the lead pump, the control system will then start the lag pump. The lag pump will increase its speed while the lead pump will decrease its speed up to the point where the two pumps share the flow, both at the same speed. As the inflow increases, the two pumps will increase their speeds in proportion to the inflow until the pumps have reached the maximum pump design flow, in the case of two pump combination.

c. A drop in wet well level equivalent to a decrease in pump station inflow will signal the pumps to slow down until a preset speed is reached. Then the lag pump will stop, and the lead pump will increase its speed in proportion to the inflow.

d. Further drop in wet well level will signal the lead pump to slow down until the minimum level is reached, at which level, the lead pump will stop.

e. In the event that either the lead pump or the lag pump fails, the wet well level will rise and the standby pump will be started at the same time the failure alarm is activated. The standby pump will be provided with a variable speed drive.

For pump stations equipped with more than two variable speed pumps, the same operating sequence will be followed.

Under no conditions will a force main velocity of less than 3 feet per second shall be allowed.

The variable speed drives shall be provided with bypass contactors to operate the pump at full speed when the VFD is not available.

4. Float Level Switch

The float level switches shall be used to detect the low-low level cut-off and the high-high water level alarm, and as an auxiliary system in the event of failure of the ultrasonic level control systems. When the water level in the wet well reaches the high-high level, the control system (US Filter CBIT B300 single stage controller or approved equal) shall initiate a timed pump down using all pumps. The pump station shall be capable of operating indefinitely in this mode. The float switch shall be direct acting with a single pole mercury switch which activates when the longitudinal axis of the float is horizontal and de-actuates when the liquid level falls 1-inch below the actuation level. The switch shall be encapsulated in a chemical resistant polypropylene casing with a firmly bonded electrical cable protruding. The entire assembly shall be watertight and impact resistant designed and manufactured for Class 1 Division 1, Hazardous Conditions. Float switches shall be Roto-Float as manufactured by Anchor Scientific or approved equal.

Submersible dewatering sump pumps located in dry wells and valve structures shall be controlled by float switches. Float switches shall be designed and manufactured suitable for the area classification of the sump pit.

5. Ultrasonic Level Control

The pump station's primary level controller shall be the ultrasonic level sensor. The transducers shall be hermetically sealed, self cleaning with built-in temperature compensation 6^{o} beam angle, suitable for installation in a sewage pump station wet well.

Ultrasonic measuring systems shall be the Hydroranger with XPS-15 transducer as manufactured by Milltronics, or approved equal.

17.16 Supervisory Control and Data Acquisition (SCADA) System

To monitor and control the operation of the pump station remotely at a central station, SCADA system equipment shall be provided. The system shall consist of the Remote Telemetry Unit (RTU) located in the pump station connected to a computer at a designated central station. The signal to the central station shall be transmitted over spread spectrum radio.

The pump operation is initiated by a motor starter mounted in the Motor Control Center (MCC). The starter is controlled by a signal from the level sensor or push buttons or by local control automation, such as the remote telemetry unit.

The Central Computer System displays information such as graphics and tables; gathers historical data such as trends of pumping cycles, measurement of flows and pressures, equipment running time, number of pump starts per hour; and can remotely control the operation of the pump stations.

17.17 Pressure Gauges

In a wet well-dry well type pump station, pressure gauges shall be installed at the suction and discharge sides of each pump to measure the pump total dynamic head. The pressure gauges shall be at least 4-1/2 inches in diameter. Where seal flushing water is required, a pressure gauge and low pressure switch shall be provided to activate an alarm in case of loss of flushing water. A low flow alarm switch may be used in lieu of the pressure switch.

A pressure switch shall be provided between the pump and the check valve or pump control valve to activate an alarm in the event of failure of the valve to open or accidental closure of any isolation valve located at the pump discharge piping. A micro-switch attached to the valve shaft may be provided in lieu of the pressure switch.

All, pressure gauges and switches installed in a piping system carrying solids bearing fluids such as wastewater, sump pump discharge or chemical lines shall be provided with diaphragm seals and snubbers where pulsating flow is expected. The assembly shall be provided with an isolation ball valve for maintenance. Diaphragm seal material shall be compatible with the pressure and fluid being handled.

In a submersible pump station, a pressure gauge/switch shall be installed in the discharge pipe of each pump in the valve vault upstream of the check valve. The discharge pressures shall be indicated in the pump control panel.

17.18 Pump Station Facility

The pump station facility includes the pump station structure, buildings, electrical substation or transformer, access roads and other appurtenant equipment inside the property. The facility design shall incorporate access road and security. The architectural treatment shall blend with the surrounding area.

