SECTION 7.00
SANITARY SEWER

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SECTION 7.00
SANITARY SEWER

7.01 GRAVITY SEWER MAINS

A. General

Gravity sewer extensions shall meet all requirements of these standards. In addition, the *Minimum Design Criteria for the Permitting of Gravity Sewers* and *Alternative Design Criteria for Minimum Separation for Sewer Systems to Wetlands*, prepared by the Division of Water Resources of NC DEQ, and the *North Carolina Administrative Code Title 15A Chapter 02 Subchapter T Waste Not Discharged to Surface Waters* (15A NCAC 02T) are hereby incorporated into the Town's standards for gravity sewer design. This specification section identifies minimum equipment and construction requirements for gravity sewer extensions that are to be owned and operated by the Town of Holly Springs. This section does not address every aspect of gravity sewer extensions; it is the design engineer's (Designer's) responsibility to supplement these requirements as necessary to produce a complete set of plans and specifications.

All utility extension permits must be obtained prior to construction. Refer to the Town Code of Ordinances Section 16 for further requirements.

B. Design

Location

1. All public sanitary sewer mains shall be installed in dedicated street right of way or in dedicated utility easements. Sanitary sewer mains installed in Town of Holly Springs maintained streets shall be located in the center of travel lanes. Mains located within N.C. Department of Transportation right of way shall be placed outside of pavement limits, in accordance with NCDOT standards. See Section 2.10 for landscape plantings within Utility easements.

2. Minimum widths of public sanitary sewer easements shall be:

Pipe Size (inches)	Pipe Depth (feet)	Easement Width (feet)
< 12	< 20	20
< 12	> 20	30
12 - 24	< 20	30
12 - 24	> 20	40

> 24	All depths	Executive Director of Utilities and Infrastructure Services Specified

a) Additional width of easement will be required when easement contains multiple utilities.

b) Additional temporary construction easement may be required for any sewer not constructed at the time the easement is recorded.

c) Sewer mains shall be centered within their easements.

d) All sewer mains that extend as an outfall between residential lots shall have a minimum 30ft easement.

3. Outfalls shall require accessibility with a maximum cross slope of 6:1.

4. Proposed sanitary sewers paralleling a creek shall be designed to a proper depth to allow lateral connections such that all creek crossings will be below stream bed elevation unless otherwise approved by the Executive Director of Utilities and Infrastructure Services. The top of the sewer main shall have a minimum of one foot of cover between steel encasement pipe and the stream bed. In addition, the following is required:

a) Sewer lines crossing stream beds will be required to be installed with restrained joint pipe inside a steel encasement pipe in accordance with the Standard Details section of these standards (Reference TOHS HS607).

b) Sewer lines crossing under storm drainage pipe containing a single pipe greater than 42 inches or multiple pipes greater than 36-inches will be required to be installed with restrained joint pipe inside a steel casing pipe. Installation may be by bore and jack or excavation which will be at the discretion of the Executive Director of Utilities and Infrastructure Services. All encasements to be extended a minimum of 10 feet beyond the stream bank and/or storm drainage pipe.

5. Sanitary sewer mains shall not be installed under any portion of water impoundments unless approved by the Executive Director of Utilities and Infrastructure Services.

6. The following minimum separations must be maintained:

a) Any private or public water supply source, including WS-1 waters or Class I or Class II impounded reservoirs used as a source of drinking water – 100 feet;

b) Any waters classified WS-II, WS-III, B, SA, ORW, HQW or SB (from normal high water [or tide elevation] – 50 feet);

c) Any other stream, lake, or impoundment – 25 feet or as required by State law.

Where the required minimum separations cannot be maintained, ferrous sanitary sewer pipe with joints equivalent to water main standards shall be used. However, in no instance may sanitary sewer lines be installed less than 25 feet from a private well or less than 100 feet from a public water supply source (or as required by State law).

7. Sanitary sewer lines shall be extended to adjacent upstream property lines, in order to serve all upstream properties. These lines shall be sized to serve all upstream tributary areas in accordance with the Master Land Use Plan or approved developments (whichever results in the larger flow).

