CHAPTER 3

DESIGN CRITERIA

3.1 DETERMINATION OF DESIGN FLOW

The design of sanitary sewers, including new construction and replacement sewers, must consider minimum, average, and peak flows. Normally, ADWF is determined or selected, and a factor is applied to determine the peak dry weather flow. The PDWF is the design flow used to select the pipe size. Minimum flows are used to determine if specified velocities can be maintained to prevent deposition of solids. The ratio of PDWF to ADWF will range from less than 130% for some large diameter sanitary sewers to more that 260% for smaller sewers.

3.2 HYDRAULICS

Sewers shall be designed to accommodate future tributary flows, in addition to those from the project. Gravity sewer capacities shall be determined for peak flow rates by Manning's Formula using an "n" value of 0.013 for all pipelines.

Sewers less than 12" in diameter shall be designed to flow half full at ADWF. Sewers 12" to 18" in diameter shall be designed to flow two-third full at PWWF. Sewers larger that 18" shall be designed to flow at 90% PWWF.

3.3 MINIMUM DIAMETER

Unless approved by District Engineer, the minimum diameter for District sewer mains shall be 8-inch in diameter. The required pipe size may be calculated using Manning formula:

$$Q = 1.486 / n * AR^{2/3} S^{1/2}$$

where,
- Q = Flow, cfs
- A = Area of flow, ft^2
- R = Hydraulic radius (A/P), ft.
- n = Roughness factor
- S = Slope, ft/ft

3.4 DEPTH OF SANITARY SEWERS

Depth of cover is measured as the distance from the top of pipe to the finished grade surface over the sewer center-line. Wherever possible, the minimum depth of cover shall be six (6) feet. Special approval from the District Engineer is required wherever the cover is less than six (6) feet. Where this cover cannot be maintained, other details may be required, such as higher strength pipe, pipe encasements, special backfill, or concrete trench slab.

Sewer laterals shall have a minimum cover of 5 feet to the invert of pipe at the property line.

3.5 ACCEPTABLE SANITARY SEWER PIPES AND FITTINGS

Acceptable sewer pipes and fittings for new construction are:

A. **Vitrified Clay Pipe (VCP).** VCP shall be furnished in lengths not exceeding 6 feet. The applicant's engineer should be familiar with the "Clay Pipe Engineering's Manual" as published by the National Clay Pipe Institute (latest edition).

B. **Polyvinylchloride Pipe (PVC).** PVC sewer pipe for sizes 4 inches through 15 inches shall meet the requirements of ASTM D3034, DR 26 or better, Cell Classification 12454-B or 12454-C. Fittings shall have the same classification, but with DR 35 rating.

PVC pipe and fittings for sizes 18 inches through 24 inches shall meet the requirements of ASTM F679, Wall T-1, Cell Classification 12454-C. Use of 15-inch pipe and larger requires special approval from the District Engineer.

In addition, the engineer should be familiar with the "Design and Construction Handbook of PVC Pipe" as published by the Uni-Bell Plastic Pipe Association (latest edition).

C. **Others**. HDPE, DIP, RCP, etc. will require special approval from District Engineer.

D. **Fittings**. All fittings shall comply with pipe manufacturer's requirements or recommendation and shall be the same material as the pipe.

E. **Repairs/Connections**. Stainless steel repair couplings must be used for all repair work and/or reconnections.

3.6 LOCATION OF SANITARY SEWER

A. **Streets**. Wherever possible, maintain sewer mains five (5) feet off centerline of streets. However, where storm drains are in the center of the street, the sewers should be located to provide a minimum of five (5) feet clearance between the outsides of pipe measured on a horizontal plane. Special care is required where storm drains or other pipelines cross above flexible pipes to avoid deflection problems.

When an area outside the improvements can be logically served by future extension of the sewer, it shall extend to the improvement boundary or to the next end of a paved street in a manner facilitating future extensions.

B. **Easements**. Easements shall be avoided where a reasonable alternate solution is available. Unless there are physical limitations, sewers shall be installed within streets. When easements are required, there shall be careful consideration of sewer accessibility for sewer maintenance, repair, and replacement.

All manholes within easements shall be accessible by conventional maintenance vehicles traveling over paved roads or driveways unless otherwise approved. Manholes within private property are discouraged and are subject to special approval.

