# SECTION L

## TECHNICAL PROVISIONS FOR THE CONSTRUCTION OF SANITARY SEWER LIFT STATIONS

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**Standard Drawings**

LS-1 through LS-11 

**Appendixes**
SECTION L

TECHNICAL PROVISIONS FOR THE CONSTRUCTION OF
SANITARY SEWER LIFT STATIONS

INTRODUCTION

This section applies to 'City ACCEPTED' wastewater pump stations with peak
design of 1500 GPM or less per pump or station that requires motor sizing smaller
than 20 hp. All such wastewater pump stations shall be submersible type stations.
The type and bases for design of all other stations shall be reviewed with the City
and the approval obtained before proceeding with design.

Only equipment compatible with existing components and operations will be considered.
It is the scope of this provision to insure uniform operation and to minimize spare part
inventory. Interchangeability with existing equipment and emergency connection to this
equipment with no adverse effect on operations will be required.

All wastewater pump stations that are not accepted by the City, yet intend to discharge
into the City’s wastewater collection system shall have a current repair and maintenance
contact name and telephone number visibly attached to the outside face of the control
panel. The owner shall keep access available to the pump station at all times. The City
shall have the right to enter said station in times of emergencies to allow control of
wastewater discharged into the City’s system.

Contractor/Owner will be responsible for all permits and fees required by all
organizations responsible for such fees and permits including, but not limited to, CITY,
COUNTY, STATE, and FEDERAL Governments.
L.1 SITE LAYOUT, SIZING, AND EASEMENT REQUIREMENTS

Pump station sites shall be laid out and sized as delineated on the ‘Pump Station Site Plan’ in the ‘Standard Drawings.’ Site must meet all setback and landscape requirements found in Article XVIII, paragraph 26, City Zoning Appendix B. Lift station site within limits of utility easement shall be uniform and level with top elevations of wet well and valve vault 3 inches above finish grade. Finish grade is defined as top of bedding rock within confine of pump station security fence. The Developer shall dedicate pump station by warranty deed or plat to the City. Dedicated easement shall also be required around the site as delineated on the ‘Pump Station Site Plan’ in the ‘Standard Drawings.’ In general, the site for the paved access road shall also be dedicated to the City by warranty deed or plan. An exception to this requirement may be allowed on a case-by-case basis in the form of an ingress/egress easement for the access road.

L.2 SITE ACCESSIBILITY

The pump station shall be readily accessible by maintenance vehicles during all weather conditions. The access road to the pumping station shall be paved. The facility shall not be located in road right-of-way. In a phased development, a stabilized access road may be accepted during the initial phase with paving to be accomplished in the later phase.

L.3 AREA FLOODING

Wastewater pumping station structures and electrical/mechanical equipment shall be protected from physical damage from a 100-year flood. Regulations of Local, State, and Federal agencies regarding flood plain construction shall be considered.

L.4 DESIGN FLOWS

Design flows shall be based upon the total ultimate development flow from all contributory areas to the pump station. The design average daily flow shall be based on Equivalent Residential Unit (ERU) determination and computed as outlined in the City of Melbourne Comprehensive Plan and Concurrence Ordinances.

The design pumping capability of the station shall be based upon the Peak Design Flow which shall be calculated by multiplying the design average flow with the applicable minimum peaking factors as outlined below:
<table>
<thead>
<tr>
<th>Design Average Daily Flow</th>
<th>Minimum Peaking Factor for Peak Design Flow</th>
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<tr>
<td>Flows to 100,000 GPD</td>
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For design average daily flow above 2,000,000 GPD, peaking at factors less than 2.5 may be considered if substantiated by extensive data. Under no circumstances shall peaking factors less than 2.0 be allowed.

L.5. WET WELL AND VALVE VAULT DESIGN

Wet well shall be minimum six-foot (6’) diameter and shall have a minimum four and one-half-foot (4 ½’) depth below the lowest invert. Additional depth shall be provided based on station design and cycle time.

Pumping levels shall be adjusted to provide a minimum capacity between normal operational water levels sufficient to allow a minimum of five (5) minutes between successive starts of the pumps.