8. All non-residential swimming pools shall be discharged into the storm sewer system after dichlorination.

Size

1. The minimum size of public gravity sanitary sewer mains shall be 8 inches.

2. Major interceptors shall be sized in accordance with the "Master Wastewater Plan of the Town of Holly Springs." In areas not included in the master plan, new sewer interceptors shall be designed based on the proposed land use (in accordance with the Town's Master Land Use Plan) of the contributory area. The following flow factors shall be used:

Residential, (Single-Family) flow rates:
Use flow factors of 255 gpd/unit.

Residential (Multi-Family) and Non-Residential flow rates:
Use flow factors as required by the North Carolina Department of Environmental Quality- (at the time of this specification revision, these flow rates are contained in 15A NCAC 02T.0114).

3. For existing sewer systems, an additional allowance shall be made to the above flow factors where the existing flow exceeds these values and immediate remedial measures are not proposed.

4. The ratio of peak to average daily flow shall be 2.5.

5. Sanitary sewers shall be designed to carry the projected peak flow at no more than ½ full. The recommended minimum velocity for sanitary sewer lines is 2 fps. The minimum slope for the uppermost reach of a sanitary sewer line shall be 1.00%.

The minimum grades for public sanitary sewers shall be as follows:

Main Size (inches)	Minimum Slope (feet/100 feet)
8	0.40
10	0.28
12	0.22
14	0.17
15	0.15
16	0.14
18	0.12
21	0.10
24	0.08
27	0.07
30	0.06

6. The maximum grade for sanitary sewers is 10%. The maximum velocity in sanitary sewers is 15 feet per second. These limits may be exceeded with the approval of the Executive Director of Utilities and Infrastructure Services and with the incorporation of the following provisions:

   a) All sewers of greater than 10% slope shall be ductile iron pipe;

   b) High velocity manholes, in accordance with the Standard Details Section of these Standards shall be used on all sewers with a slope greater than 10%;

   c) Concrete anchors shall be installed on all sewers of greater than 10% slope at the following spacings:

      i) Not over 36 feet center to center on grades from 10% to 25%;
      ii) Not over 24 feet center to center on grades from 25% to 40%;
      iii) Not over 16 feet center to center on grades exceeding 40%.

7. Sewer extensions should be designed for projected flows even when the diameter of the receiving sewer is less than the diameter of the proposed extension.

8. Pipe diameter changes shall occur in a manhole with the invert of the larger pipe lowered sufficiently to maintain the same energy gradient. An approximate method of securing these results is to place the 0.8 depth point of both sewers at the same elevation.

9. All residential subdivision lots shall be served by public gravity sanitary sewer unless otherwise approved by the Executive Director of Utilities and Infrastructure Services. If a pump is approved, it shall be privately maintained, must pump into a gravity service connection placed on the lot, and must have a note on the construction plans and recorded plat indicating a private pump may be required to serve the lot with sanitary sewer service. In instances where private pump stations are approved, the gravity service that received the force main shall be required to extend into private property so that the required private force main vent is located a minimum of 20 feet from public right of way.

10. Downstream receiving sewer infrastructure shall be evaluated to confirm adequate capacity by the design engineer for each project. In addition, a sewer study may be required to accompany plans submitted to the Town for consideration of impacts to downstream sewer infrastructure. Developer shall be required to upgrade insufficient infrastructure.

Installation

1. Sanitary sewer mains shall be deep enough to serve adjoining and upstream properties and allow for sufficient slope in lateral lines. All sanitary sewer mains shall have the following minimum of 4.5 feet of cover and be measured as follows:

   a) 4.5 feet from the top of pipe to finished subgrade when under a roadway;

   b) 4.5 feet from top of pipe to existing edge of pavement elevation when adjacent to a roadway which may be widened in the future;

   c) 4.5 feet from top of pipe to finished grade in all other areas.

   The above requirements may be waived at the direction of the Executive Director of Utilities and Infrastructure Services, in which case ductile iron pipe shall be installed.

2. The construction of all sanitary sewer lines which will be maintained by the Town must be performed by a contractor licensed in North Carolina.

3. Sewer mains from 14 to 20 feet deep shall require special bedding in accordance with the Standard Details Section of these Standards.

4. Sewers over 20 feet deep shall require ductile iron for the entire run between manholes and shall be 401 protectant lined.