Laterals shall not be connected to a main line within an easement unless otherwise approved. If approved by the District, the property owner will be responsible to maintain the lateral, including clearing blockages in the lateral.

1. **Width.** Sanitary sewer easements for pipes up to fifteen (15) inches in diameter shall be a minimum of fifteen (15) feet wide. However, additional easement width shall be required where the depth of pipe exceeds fifteen (15) feet or as deem necessary. The plans shall clearly indicate any known block walls,

pavement, trees or other obstructions within a proposed easement. Such items are contrary to District policy and require special approval.

2. **Sewer Location.** Sanitary sewer shall generally be placed in the center of easements; only in unusual circumstances will a line be approved which is closer than 5 feet from the easement edge. Unless specifically approved otherwise, the sewer line shall be straight without horizontal bends or deflections.

3. **Easement Locations**. The full easement width shall be on one lot or property in such manner that access to manholes will not be obstructed by walls, trees or permanent structures. Where this requirement cannot be met without interfering with existing building, easements may straddle lot lines provided approval is received and the sewer is not located on the lot lines.

4. **Over sizing of Sewer**. If a sewer within an easement is over 15 feet deep, District may require the oversizing (such as from an 8-inch to a 10-inch line) to facilitate future sewer lining.

5. **Deeds.** Deeds for easements shall provide for restrictions of permanent construction within the easement to provide ingress and egress for maintenance.

6. **Easement Provisions.** Easements shall be provided as follows:

(a) For subdivisions – The owners of land included within the subdivision shall offer to dedicate, for public use, the sanitary sewer easements designated on the Final Map and Improvement Plans.

(b) For other sewer extension – Dedication of sanitary sewer easement shall be done by the District's standard Deed of Easement form.

3.7 OVERSIZING AND EXTRA DEPTH

The installer may be required to oversize and/or deepen the sewer pursuant to Article 6.010, "Design of Public Sewers", of the District Ordinance Code where such sewers can logically serve an upstream tributary area.

3.8 SLOPE OF LINES

Allowable minimum slopes for gravity sewer are:

Pipe Sizes	Min. Slope (ft/ft)
6"	0.0060
8"	0.0040
10"	0.0028
12"	0.0022
15"	0.0015
18"	0.0010
21"	0.0008
24"	0.0007

The above is based on Manning's Formula where n = 0.0130. Pipe slope shall be shown in feet per feet as above.

3.9 VELOCITY

Gravity sewer mains shall be designed to provide a mean velocity of not less than 2 feet per second flowing at the specified depth in Article 3.2, except that the District may approve a gradient that will develop a velocity of less than two (2) feet per second in unusual circumstances. Where there is conflict between design by velocity and design using minimum slopes in Article 3.8, the design with the steepest slope shall be used.

The maximum velocities for gravity sewers shall normally be 8 to 10 feet per second. To minimize turbulence in manholes, the grade of the incoming sewer shall not exceed the grade of the outgoing sewer by more that 10 percent. Where this value is exceeded, the design should consider using a vertical curve or an outside drop manhole.

3.10 HORIZONTAL AND VERTICAL SEPARATION

A. All horizontal and vertical separation between potable water mains and sewer mains and service laterals shall conform to the criteria contained in the State of California, Department of Health Services, "Criteria for the Separation of Water Mains and Sanitary Sewers". A copy of this document is included in the Appendix B of these Design Standards. Wherever the State of California separation criteria cannot be maintained, all special construction criteria outlined in the State document shall be followed.

B. Vertical separation between sewers and all other utilities other than potable water shall be no less than twelve (12) inches. Special structural protection is required when a smaller diameter sanitary sewer crosses under a larger diameter utility lines such as storm sewer. In special cases, a separation of less than twelve (12) inches may be allowed with approved special structural protection.

3.11 STRUCTURAL REQUIREMENTS

A. **Streets**. All structures and pipe placed under public streets and roadways shall be of sufficient strength to support, with an adequate factor of safety, the backfill, road surfacing and H-20 loads per AASHTO Standard Specifications, truck loading with impact. Higher loading may be as specified by the District or as required by good design. Such designs shall require the submittal of calculations by the design engineer.

B. **Other Pipes or Structures**. Sewers designed to cross under or over other structures shall be protected from damage and shall be constructed to prevent endangering the other pipe or structures. In this regard, particular attention shall be given to the possibility and prevention of settlement-caused damage.