Pump-off water levels shall provide adequate submergence to preclude pump inlet vortexing, or air binding. Operational maximum water levels shall not exceed the invert elevation of the influent pipe.

The wet well floor shall have a minimum slope of 1 to 1 to the hopper bottom. The horizontal area of the hopper bottom shall be no greater than necessary for proper installation and function of the pump inlet.

No fixed interior ladders shall be permitted in the wet well.

Locate manhole within limits of fenced-in area to allow isolation of wet well during by-pass operations. Manhole shall be lined as required for wet well. Only one wastewater inlet connection shall be permitted to a wet well. All openings in wet well and valve vault shall be manufactured at foundry. No field coring is permitted without City approval.

Wet well shall be constructed of precast units. Cast-in-place shall not be permitted.

Precast wet wells shall conform to specifications for Precast Reinforced Concrete Sections, ASTM Designation C478, except as otherwise specified below:

The minimum wall thickness shall be 8” for all wet wells. Precast wet wells shall be constructed with a monolithic base structure as shown on the ‘Standard Drawings.’ The minimum base thickness shall be 12 inches. The precast top slab shall have thickness of 10 inches (10”). Concrete for wet wells shall be Type II, 4000 psi at
28 days. Barrel, top and base sections shall have tongue and groove joints. All joints will use ‘O’ Ring Gaskets for seal between well sections. The date of manufacture and the name or trademark of the manufacturer shall be clearly marked on each precast section. Sections shall be cured by an approved method for at least 28 days prior to painting and shall not be shipped until at least two days after having been painted. Lifting rings or non-penetrating lift holes shall be provided for after having been painted. Lifting rings or non-penetrating lift holes shall be provided for handling precast wet well sections. Non-penetrating lift holes shall be filled with non-shrink grout after installation of the sections. Concrete surfaces shall have form oil, curing compounds, dust, dirt, and other interfering materials removed by sandblasting and shall be fully cured prior to the application of any coatings.

Interior of wet well shall have a high-density polyethylene (HDPE) and Polypropylene Copolymer (PPR) thermal plastic liner installed at the foundry as an integral part of the concrete casting process. Acceptable manufacturer: Argu Sure Grip or approved equal.

**Wet Well Structure Inspection**

The quality of all materials, the process of manufacture, and the finished sections shall be subject to inspection and approval by the City. Such inspection may be made at the place of manufacture, or at the site after delivery, or at both places, and the section shall be subject to rejection at any time on account of failure to meet any of the specification requirements even though sample sections may have been accepted as satisfactory at the place of manufacture. Sections rejected after delivery to the job shall be marked for identification and shall be removed from the job at once. All sections which have been damaged after delivery will be rejected and, if already installed, removed and replaced, entirely at the Contractor’s expense.

At the time of inspection, the sections will be carefully examined for compliance with the specified ASTM designation and with the approved manufacturer’s drawings. All sections shall be inspected for general appearance, dimension, “scratch-strength” blisters, cracks, roughness, soundness, etc. The surface shall be dense and close-textured to form an integral watertight unit.

**Wet Well Placement**

Base sections shall be placed on bedding rock conforming to the requirements on standard drawing. The bedding rock shall be firmly tamped and made smooth and level to assure uniform contact and support of the precast structure.

A precast base section shall be carefully placed on the prepared bedding so as to be fully and uniformly supported in true alignment and making sure that all entering pipes can be inserted on proper grade.
Precast wet well section shall be handled by lift rings or non-penetrating lift holes. Such holes shall be filled with non-shrink grout after installation of the wet well.

The first precast sections shall be placed and carefully adjusted to true grade and alignment. All inlet pipes shall be properly installed so as to form an integral watertight unit. The sections shall be uniformly supported by the base structure and shall not bear directly on any of the pipes. Precast sections shall be placed and aligned to provide vertical alignment with a ¼ inch maximum tolerance per five (5) feet of depth. The completed wet well shall be rigid, true to dimensions, and watertight.

Valve vault floor shall slope to center and have a solid PVC floor drain with stainless steel grating. Floor drain shall be connected to wet well as shown on ‘Standard Drawings.’ Drain line shall include two (2) in-line “P” traps; one located under drain below valve vault and one located at the discharge of drain in wet well to prevent corrosive gases from entering valve vault.