5. Pipe trench excavation and backfilling shall be performed in accordance with Section 5.00 of these Standards.

6. Transitions of pipe material shall occur only at manholes.

7. Sewer mains shall be laid at least 10 feet laterally measured edge to edge from existing or proposed water mains unless it is determined that local conditions or barriers prevent a 10-foot lateral separation in which case:

   a) The water main is laid in a separate trench, with the elevation of the bottom of the water main at least 18 inches above the top of the sewer;

   b) The water main is laid in the same trench as the sewer with the water main located at one side on a bench of undisturbed earth, and with the elevation of the bottom of the water main at least 18 inches above the top of the sewer.

8. Where sanitary sewers cross NCDOT roadways or major Town roads, as determined by the engineer, pipe encasement shall be required.

9. Where sanitary sewers cross beneath water mains with a vertical separation of 18 inches or less or where water mains cross under sewer mains, the entire leg of sewer line shall be ductile iron pipe. The water line pipe shall be centered at the point of crossing and shall cross sanitary sewer lines at an approximate 90º angle.

10. Where sanitary and storm sewers cross with a vertical separation of less than 24 inches the entire leg of sanitary sewer shall be of ductile iron pipe. There shall be a minimum 5-foot horizontal separation between sanitary sewer and storm sewer.

11. For sanitary sewer and reclaimed separation, see Section 11.01.

12. There shall be a minimum 5-foot horizontal separation between parallel gravity and/or force mains.

13. Sewer line easements shall be completely cleared of all vegetation, graded smooth with minimum cross slope of 6:1, free from rocks, boulders, roots, stumps, and other debris, free from ponded water, and seeded and mulched upon the completion of construction.

14. The first new downstream manhole(s) of any sanitary sewer line extension under construction shall be plugged on the outlet side with a masonry wall or a wing nut plug (to be determined and inspected by the Development

Inspector); secured with a stainless steel cable with identification plate of contractor's name; and secured with stainless steel cable to prevent the passage of groundwater, runoff and sediment into the existing sanitary sewer system. All water upstream of the plug shall be pumped out of the sanitary sewer line and all sediment and solids shall be removed and properly disposed of by the Contractor prior to removal. The plug shall not be removed until the line has been inspected by the Development Inspector to ensure that all possible points of inflow or infiltration have been secured. Failure to meet this requirement will result in a $1,000 per day fine. If the plug blows out and causes equipment or material damage or spills downstream, the Contractor shall be responsible for resulting fines and costs of repairs. Authorization to remove the plug shall be required by Development Inspector. If the Contractor fails to obtain necessary approvals and removes the plug before the system is activated, the Contractor shall be responsible for resulting State and Town fines and damages resulting.

Manholes

1. All manhole cone sections shall be the eccentric type.

2. Manholes shall be spaced at a maximum distance of 425 feet apart for lines 12 lines in diameter or less and at a maximum of 500 feet apart for lines greater than 12 inches in diameter.

3. Manholes for sewers under 21 inches in diameter shall be a minimum of 4 feet in diameter. Manholes for sewers 21 inches in diameter or greater shall be 5 feet in diameter. Manholes requiring inside drops shall be a minimum of 5 feet in diameter. When 2 or more inside drops occur at one manhole, a minimum 6-foot diameter manhole shall be used.

4. All manholes that are over 20 feet deep shall be 5 feet in diameter.

5. Manholes shall be installed at each deflection of line and/or grade. The flow channel through manholes should be smooth and shall conform to the shape of the entering/exiting sewer line. A standard 0.20-foot drop shall be provided at each manhole. Inverts "in" and "out" shall be as designated on the approved plans. Sewers shall be designed to minimize free drops in manholes.

   Either precast or brick and mortar inverts may be used conforming to these Standards. The invert shall be smooth and uniform in shape along the entire length.

6. Inside drops shall be used when free drops exceed 12 inches. For inside drop manholes, the entire upstream leg of sewer must be ductile iron. For inside drop manholes, see the Standard Details Section of these Standards. Outside drops shall not be permitted except when necessary to connect to existing manholes.

7. Manholes not located in roadways shall have a top elevation a minimum of 12 inches above finished grade. Manholes located along outfalls shall have a top elevation a minimum of 24 inches above finished grade or 100 year flood plain, or 12 inches above 500 year flood plain, whichever is higher.

8. Watertight manhole rings and covers shall only be allowed upon approval by the Executive Director of Utilities and Infrastructure Services. Manholes with watertight tops shall be vented in accordance with the Standard Details Section of these Standards.