A. Building Design and Materials of Construction

The pump station usually consists of an underground concrete structure to house the wet well and the dry well. Where the pump station requires an above ground structure to house the electrical room, generator room, office area and maintenance shop, the above ground building shall be designed in accordance with the requirements of the Uniform Building Code and California Fire Code. In general, all buildings shall be cast-in-place concrete or masonry block wall construction.

Wet Well and Dry Well. The wet well and dry well shall be reinforced cast-in-place concrete with wall thickness to withstand the earth and seismic loads, and shall be heavy enough to resist floatation without earth skin friction resisting the outside surfaces when the wet well is empty.

The size and configuration of the wet well shall be designed in accordance with Section 17.5. The bottom of the wet well shall be sloped to at least 15 degrees and corners grouted to prevent accumulation of solids during operation.

The dry well shall be designed to provide the following:

1. Minimum of 42-inch clear working clearance between pumps and piping;
2. Access doors, stairways and landing;
3. Access opening for equipment installation, maintenance and removal;
4. Hoisting equipment or lifting hooks;
5. Adequate ventilation
6 Fire protection equipment where required.

17.19 Force Mains

The minimum diameter for a force main shall be 4 inches. The capacity of the force main shall be the design peak flow from the pump station. The minimum design velocity for a force main shall be 3.0 fps, and maximum allowed 5.0 fps for PVC and 6.0 fps for DIP.

Force mains shall continuously rise from the pump station to the terminal manhole to eliminate the need for air and vacuum release valves.

For new pump stations with phased development of the tributary area, dual force mains may be required. The District Engineer shall select the number of force mains that will be installed at each pump station.

17.20 Access Roads

Pump stations shall be designed with access roads for construction, operation and maintenance of the equipment. The roads shall have turning radii suitable for the size of vehicle, or heavy hoisting equipment necessary for installation, removal or delivery of equipment or supplies into the station. Pavement sections shall be able to support the load of the heaviest anticipated equipment to be used in the station. Where monorail hoists or traveling cranes are required, adequate headroom clearance shall be provided or loading docks can be used to limit the height of the building.

17.21 Flood Control

The pump stations shall be designed with pad elevation one foot above the expected value100-year flood elevation or the elevations indicated on the Flood Insurance Rate Maps in areas where detailed studies have been conducted, whichever is higher. Where available and current, information contained in the Orange County Public Facilities and Resources Department documents can be used to determine the expected value 100-year flood elevation.

All hydrologic and hydraulic calculations and design shall be in accordance with the standards of the jurisdictional flood control agency standards.

17.22 Grading and Area Drainage

The site drainage shall be designed to prevent standing water or the erosive effects of storm runoff. Pavement areas shall have a positive drain of up to 3%. Flow lines shall have a

minimum of 1% slope. Underground structures shall not be constructed in partially cut and partially fill. Where this condition exists, the site shall be over-excavated and re-stabilized. The pump station shall be designed not to float where high groundwater exists.

17.23 Soils Report

A geotechnical investigation shall be conducted to determine the underground soils conditions. The Soils report shall show the foundation design criteria, corrosiveness of soils and ground water, groundwater elevations if it exists, and possible hazardous materials underground. Cleaning of such materials shall be addressed in the construction contract, or can be awarded to a separate hazardous materials contractor as determined by the District Engineer.

17.24 Surveying

The control bench marks shall be referenced from the County of Orange records. Where existing survey and reference plans are available, field check existing data with the current datum and adjust all elevations to current datum where required.. The location of the pump station shall be tied to a nearby street and to an existing property line. Basis of survey bearings and control shall be given if the local coordinate are established.

17.25 Security

The pump station site shall be provided with an 8 foot high chain link fence or masonry block wall fence, as directed by the District Engineer. The fence or wall shall be designed in accordance with applicable American Public Works Association Standards. The entrance gate shall be secured with a padlock. Where the pump station has a superstructure housing the motor control center and the generator, the building shall be equipped with intrusion alarms. Where there is no superstructure, the NEMA 3R enclosure housing the motor control center shall be equipped with an intrusion alarm. The alarms shall be connected to a horn mounted in the building, a red beacon light mounted outside the building or above the NEMA 3R enclosure, and remoted via telemetry to the main control system.

17.26 Water Supply System

The pump station water supply system shall be provided for pump seal water system, irrigation system, rest rooms and housekeeping hose downs. A backflow preventer shall be installed in the pipeline connecting the hose bibs, seal water and irrigation system. Seal water systems shall utilize air gap tanks, and not be directly connected to the water supply system. All piping shall be designed in conformance with the Uniform Plumbing Code.