C. **Steep Grades.** Sewer constructed on grades steeper than 10 percent which are not under or intended to be under pavement shall be examined for possible erosion protection and erosion protection shall be provide as required.

3.12 CURVES

Horizontal or vertical curves may be used where economies in construction may be obtained without increasing problems of maintenance and operations. Curves shall have a minimum radius of 200 feet, and only one curve, either horizontal or vertical, shall be permitted between manholes, with the manhole spacing being reduced to a maximum of 350 feet.

In curved streets, the sewer shall follow the curvature parallel to the centerline where the street curve is the same or greater than the minimum allowable radius of the sewer. Allowable joint deflections shall be the more stringent of those set forth below and the manufacturer's recommendations.

A. **Horizontal Curve.**

1. **Vitrified Clay Pipe.** Horizontal curve shall be obtained by pulling the pipe joint. Joint deflections shall conform to the table entitled "RADIUS OF CURVATURE AND ANGLE OF DEFLECTION FOR CURVILINEAR SEWERS USING VARIOUS PIPE LENGTHS", of Clay Pipe Engineering Manual, latest edition, published by National Clay Pipe Institute. The following table for shall be used as basis for horizontal curve:

Pipe Dia.	Max. Allow. Defl. in./ft., Defl. Angle	Equation for Min. Radius Equation for Min. Radius (L = Pipe Length)	Min. Radius Curvature (ft) for Pipe Length, L, of 4'	6'
4" to 12"	1/2", (2.4^{O})	R = 24.0(L)	96'	144'
15" to 24"	3/8", (1.8^{O})	R = 32.0(L)	128'	192'

2. **PVC.** Horizontal curves for PVC shall be obtained by bending the pipe along its length within the trench. Beveling pipe ends will not be allowed. Bending should be done manually by the workers in the trench, and should not be done by mechanical equipment. The following table shall be used as basis for horizontal curve:

Minimum Radius of Pipe	Minimum Radius in Feet.
4"	100'
6"	150'
8"	200'
10"	250'
12"	300'
15"	400'

B. **Vertical Curve.** Vertical curves shall conform to the requirements for horizontal curves except that the radius shall not be less than 400 feet. Vertical curves may be either circular or parabolic in profile. An approximate formula for determining the required minimum length of a parabolic curve is:

$$L = R\ (S_1 - S_2)$$

where: L = minimum length of curve,
R = minimum radius of curve permitted; and,
S_1 and S_2 are the two sewer grades being used, with S_1 being the steepest grade.

C. **Reverse Curve.** Reverse curve shall conform to the requirements of horizontal curves. Reverse curve is not permitted between manholes.

3.13 MANHOLES

The maximum distance between manholes shall be 500 feet from centerline to centerline. The District may require the installation of stub and capped pipes not to exceed 5 feet in length for future sewer extensions. Unless approved otherwise, all manholes shall be

accessible to standard maintenance vehicles. A paved or all weather gravel roadway shall be provided for access to manholes in open space areas.

A. **Locations**. Manholes shall be provided at the following locations:

1. At all abrupt grade changes (too large for a vertical curve.)
2. At all changes in horizontal alignment (except on curves.)
3. At all changes in pipe diameters.
4. At all changes in pipe materials.
5. At the terminus of all lines.
6. At all junctions of main sewers.
7. At the point of tangency of each reverse curve.
8. At the connection of any commercial or industrial services where the average daily flow exceeds 2000 gallons per day, a 6-inch minimum sewer lateral and a manhole may be required by the District.
9. At the connection of an eight-inch or larger sewer lateral connected to an equal or larger diameter sewer.
10. Manhole shall be located away from surface water flows.

B. **Slope of Manhole Channels**. When sewers of uniform size and slope pass through a manhole, the slope shall be maintained and the invert of the center of the manhole shall be given. In sewers that change slope, the slope of the incoming sewer(s) shall be carried through to the outlet and the invert elevation(s) at the inlet(s) and outlet shall be given. When there is a change of pipe diameters, the elevations of the crown of the inlet and outlet pipes shall match.

When the incoming sewer makes an angle of 45^{O} to 90^{O} with the outlet sewer, the outlet sewer's elevation shall be 0.10' lower than the inlet sewer's elevation. If the angle is between 15^{O} to 45^{O}, the outlet sewer's elevation shall be 0.05' lower than the inlet sewer's elevation.