9. Manholes located within flood plain areas, on outfalls, and within any areas of high groundwater shall be waterproofed by wrapping all joints with a minimum 8-inch width band of butyl joint wrap. Waterproofing shall be installed by mopping asphalt over the joint area, then wrapping butyl joint wrap around the joints, and finally mopping the wrap with another coat of asphalt. The total asphalt coat thickness shall be a minimum of 20 mils.

10. Manholes for sewers 12 inches and above shall be coated with an epoxy coating system such as Cor-Cote SC as manufactured by Sherwin-Williams, Raven 405 as manufactured by Raven Lining Systems, Sewer Kote Duramer 1030 or an approved equivalent.

11. Manholes with an exterior height of four feet or greater from finished grade shall have exterior steps.

12. Manholes on outfalls shall have frames and rotating covers as detailed in HS722 with vent holes.

13. All sanitary sewer manholes in areas of special concern shall be required to be vacuum tested in accordance with ASTMC-1244.

C. Materials

The Executive Director of Utilities and Infrastructure Services will maintain a list of approved manufacturers for all sanitary sewer collection system products. New manufacturers must submit requests for approval to the Executive Director of Utilities and Infrastructure Services. Additional information such as catalogs, lists of installations in the area or material samples may be required. A written response

will be mailed to the applicant accepting or rejecting the product within 90 days of the receipt of all necessary information.

Each length of sanitary sewer pipe installed shall have plainly and permanently marked thereon the following information:

1. Pipe class or strength designation;

2. Manufacturer's name or trademark;

3. Nominal pipe size.

A.B.S. Composite (Truss) Pipe

A.B.S. composite pipe shall meet the requirements of ASTM D 2680. Pipe joints shall be chemically welded or gasket joints in accordance with ASTM D 3212. See Section 7.01-C for additional installation requirements. See the Standard Drawing Details Section of these Standards for bedding requirements.

Ductile Iron Pipe

Ductile iron pipe for gravity sewer use shall be designed and manufactured in accordance with AWWA C150 and C151 for a laying condition Type 2 and a working pressure as follows:

3 – 12 inches	350 psi
14 – 20 inches	250 psi
24 inches	200 psi
30 – 54 inches	150 psi

Pipe joints shall be of the push-on type as per AWWA C1211. Pipe lining shall be cement lined. All ductile sewer lines 12" and above shall be 401 protectant lined

Polyvinyl Chloride (PVC) Pipe

PVC pipe shall be made of PVC plastic having a cell classification of 12454-B, 12454-C or 13364-B (with minimum tensile modulus of 500,000 psi) as defined in Specification D1784. PVC pipe shall have integral wall bell and spigot joints for the conveyance of domestic sewage. Fittings shall be made of PVC plastic having a cell classification of 12454-B, 12454-C or 13343-C as defined in Specification D1784. Fittings must be manufactured by pipe supplier or approved equal, and have bell and/or spigot configurations compatible with that of the pipe. Compounds with superior properties are also acceptable.

All pipe less than 18 inches in diameter shall have a maximum Standard Dimension Ratio (SDR) of 35. Where laying conditions so warrant, and in accordance with manufacturer's recommendations, lower SDR values (stronger pipe) may be required.

PVC pipe 18 inches in diameter and larger must be SDR-35 as defined in ASTM 679. Pipe strength shall be equal to or exceed that required for pipe less than 18" in size. Pipe shall have special bedding as per Detail HS 703.

Installation shall consist of Class I bedding material (as defined in Section 7.01 C) placed 4 inches below the pipe barrel and continuing to 4 inches above the pipe barrel, as per ASTM D2321. In addition, the installation of PVC pipe shall satisfy the requirements of Section 7.01-C below. See the Standard Details Section of these Standards for bidding requirements.

PVC Composite (Truss) Pipe

PVC thermoplastic material shall be a rigid PVC plastic conforming to ASTM D-1784 for a minimum cell class of 12454-B. The Portland Cement Perlite concrete or other inert filler material shall be as described in Section 6.3 of ASTM D-2680.

Joints shall be chemical welded or gasketed in accordance with ASTM D3212. Solvent cement for joining PVC to PVC shall comply with ASTM D-2564. Pipe test specimens shall meet all the manufacturing requirements established in ASTM D-2680.