17.27 Landscaping and Irrigation System

Plants selected shall be drought resistant and approved by the District Engineer. Irrigation system equipment shall utilize water saving kits that are controlled by automatic timers.

17.28 Construction

The pump station shall be constructed in conformance with the specifications and drawings. The pump station construction shall be administered and inspected by the Garden Grove Sanitary District, or its designated representative.

A. Shop Drawing Submittal and Shop Drawing Review

The Technical Specifications shall specify the requirements for shop drawing submittal and review process.

Once the project is awarded, shop drawing submittals shall be reviewed and accepted. The shop drawing review is one way to check compliance with the specifications. It also serves as a mechanism to get from the contractor the equipment as specified. Where a substitution to specified equipment is proposed to the construction project Design Engineer for review, the design project engineer shall be consulted.

B. Equipment Installation and Testing

The equipment installation and testing shall be specified in each equipment specification. Normally, the equipment shall be specified to be installed by the Contractor under the supervision of a certified factory representative. After installation, the Contractor shall conduct trial operation of the equipment, and make the necessary adjustments as required. When the equipment becomes operational, the Contractor shall test the equipment in the presence of the District's representative. The test shall include a performance test, simulating the manual and automatic operation, and checking of other components in compliance with the specifications. The test shall also include verification of all alarm functions. A continuous test using the actual process material shall be conducted without any breakdown prior to final acceptance.

C. Operation and Maintenance Manuals

The Operation and Maintenance Manual shall be prepared by the construction contractor based upon the plans and specifications, and assistance from equipment manufacturers, to clearly describe how the pump station shall operate under normal and emergency conditions, and how it should be maintained.

Final payment shall not be made to the Contractor until the Operation and Maintenance Manual is approved by the District Engineer.

D. Operator Training

Each pump station has unique operational requirements and some have equipment that requires familiarization by the station operators. The Contractor shall provide training, through respective authorized equipment representatives, to the station operators as specified in the Contract Documents.

18. INSPECTION AND TESTING OF GRAVITY SEWERS

18.01 CCTV Inspection

The Contractor shall perform Closed Circuit Television inspection (CCTV) of all gravity sewers to determine alignment, grade and damaged or defective pipe in place; after the pipe has been installed, backfilled and compacted to grade, tested for leakage, manholes raised to grade, but prior to final resurfacing, from manhole to manhole. CCTV inspection shall be recorded on DVD, and recording procedures shall conform to the requirements of Standard Specifications for Public Works Construction Section 500-1.1.5, Television Inspection, except that the maximum speed shall be 15 feet per minute. The recording shall continuously display the following on-screen data: contract number, project name, date, time, distance (in feet) from the insertion manhole, and manhole identification codes.

Two copies of the recording shall be submitted to the District for approval within two days of the CCTV inspection. CCTV recording shall be performed first with the pipe dry, and then immediately following clean water flowing in the pipe to clearly indicate vertical misalignments, sags or other defects. Should CCTV inspection indicate any faulty installation of the pipe, repairs or replacement shall be made at the Contractor's expense by a method approved by the District. Repaired and or replaced pipe and/or segments shall be retested and reinspected through CCTV at no additional cost to the District, until final acceptance is granted. Any sag greater than one (1) 0.25 inch in 100 feet of pipe reach shall be considered excessive, and the pipe shall be removed and reinstalled to proper grade.

18.02 Gravity Pipe Leakage Tests

All gravity sewer pipes and service laterals shall be tested for exfiltration and/or infiltration and deflection. All leakage tests shall be in conformance with Standard Specifications for Public Works Construction (SSPWC), "GREENBOOK" Section 306-1.4.1. Water exfiltration test shall be in conformance with SSPWC Section 306-1-4.2. Air pressure test shall be in conformance with SSPWC 306-1.4.4. All testing shall be performed in the presence of the District Inspector.

18.03 Manhole Leakage Tests

1. Leakage tests shall be made and observed by the District Inspector on each manhole. The test shall be the exfiltration test made as described below:

2. After the manhole has been assembled in place, all lifting holes and those exterior joints within 6 feet of the ground surface shall be filled and pointed with an approved non-shrinking mortar and the lining joints completed. The test shall be made prior to placing the shelf and invert. If the groundwater table has been allowed to rise above the bottom of the manhole, it shall be lowered for the duration of the test. All pipes and other openings into the manhole shall be suitably plugged and the plugs braced to prevent blow out.