All pipe openings shall be sealed with EMBCO non-shrink grout or approved equal.

Both the wet well and the valve vault shall be furnished with an access frame and cover. Equipment furnished shall include the necessary aluminum access frames complete with hinged and slide bar equipped, stainless steel upper guide holder, and level sensor cable holder. The frames shall be cased in structure at foundry with upper guide holder securely mounted above the pumps. Doors shall be of aluminum checkered plate. The access cover and frame with steel hardware shall be installed as shown on the ‘Standard Drawings.’ Wet well cover shall be minimum of 30” x 48”, valve box shall be minimum of 48” x 48” double door. Both covers shall be aluminum locking type similar and equal to U.S. Foundry Corp. Model APS300 (wet well) and Model APD300 (valve vault). Larger size covers may be required to accommodate pump equipment.

Grounding wire to be poured into top slabs and connected to access frames as outlined in SUB-SECTION L.12.6.

Buoyancy of wet well and valve vault structures shall be considered and adequate provisions shall be made for protection. Wet well and valve vault structures shall be installed as shown on the ‘Standard Drawings.’ Wet well construction shall be in conformance with the pre-cast structure specifications as outlined on ‘Standard Drawings.’

Exterior of wet well to receive at foundry two coats (black over red) of coal tar epoxy paint (8mm dry film thickness each). This is to be continuous coating free of “pin holes” and/or voids and is to be applied in accordance with manufacturer instructions as not to void manufacturers warranty. Technical specifications and general information concerning the specific coating used shall be supplied by the paint manufacturer and be included as part of the required submittals as outlined in Sub-Section L.13. After wet well top slab, base and all sections have been permanently set in place, seal outside with non-shrink grout prior to exterior
application of protective epoxy coal tar coating. (Koppers Bitumastic 300m, no substitute allowed).

L.6. PUMP AND MOTOR SIZING

Pump station shall be capable of pumping the peak design flow with the largest pumping unit out of service. Pumps shall be capable of meeting all system hydraulic conditions without overloading the motors. In addition, a minimum of 3-hp motor shall be required unless prior arrangements have been approved by the City. Head capacity curves shall be prepared and submitted to the City along with the pump station plans. Such curves shall be based upon friction losses through force mains. Determination of such friction loss shall be based on the Hazen and Williams formula, the value for “C” shall be 120 for ductile iron pipe and 130 for PVC. “C” values greater than 130 shall not be allowed. When initially installed, force mains may have a significantly higher “C” factor. The higher “C” factor should be considered only in calculating maximum power requirements and duty cycle time of the motor. Head capacity curves shall verify that the pumps are operating at peak efficiency and are suitable for the design flow applications. Pump and motor selection and head capacity curves shall reflect hydraulic conditions in cases where receiving force main systems are interconnected to additional pumping stations.

For pumping stations with a peak design flow of 1500 GPM or less, a minimum of two pump units shall be provided. Where the peak design flow exceeds 1500 GPM, three or more pump units shall be provided. Stations with three or more pump units may require on site stand by generator capabilities as determined by City.

Developer’s Engineer shall submit design calculations for all wastewater pump stations. Calculations shall include head capacity curves with copies of manufacturers pump curves, hydraulic analysis of force main systems, operating cycle calculations with wet well sizing, and buoyancy calculations. Pump impeller selection shall be based on a non-overloading factor in relation to the submitted pump curve.