All recommendations of the manufacturer shall be followed in shipping, handling, laying, joining and backfilling of the pipe, and the pipe shall be installed in full and complete compliance with Recommended Practice D2321. In addition, the installation of PVC composite pipe shall satisfy the requirements of Section 7.01-C below. See the Standard Details Section of these Standards for bedding requirements.

Steel Encasement for water/sewer pipes are required for the following Street Classifications to avoid traffic disruption in the future:

- Controlled Access Highway

For carrier pipes that employ cathodic protection anticorrosion systems, the carrier and casing pipes shall be effectively insulated from one another. Carrier and casing shall be cathodically protected as a unit.
See Section 5.03 Boring and Jacking for more casing pipe size requirements.

D. Additional Requirements for Flexible and Semi-Rigid Sanitary Sewer Pipe

Installation of flexible and semi-rigid sanitary sewer pipe shall satisfy the requirements of the manufacturer and/or the following, whichever is more stringent:

1. Installation shall follow the recommendations of ASTM D-2321 "Underground Installation of Flexible Thermoplastic Sewer Pipe." For flexible and semi-rigid pipes, bedding and embedment material shall be Class I. In any area where the pipe will be installed below existing or future ground water levels or where the trench could be subject to inundation, additional Class I material shall be used for bedding. Refer to the Standard Details Section of these Standards for embedment requirements.

2. The manufacturer's specifications or otherwise approved method shall be used in determining the stiffness class of the pipe to be installed so as to attain the required deflection control. The class of the pipe must be approved by the Executive Director of Utilities and Infrastructure Services prior to installation.

3. The maximum allowable deflection after installation shall be less than 5% for flexible pipe and 3% for semi-rigid pipe. The mandrel (go/no-go) deflection test must be performed on each line prior to acceptance, and no less than 30 days after installation. The Contractor shall supply the mandrel used for this performance test. The mandrel device shall be cylindrical in shape having 9 possible contact points with the pipe. The mandrel's length and diameter (ID of proving ring) shall equal the dimensions in the following table, and shall be subject to the Construction Inspector's approval. A mandrel test on truss pipe shall only be required if the Construction Inspector finds a problem during the visual inspection.

For polyethylene pipe, the following shall apply:

Nominal Diameter (inches)	Mandrel Length (inches)	Mandrel Diameter (inches)
18	12 (minimum)	16.53
21	″	19.30
24	″	22.08
27	″	24.84
30	″	27.62
33	″	30.38
36	″	33.15
42	″	38.68
48	″	44.21
54	″	49.74
60	″	55.27

For other flexible pipes the following shall apply:

Nominal Diameter (inches)	Mandrel Length (inches)	Mandrel Diameter (inches)
6	6	5.65
8	8	7.40
10	10	9.31
12	10	11.22
15	12	14.09

For semi-rigid (truss) pipes the following shall apply:

Nominal Diameter (inches)	Mandrel Length (inches)	Mandrel Diameter (inches)
8	8	7.52
10	10	9.46
12	10	11.40
15	12	14.31

4. For PVC and Polyethylene pipe, the pipe shall be produced with bell and spigot end construction. Joining will be accomplished by rubber gasket in accordance with manufacturer's recommendation, unless otherwise directed or approved by the Executive Director of Utilities and Infrastructure Services. Flexible watertight elastomeric seals in accordance with ASTM D3212-81, may also be used. Each pipe length shall be clearly

marked with information including pipe size, profile number, and class number.

5. Minimum trench width shall be one pipe diameter plus 9 inches on each side of the pipe.

6. Special Bedding (6-inch minimum) and embedment materials shall be per ASTM D2321. Embedment materials shall be installed from trench wall to trench wall and from 6" below the invert to a minimum of 6 inches above the crown of the pipe, for all pipe 14-20 feet deep.

7. The bedding and embedment material shall be compacted to a minimum of 90% Standard Proctor density for Class I materials.

8. If hydraulic jack shoring is utilized for trench walls where shoring is used, it shall be kept to the area just above the top of the pipe. This will ensure the embedment materials and pipe will not be disturbed when removal is made.

9. Bedding and embedment material classifications shall be defined as follows:

   Class I - Angular, (¼ to 1½ inch) graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, crushed gravel, and crushed shells.