3. The manhole shall then be filled with water to the top of the cone section. If the excavation has not been backfilled and observation indicates no visible leakage, that is, no water visibly moving down the surface of the manhole, the manhole may be

considered to be satisfactorily water-tight. If the test, as described above is unsatisfactory as determined by the District Inspector, or if the manhole excavation has been backfilled, the test shall be continued. A period of time may be permitted if the Contractor so wishes, to allow for absorption. At the end of this period, the manhole shall be refilled at the top of the cone, if necessary and the measuring time of at least 8 hours begun. At the end of the test period, the manhole shall be refilled to the top of the cone, measuring the volume of water added. This amount shall be extrapolated to a 24-hour rate and the leakage determined on the basis of depth. The leakage for each manhole shall not exceed 1 gallon per vertical foot for a 24-hour period. If the manhole fails this requirement, but the leakage does not exceed 3 gallons per vertical foot per day, repairs by approved methods may be made as directed by the District to bring the leakage within the allowable rate of 1 gallon per foot per day. Leakage due to a defective section or joint or exceeding the 3 gallon per vertical foot per day shall be the cause for the rejection of the manhole. It shall be the Contractor's responsibility to uncover the manhole as necessary and to disassemble, reconstruct or replace it as directed by the District Engineer. The manhole shall then be retested and, if satisfactory, interior joints shall be filled and pointed.

4. No adjustment in the leakage allowance will be made for unknown causes such as leaking plugs, absorptions, etc., i.e., it will be assumed that all loss of water during the test is a result of leaks through the joints or through the concrete. Furthermore, the Contractor shall take all steps necessary to assure the District Inspector that the water table is below the bottom of the manhole throughout the test.

5. If the groundwater table is above the highest joint in the manhole, and if there is no leakage into the manhole as determined by the Engineer, such a test can be used to evaluate the water-tightness of the manhole. However, if the District Engineer is not satisfied, the Contractor shall lower the water table and carry out the test as described herein before.

18.04 Pipe Slope

All gravity sewer pipe shall be laid to the line and grade shown on the plans and per Section 306.1.2 of "GREENBOOK," with a maximum allowable tolerance of 0.125 inch at the invert. The Contractor shall continuously check the grade of the pipe being installed through the use of laser line.

19. STANDARD SEWER NOTES

The following notes must appear on the plans under Standard Sewer Notes.

A. The sewer Contractor shall have a copy of the Project Plans and Specifications, as well as the Garden Grove Sanitary District Design Criteria for Sewer Facilities on the job site.

B. The Contractor shall obtain a City and/or County permit for work done on public right-of-way.

C. The Garden Grove Sanitary District Office shall be called for inspection five (5) working days before start of work at (714) 741-5566.

D. A pre-construction conference shall be held 48 hours before starting construction work.

E. The Contractor shall expose all join points to the existing sewer system for verification of location and elevation before construction.

F. Stations shown as 1+00.00 are sewer stations and are independent of all other stations.

G. All laterals shall be staked by a surveyor before trenching and a complete set of cut sheets shall be supplied to the Contractor and the District Inspector.

H. The District will inspect and test the sewer collection system and lateral sewers to the property clean-out. Privately owned sewer laterals from the property line clean-out will be inspected and tested by an approved contractor subject to the City of Garden Grove Building Department approval.

J. All sewer lines shall be balled in the presence of the District Inspector before completion of all leakage tests.

K. Pipeline leakage tests shall be made in the presence of the District Inspector, only after backfill has been completed, compaction tests on backfill have been made, and the backfill has been accepted by the District Inspector.

L. All sewer main lines shall be inspected using a closed circuit television system. Two recordings shall be made of the inspection on a DVD disk in accordance with the Garden Grove Sanitary District Specifications for Video Inspection of Sewer Lines. One recording shall inspect the system constructed with no flow, and one shall conduct the inspection 15 minutes after flowing water in the sewer.

M. The Contractor shall provide the Garden Grove Sanitary District with an as-built set of job prints with tie-down measurements for all laterals and manholes.

N. Before final acceptance, the developer's engineer signing the plans shall furnish the Garden Grove Sanitary District with a set of as-built mylars of the sewer plan.

O. Curbs, or pavement surfaces in alleys where sewer laterals exist shall be inscribed with an "S" indicating locations of all sewer laterals.

P. Curbs shall be inscribed with ties for all manhole locations.

Add the following notes to plans having <u>on-site</u> work which will be dedicated to the District:

Q. Trench backfill, on all sewer lines to be dedicated to the District, shall be compacted to a minimum of 90% relative density as determined by the five-layer test method (California 216G). Tests will be required every 300-feet of trench or as determined by the District Inspector. The developer shall submit written results of compaction testing to the District before acceptance. If in dedicated street or future street, compaction will be as required by governmental agency having jurisdiction, but no less than 90 percent relative compaction.