L.7. PUMP EQUIPMENT DESIGN AND CONSTRUCTION

The pumping equipment covered by these specifications is intended to be standard pumping equipment of proven ability as manufactured by a reputable firm having at least ten- (10) year’s experience in the production of such equipment. The equipment furnished shall be designed, constructed, and installed in accordance with the best practices and methods, and shall operate satisfactorily when installed as shown on the ‘Standard Drawings.’ All parts shall be designed and proportioned to be specifically adapted for the work to be done. Base elbows and pump guide rail systems shall be designed as an integral part of the specific pumping equipment to be used.
All necessary materials such as bolts, nuts, washers, and foundation fasteners, used to secure such pumping equipment for operation in accordance with the manufactures and the City specifications shall be furnished by the pump manufacturer or his designated representative and be of “Type 316 Stainless Steel.” Brass or stainless steel nameplates giving the name of the manufacturer, voltage, phase, rated horsepower, speed, serial number, model number, impeller size and any other pertinent data shall be permanently attached to each pump. The nameplate rating of the motors shall not be exceeded. Pump suction and discharge openings shall be at least four (4) inches in diameter. The pump shall be capable of handling raw unscreened sewage with minimum three- (3) inch diameter solid spheres.

**Pump construction:**

Major components shall be of gray cast iron, ASTM A-48, class 30B, with smooth surface devoid of blowholes or other irregularities. All exposed nuts or bolts shall be AISI type 304 stainless steel construction. All metal surfaces coming into contact with the sewage, other than stainless steel or brass, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump. Sealing design shall incorporate metal-to-metal contact between machined surfaces. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or Viton rubber O-rings. Fittings will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific torque limit. Rectangular cross-sectioned gaskets requiring specific torque limits to achieve compression shall not be considered as adequate or equal. No secondary sealing compounds, elliptical O-rings, grease or other devices shall be used.

**Cooling System (Dry Pit Installation):**

Each unit shall be provided with an adequately designed cooling system. The water jacket shall encircle the stator housing, thus providing heat dissipation for the motor regardless of the type of installation. Impeller back vanes shall provide the necessary circulation of the cooling liquid through the water jacket. The cooling media channels and ports shall be non-clogging by virtue of their dimensions. The cooling system shall provide for continuous pump operation in liquid temperature of up to 104 degrees F. Restrictions below this temperature are not acceptable.

**Cable Entry Seal:**

The cable entry seal shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall consist of a single cylindrical elastomer grommet, flanked by washers, all having a close tolerance fit against the cable outside diameter and compressed by the body containing a strain relief function, separate from the function of sealing the cable. The assembly shall provide ease of changing the cable, when necessary, using the same entry seal. The cable entry junction chamber and motor shall
be separated by a terminal board, which shall isolate the interior from foreign material gaining access through the pump top. Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable.

**Motor:**

The pump motor shall be induction type with a squirrel cage rotor, shell type design, housed in an air filled watertight chamber, NEMA B type. The stator windings and stator leads shall be insulated with moisture resistant Class F insulation rated for 155 degrees C (311 degrees F). The stator shall be dipped and baked three times in Class F varnish and shall be heat-shrink fitted into the stator housing. The use of bolts, pins, or other fastening devices requiring penetration of the stator housing is not acceptable. The motor shall be designed for continuous duty handling pumped media of (40 degrees C) (104 degrees F) and capable of up to ten (10) evenly spaced starts per hour.

The rotor bars and short circuit rings shall be made of cast aluminum. Thermal switches set to open 125 degrees C (260 degrees F) shall be embedded in the stator coils to monitor the temperature of each phase winding. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the control panel. The junction chamber containing the terminal board shall be hermetically sealed from the motor by an elastomer O-ring seal. Connection between the cable conductors and stator leads shall be made with threaded compression type binding posts permanently affixed to a terminal board. Wire nuts or crimping type connection devices are not acceptable.

The motor and pump shall be designed and assembled by the same manufacturer. The combined service factor (combined effect of voltage, frequency and specific gravity) shall be a minimum of 1.15. The motor shall have a voltage tolerance of plus or minus 10%. The motor shall be designed for operation up to 40 degrees C (104 degrees F) ambient and with a temperature rise not to exceed 80 degrees C. A performance chart shall be provided showing curves for torque, current, power factor, input output kw, and efficiency. This chart shall also include data on starting and no-load characteristics. The power cable shall be sized according to the NEC and ICEA standards and shall be of sufficient length to reach the junction box without the need of any splices. The outer jacket of the cable shall be oil resistant SPC. The motor and cable shall be capable of continuous submergence under water without loss of watertight integrity to a depth of 65 feet. The motor horsepower shall be adequate so that the pump is non-overloading throughout the entire pump performance curve from shut-off through run-out.