   Class II - Coarse sands and gravels with maximum particle size of 1½ inch, including variously graded sands and gravels containing small percentages of fines, generally granular and non-cohesive, either wet or dry. Soil types GW, GP, SW and SP are included in this class.

   Class III - Fine sand and clayey gravels, including fine sands, sand-clay mixtures, and gravel-clay mixtures. Soil types GM, GC, SM, and SC are included in this class.

   Class IV - Silt, silty clays, and clays, including inorganic clays and silts of medium to high plasticity and liquid limits. Soil types MH, ML, CH and CL are included in this class. These materials are not recommended for embedment.

7.02 FORCE SEWER MAINS

A. General

Force mains shall meet all requirements of these standards. In addition, the *Minimum Design Criteria for the Permitting of Pump Stations and Force Mains* and *Alternative Design Criteria for Minimum Separation for Sewer Systems to Wetlands*, prepared by the Division of Water Resources of NC DEQ, and *North Carolina Administrative Code Title 15A Chapter 02 Subchapter T Waste Not Discharged to Surface Waters* (15A NCAC 02T) are hereby incorporated into the Town's standards for force main design. This specification section identifies minimum equipment and construction requirements for force mains that are to be owned and operated by the Town of Holly Springs. This section does not address every aspect of force main design; it is the pump station design engineer's (Designer's) responsibility to supplement these requirements as necessary to produce a complete set of plans and specifications.

B. Materials

PVC pipe shall be required for all sewer force mains. Ductile iron pipe shall be designed and manufactured in accordance with AWWA C150 and C151 for a laying condition Type 2. When it is determined that ductile iron pipe is required, it must have 401 protective coating and meet the following working pressure ratings:

3 – 12 inches	350 psi
14 – 20 inches	250 psi
≥24 inches	200 psi

PVC pipe shall meet the requirements of AWWA C900. Pipe shall be Class 150, SDR 18, integral bell with strength equal to the pipe wall, cast iron O.D., 18-foot length, with a solid elastomeric ring.

PVC pipe for force mains with a diameter of 3 inches or less shall be SDR-21 or Schedule 40 in accordance with ASTM D1785. PVC pipe shall require the installation of a 3-inch wide detector tape placed a maximum of 2 feet below the covering surface.

Pipe fittings shall be compact designed and manufactured per AWWA C153. Joints for fittings shall be mechanical joint and 401 protectant coated. Combination air valves shall be Val Matic - VMC-802ABW or an approved equal. Must be verified with Development Inspector before installation.

C. Installation

Reaction blocking for all fittings or components subject to hydrostatic thrust shall be securely anchored by the use of concrete thrust blocks poured in place. The reaction areas are shown in the Standard Details Section of these Standards. No concrete shall interfere with the future removal of fittings. Material for reaction blocking shall be 3000 psi concrete.

Force mains shall be installed with a minimum cover of 4.5 feet measured from the top of the pipe to existing edge of pavement. Force mains shall be appropriately identified upon installation so that they will not be confused with potable waterlines. The pipe material shall be designated continuously on each joint of pipe as "sewer." Force mains shall be designed and installed to minimize high points.

Sewage combination air valves shall be installed at all the high points of all force mains in accordance with the Standard Details Section of these Standards. Manholes containing valves shall receive an epoxy coating system on the interior such as Cor-Cote SC as manufactured by Sherwin-Williams, Raven 405 as manufactured by Raven Lining Systems, Sewer Kote Duramer 1030 or an approved equivalent.

Force sewer mains shall be installed in dedicated public rights of way or in dedicated utility easements. See Section 2.10 for landscape planting requirements within easements. Easements shall have the following dimensions:

Line Size	Easement Width
<12 inches	20 feet
> 12 inches	30 feet

All force mains shall have an in-line valve located 25 feet from the pump station. In addition, force main valves shall be spaced at appropriate intervals as determined by the Executive Director of Utilities and Infrastructure Services, and shall have **locking** valve box caps marked "Sewer." Force main valves shall be resilient wedge gate type for force mains less than 12 inches; valves greater than or equal to 12 inches, shall be sewer plug valves, designed to hold a minimum 150 lbs on both sides. Pressure testing will be required.

Force mains at air release manholes shall be a minimum of 6 feet deep.