C. **Drop Manholes**. Drop manholes shall not be used to avoid extra trench depth unless unusual circumstances exist. All proposed drop manholes shall be approved by the district. Where approved, the vertical drop shall not exceed 10 feet, and shall be constructed in accordance with District Standard Drawing Number 12 "DROP MANHOLE CONNECTION".

D. **Rim Elevations**. Rim elevations for manholes shall be shown on the profile. In paved area, the rim elevation shall match the finished grade. In easement and other unpaved area, the rim elevation shall be at least nine (9) inches above finished grade. The elevation shown on the design plan does not relieve the contractor from making final adjustments to match street surfaces.

E. **Manhole Size**. Standard manholes shall be in accordance with District Standard Drawings Number 1 and 2. Normally, manholes shall be 4-foot in diameter; and 5-foot

diameter manholes are required for lines 18" and larger or where the depth to pipe invert exceeds fifteen (15) feet. Where the depth exceeds fifteen (15) feet, the manhole lid shall be thirty (30) inches in diameter.

3.14 VERTICAL RISERS

Vertical risers are only permitted if a terminating sewer will be extended in the future.

3.15 BUILDING SEWERS

Whenever is known or can be reasonably assumed that a building sewer connection is required, a service lateral shall be shown on the sewer improvement plans and installed to the property line as part of the street sewer construction prior to paving. An independent sewer lateral shall be provided for each house or building site. A cleanout extending to the finished grade shall be installed at the property line, at the connection of the house to the building sewer unless exempted by the District.

A. **Size**. Building sewers for single-family dwellings shall be 4-inch minimum diameter unless a larger size is required by the District. Condominium or townhouses shall have separate 4-inch minimum diameter laterals for each dwelling unit. All other laterals for commercial, institution, or industrial users shall be no less than 6-inch minimum diameter unless approved otherwise by the District.

The maximum size for building sewer connection by wye or tee fitting to a larger diameter sewer shall be six (6) inches.

B. **Material**. For all new construction, the building sewers shall be constructed with the same pipe material as the main sewer. Use DR35 fittings for PVC sewers.

C. **Length**. Unless approved otherwise, the building sewer shall not exceed 100 lineal feet.

D. **Depth**. Building sewers from the main sewer to the property line shall be constructed at a minimum of two (2) percent grade unless otherwise approved. In addition the depth at the property line shall be five (5) feet minimum from the top of the pipe to the ground surface. The grade and location of the lateral within the property are under the jurisdiction of the local municipality.

E. **Connection**. All building sewers must connect to the main sewer by wye or tap connection. Unless otherwise approved, direct connection into manhole is prohibited.

F. **Backflow Preventor**. A backflow preventor is required when the elevation of the finished floor is less than twelve (12) inches above the nearest upstream manhole. It is the designer's responsibility to recognize the possibility of reversed flow in building sewers serving lots or buildings. The lots where a backflow prevention device is required shall be indicated on the plans.

G. **Cleanouts**. Cleanouts are required at the junction of the house sewer and the building sewer at the property line. ABS cleanout stacks are not allowed.

3.16 FORCE MAINS AND LIFT STATIONS

All sewage shall reach the sewer system by gravity flow, in a fresh (non-septic) condition suitable for conventional sewage treatment processes. Where extreme hardship

conditions prevail and a substantial area cannot be served by gravity sewers a sewage pumping station may be considered in accordance with these requirements. No pumping facilities shall be designed or incorporated into sewer improvement plans without prior District approval.

A. **Lift Station Design**. Lift stations, where permitted, shall be of the submersible pump type incorporating the following features:

1. Submersible pumps shall be heavy-duty, non-clog type approved by the District.

2. Pumps or other devices shall be provided in duplicate, arranged for positive priming.

3. Capacity shall be provided to handle ultimate peak flow from the tributary area with the largest pump out of service. Staged installation of pumps will be permitted if space is provided for future pump units.

4. Access shall be provided to the site for removal and repair of equipment.

5. A means of dewatering force mains shall be provided.

6. Wet wells shall be designed with a gravity overflow relief whenever possible. When it is not possible to have an overflow relief, a gated quick disconnect fitting for a portable pump connection shall be install in the discharge valve box on the force main downstream of the discharge valve.