**Bearings:**

The pump shaft shall rotate on two bearings. Motor bearings shall be permanently grease lubricated. The upper bearing shall be a single row roller bearing. The lower bearing shall be a two-row angular contact bearing to compensate for axial thrust and radial forces. Single row lower bearings are not acceptable.
**Mechanical Seal:**

Each pump shall be provided with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The seals shall operate in a lubricant reservoir that hydrodynamically lubricates the lapped seal faces at a constant rate. The lower, primary seal unit, located between the pump and the lubricant chamber, shall contain one stationary and one positively driven rotating tungsten-carbide ring. The upper, secondary seal unit, located between the pump and the lubricant chamber and the motor housing, shall contain one stationary tungsten-carbide seal ring and one positively driven rotating carbon seal ring. Each seal interface shall be held in contact by its own spring system. The seals shall require neither maintenance nor adjustment nor depend on direction of rotation for sealing. The following seal types shall not be considered acceptable nor equal to the dual independent seal specified: shaft seals without positively driven rotating members, or conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces.

Cartridge type systems will not be acceptable. No system requiring a pressure differential to offset pressure and to effect sealing shall be used. Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and to provide lubricant expansion capacity. The drain and inspection plug, with positive anti-leak seal shall be easily accessible from the outside. The seal system shall not rely upon the pumped media for lubrication. The motor shall be able to operate dry without damage while pumping under load. Seal lubricant shall be FDA approved non-toxic.

**Pump Shaft:**

Pump and motor shaft shall be the same unit. The pump shaft is an extension of the motor shaft. Couplings shall not be acceptable. The pump shaft shall be of AISI type 420 stainless steel or type 329 stainless steel.

**Impeller:**

The impeller(s) shall be of gray cast iron, Class 30B, dynamically balanced, double shrouded non-clogging design having a long throughlet without acute turns. The impeller(s) shall be capable of handling solids, fibrous materials, heavy sludge and other matter found in wastewater. A full vaned, not vortex, impeller shall be used for maximum hydraulic efficiency. Mass moment of inertia calculations shall be provided by the pump manufacturer upon request. Impeller(s) shall be keyed to the shaft, retained with an expansion ring, and shall be capable of passing a minimum three- (3) inch diameter solid. All impellers shall be coated with an acrylic dispersion zinc phosphate primer.

**Wear Rings:**

A wear ring system shall be used to provide efficient sealing between the volute and suction inlet of the impeller. Each pump shall be equipped with a nitrite rubber coated
steel ring insert that is drive fitted to the volute inlet. This pump shall also have a stainless steel impeller wear ring heat-shrink fitted onto the suction inlet of the impeller.

**Volute & Flush Valve:**

Pump volute(s) shall be single-piece gray cast iron, Class 30B, non-concentric design with smooth passages large enough to pass any solids that may enter the impeller. Pump volute shall be manufactured to accommodate a device designed by the pump manufacturer to produce a flushing action at the start of pump cycle. Water from the pump will be forced through the device into the wet well as a jet flushing stream. This device is mounted on the pump. It is based on the ejector principle with a ball as closing device. The operation is automatic and induced by the pump flow and pressure. Electrical components or cabling will not be accepted. Install one flush valve on one pump per installation.

**Protection:**

All stators shall incorporate thermal switches in series to monitor the temperature or each phase winding. At 125 degrees C (260 degrees F) the thermal switches shall open, stop the motor, and activate an alarm.

**Pump Operation:**

Pumps shall be controlled automatically by means of float-type liquid level sensors in the wet well. These sensors shall be of the Roto-Float type as manufactured by Anchor Scientific, Inc. or City approved equal. Alternate forms of control may be required for pump operation in cases where wet well design or operational conditions preclude the use of float type sensors. The type and installation must be approved by City operations staff.