7. Holding capacity in a wet well that has an overflow relief shall be equivalent to two (2) hours accumulation of the maximum design flow from the fully developed area tributary to the pump station. Wet wells that do not have overflow relief shall have a holding capacity equivalent to four hours (4) hours accumulation of the maximum design flow from the fully developed area tributary to the pump station.

8. Bottom of the wet well shall slope to suction lines at least 2.0 vertical to 1.0 horizontal. The width of the flat bottom in the wet well shall not exceed twice the diameter of the pump suction inlet.

9. Pump stations for newly developed areas shall not be located in road right-of-way, but shall be located on a separate parcel of land, and shall include fence, gates, landscape, etc. Pump stations located in road right-of-way will only considered when it could be demonstrated to the governing body of the road right-of-way and the District that no other site out of the road right-of-way is possible and such facility is no temporary.

10. A pump station shall have suitable adjustable level control, sump pump, ventilation, lights, locking entrance door, running time meters, and cathodic corrosion control in case of metallic construction materials.

11. Pump and fittings shall be designed to permit the passage of a three (3) inch diameter sphere through the pump.

12. Control panels shall incorporate the District's current monitoring system to transmit alarms and other operating data.

B. **Force Mains.** Force mains shall be laid on a continuous positive grade and to grades designed to eliminate air pockets in the line. Cleanouts shall be installed every 400 feet, sewage type air and vacuum release valves at high points, blow off valves at low points, bypass valves, pig launchers and retrievers for internal cleaning, and marker or locating tape in the trench above the pipe.

Force mains shall be designed for a minimum velocity of three (3) feet per second (fps) to maintain solids in suspension. The maximum force main velocity shall be calculated with respect to the cost of the installation of the force main versus the power cost over the 60-year life expectancy. The recommended velocity of the force mains is normally between 5 to 7.5 fps, with maximum velocity not exceeding 10 fps during intermittent flow conditions.

The pipe wall thickness shall be calculated based on the internal pressure and the external load (trench load plus corrosion allowance. In addition, the wall thickness shall be based on the predetermined bedding and backfill conditions. Pipe material, size, wall thickness, type of joints and installation shall be shown on plans and specifications.

C. **Special Structures.** Design criteria for special structures (i.e. junction boxes, etc.) that are not covered in previous sections area to be prepared individually for each specific project, and shall be approved by District Engineer.

3.17 INVERTED SIPHONS

Inverted siphons and air jumpers are constructed to convey sanitary sewer across rivers, creeks, depressed highways and other obstructions. Inverted siphons are designed and constructed to ensure proper function during the design period of the system to be fail-safe and to minimize maintenance and odor.

A **Location.** The locations of inverted siphons shall conform to the provisions in Article 3.6 "LOCATION OF SANITARY SEWER".

B. **Barrel Design.** Inverted siphons shall have a minimum of two barrels. The redundant barrel shall be provided for bypass capacity, for emergencies, and for use when another barrel is taken off-line for maintenance or repairs. When two barrels are installed, they shall be the same size, each one capable of conveying the full designed flow rate.

C. **Hydraulics.** Hydraulically, inverted siphons are designed like other pipe lines by using the Manning's Equation, with $n = 0.0014$.

The flow capacity for an inverted siphon shall not exceed the capacity of the sewer system upstream of the inverted siphon. Inverted siphons shall have minimum flow rate of three (3) feet per second (fps) under the average dry weather flow (ADWF) condition, and a minimum velocity of 4 fps under the peak dry weather flow condition.

The minimum size of the siphon shall be 6-inch. Inflows to and outflows from a multi-barrel inverted siphon shall be controlled by weirs.

D. **Horizontal Alignment.** The horizontal alignment should be a single, straight alignment. A curved alignment or one with angle point should be avoided. The curved alignment is preferred if a straight alignment is not possible. For curved alignment, an

access structure for maintenance purposes shall be constructed at both ends of the curve. If an angle point is necessary, an access structure shall be constructed at the angle point.