**L.8. PLACEMENT OF PUMP EQUIPMENT:**

Pumps shall be mounted in the wet well as shown on the ‘Standard Drawing.’ Pumps shall be readily removable and replaceable without dewatering wet well or disconnecting any piping in wet well. The pump(s) shall automatically connect to discharge elbows when lowered into place on a dual stainless steel two-inch (2”) guide rail system requiring no bolts, nuts, or fasteners to effect proper sealing. Mating of the pump discharge flange and base elbow face shall be accomplished by a simple linear downward motion and utilize smooth metal surface contact. Use of O-rings or gaskets to accomplish sealing of mated surfaces will not be accepted. Each guide rail system shall consist of two (2) two-inch (2”) stainless steel guide rails supported at the top by a stainless steel upper guide bracket and at the bottom by the discharge elbow. Ease and quick removal of pumps shall be a requirement of the system. Contractor will be responsible for demonstration of pump removal at City’s request. No portion of the pump shall bear directly on the floor of the wet well and no rotary motion of the pump shall be required for sealing. Each pump shall be fitted with a “type 316 stainless steel”
lifting bail with a grip system for removal of pumps; (see standard drawings) or City
approved equal. Guide rail system will be all stainless steel. Base elbow shall be
anchored to the wet well floor with stainless steel “J” bolts set six inches (6”) into
concrete. “J” bolts shall be hooked under reinforcing steel. Minimum of six inches (6”)
concrete shall be poured in bottom of wet well after centerline of access cover is
determined. Reinforcing steel to be placed as indicated on ‘Standard Drawing.’
Mounting of pumps and required inverts for proper pump operation will be built to meet
manufacturer requirements.

L.8.1. PUMP EQUIPMENT WARRANTY, PARTS, AND SERVICE

The pump manufacturer shall warrant pumping equipment being supplied to the
City against defects in workmanship and material for a period of five (5) years.

The following replacement components and pump repair parts shall be considered
normal stock items that are readily available and located within 100 mile radius of the
City.

<table>
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<tr>
<th>Inspection Plug Washers</th>
<th>Upper Mechanical Seal</th>
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<tr>
<td>Impeller Bolt</td>
<td>Lower Mechanical Seal</td>
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<tr>
<td>Impeller Key</td>
<td>Wear Rings</td>
</tr>
<tr>
<td>Upper Bearing</td>
<td>Motor Cable</td>
</tr>
<tr>
<td>Lower Bearing</td>
<td>Cable Entry Washer/Grommet</td>
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<tr>
<td>Complete Set of “O” Rings</td>
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The pump supplier will furnish the City with a notarized statement that the parts are
in stock. This statement will be provided, together with submittal drawings subject
to the City’s approval. If specified parts are not available when requested by the
City, the pump supplier will provide at no additional cost to the owner with a pump
to maintain the station in operation, or will reimburse the owner for equipment rental
charges he must pay to maintain the operation of his station. Replacement and/or
repair parts as well as factory certified service shall be made available 24 hours per
day, seven (7) days per week including holidays. This service shall be able, if
requested to respond on site within six (6) hours of initial contact.

“Loaner” pumps shall be available to CITY at no charge if pumping equipment is
under warranty and at a fair and reasonable charge if pumping equipment is out of
warranty. “Loaner” pump shall be made available for CITY pick up or delivered if
requested to CITY within six (6) hours of initial contact.

L.9. PUMP STATION PIPE, VALVES, AND FITTINGS

Each pump shall have separate discharge line from base elbow in wet well and through
valve vault to a point three-feet (3’) past exterior of discharge side of valve vault.
Discharge piping shall be Class 54 ductile iron conforming to ANSI AWWA
C104/A21.4-85 and have flange ends. These discharge lines shall be a minimum of four-
inch (4") in size. All pipe, valves, and fittings, unless otherwise stated, shall have flanged ends. All bolts, nuts, and washers used to connect these flange ends shall be of “Type 316 Stainless Steel.” All pipe valves and fittings shall be installed, as indicated on ‘Standard Drawings.’ Each vertical discharge pipe in wet well shall be of one piece, continuous length. If depth in wet well does not permit this, additional lengths shall be approved by City. Under no condition shall adapter flanges be permitted in wet well. Each horizontal discharge pipe shall be of one piece continuous length from connection with 90 degree bend in wet well to connection with long pattern “MH” sleeve in valve vault.