E. **Vertical Alignment**. An inverted siphon with vertical curve is preferred to one with an abrupt change of grade. A sag point in the middle of the inverted siphon should be avoided. The best design is for a uniform grade from one end of the siphon to the other end. The maximum grade of the downstream (rising) leg approaching the outlet structure shall be 15% to allow solids to be conveyed upwards from the conduit into the outlet structure. For an inverted siphon crossing a stream or waterway, the top of the inverted siphon shall be no less than three (3) feet below the level of possible scour in the stream or waterway. The inverted siphon shall be located away from an outlet of a lateral or drop manhole.

F. **Air Jumper**. In area where the installation of an air jumper is feasible, i.e., underground, the air jumper must be designed hydraulically. The cross section area of the air jumper is assumed to be twice that of the cross-sectional area allocated for gas flow of the approaching pipeline, or:

$$A_A = 2A_S$$

Where: A_A = Cross sectional area of air jumper,
A_S = Flow cross sectional area allocated for gas flow of the approaching pipeline.

G. **Materials**. Inverted siphons must be constructed with pressure rated materials. Accepted materials are: solid wall plastic pipes (PVC, HDPE), vitrified clay pipe (VCP), and ductile iron pipe (DIP). Materials for weirs can be fabricated from corrosion resistant plastics, stainless steel, redwood and treated Douglas Fir.

3.18 PRIVATE (RESIDENTIAL) SEWER SYSTEM

A. **Gravity Sewer**. The District will require a sewer system within a private development such as condominium, townhouses or single-family homes to be a privately maintained sewer system when the streets and roadways are privately maintained by the homeowners. The private sewer system shall be designed and constructed to the District's specifications. District approval of the plans will be required when such private sewer system connects to an existing District sewer.

B. **Individual Private Pumping System.** There are areas within the District that a private pumping system is: (1) in the district's best interest, or (2) the only method for serving a building site when there are plumbing fixtures at an elevation too low to permit drainage by gravity from the fixtures to the public sewer system.

The design, construction, and maintenance of the private pumping stations is the sole responsibility of the property owner. Where used, the design of a private pumping system requires District approval. Conditions for the approval of the pumping system are the following:

1. All equipment and accessories shall be standard manufactured items with those in contact with sewage being specifically manufactured for sewage use.

2. The engineer shall submit a listing of satisfactory installations using the same products.

3. Individual systems shall meet the following minimum requirements:

(a) The sump shall have a minimum 400 gallon capacity.

(b) The system shall be of the duplex type (2 pumps) and have duplex controls that will automatically alternate the pumps and energize both pumps and an alarm during high liquid level.

(c) The system shall allow the District to turn off the system when necessary.

(d) Discharge line shall be a 3 inches line with a working pressure of not less than 150 pounds per square inch (psi). All underground discharge piping shall be approved by the District Engineer.

(e) The shut-off valve shall be either ball centric or eccentric plug type with a working pressure of not less than 150 psi and suitable for wastewater use. The check valve shall be a rubber flapper swing non-slamming type with a working pressure of not less than 150 psi and suitable for wastewater use.

4. The discharge line shall be arranged such that there is gravity flow into the main sewer from the property line.

5. Where a pumping unit serves a number of homes, it shall be sized to handle daily flow volumes of at least 500 gallons per day per residence and a peak discharge into the unit to reflect the number of residences.

6. All controls shall be non-fouling type and all mechanical and electrical equipment shall equal or exceed District or other pertinent codes.

7. Where a pumping unit is proposed, it shall be requested prior to tentative map approval, except for those cases where the District may decide to approve the unit at a later date.

3.19 ABANDONMENT

All existing sanitary sewer or structures to be abandoned shall be indicated on the drawings by the applicant's engineer. In general, in-service lines that are to be abandoned shall be replaced with a parallel line or equal or larger size. The engineer shall demonstrate in all cases that the abandonment will not adversely affect the sewer system.

All abandonment and construction methods shall be discussed with the District inspector and must be approved prior to such work.

A. **Sewer Line.** Sewer lines to be abandoned shall be entirely filled in accordance with city or county requirements. Building sewers shall be capped at the property line under the supervision of the District.

B. **Structures.** Manholes to be abandoned shall have all openings, inlets and outlets sealed off. The manhole cone shall then be removed and the remaining structure filled

with material in accordance with city or county requirements. Demolition debris shall be properly disposed of in accordance with all local, state and federal laws and regulations.

C. **Salvaged Materials**. Salvaged metal castings such as frame and covers and other metal appurtenances, unless otherwise specified, shall be the contractor's responsibility.

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