The receiving manhole plus the first downstream manhole below the receiving manhole for a force main shall receive an epoxy coating system on the interior such as Cor-Cote SC as manufactured by Sherwin-Williams, Raven 405 as manufactured by Raven Lining Systems, Sewer Kote Duramer 1030 or an approved equivalent.

All nicks and scratches shall be touched up prior to acceptance of the manhole. The force main shall discharge at the invert of the receiving manhole and shall be as close as possible to 180° from the outlet pipe.

No drop is allowed in the receiving manhole for a force main.

All PVC force mains shall have detector tape installed a maximum of 2 feet below the ground and over the force main. The detector tape shall be a 3-inch wide tape marked "Sewage Force Main" as manufactured by Allen or approved equal. The pipe shall have "sewer" designated on each joint. Locator devices as manufactured by 3M Corporation shall be placed directly on top of sewer force mains, along major thoroughfares and cross-country installations (and as otherwise directed by Executive Director of Utilities and Infrastructure Services) at 100 feet intervals and turn/bends.

7.03 MANHOLES

A. Materials

Manholes shall be precast concrete. No hoop steel base or riser sections are allowed. All manholes shall have eccentric cone sections.

Precast concrete manholes shall meet ASTM C478 as to design and manufacturer. The standard joint shall be sealed with a plastic cement putty meeting Federal Specification SS-S-00210, such as Ram-Nek or a butyl rubber sealant. All lift holes must be plugged with non-shrinking grout after installation. For precast concrete manholes, see the Standard Details Section of these Standards.

Manhole frames and covers (including rotating covers) shall be cast in ductile iron, conforming to ASTM A-48 Class 30, with "Sanitary Sewer" stamped on the cover and two 1-inch perforated holes in roadways and four 1-inch perforated holes in outfalls unless covers required to be watertight. Castings shall be machined to give even and continuous bearing on the full length of the frame. Castings shall be Grey Iron ASTM 48, CL 35B made in the U.S.A. Manhole frames shall be bolted to the manhole as per the Standard Details Section of these Standards. All manhole rings in roadways shall be encased in a concrete collar, 18 inches by 12 inches, of 3,000 psi concrete beneath the asphalt, with the cover flush with the top of pavement and rated for an AASHTO loading Class HS-20, as shown in the Standard Details Section of these Standards.

Watertight manhole frames and covers shall have neoprene gasket, machine bearing surfaces. Bolts shall be standard hexagonal-head, countersunk such that when fully tightened bolt head is flush with the top of the cover. Castings shall be Gray Iron ASTM 48, CL 35B, made in the U.S.A., free of porosity and blow holes. Watertight manhole frames and covers shall only be permitted in lieu of elevating the manhole tops above the 100 and/or 500-year flood plain with specific approval by the Executive Director of Utilities and Infrastructure Services. Watertight manholes shall require venting per the Standard Details section of these standards.

Manhole steps shall be furnished with the precast sections. Steps shall be of polypropylene material reinforced with a half-inch diameter grade 60 reinforcing steel rod. Manhole steps shall be designed for a vertical load of 400 pounds and a horizontal pull out load of 1,000 pounds. Steps shall be set 16" on center. Holes for the installation of manhole steps shall not project through the manhole wall. There shall be a minimum of 1-inch wall thickness from the deepest penetration of the step installation hole and the outside wall. Steps shall be at least 10" clear width and shall project at least 4" from the wall into which it is embedded. Steps shall not be located over the influent or effluent pipes and shall be installed along a vertical manhole wall from the shelf to the top of cone.

All manholes shall have 6-inch, 3,000 psi concrete bottoms resting on a minimum of 6 inches of #57 stone. Sewer mains shall enter and exit radially through the manhole. Inverts shall be constructed with a width and height equal to half that of the effluent pipe and shall be so brushed and troweled that a minimum energy loss occurs in the manhole.

At each inlet and outlet of line 8 inches or greater, wastewater lines are to be connected to the manholes by means of compression connectors (flexible sleeves) cast into the manhole section. Flexible connectors are to be manufactured of high-quality rubber or synthetic rubber and all strap clamps or draw bolts are to be manufactured from stainless steel.

7.04 SERVICE CONNECTIONS

A. Materials

Cast iron soil pipe shall be service weight hub and spigot meeting Federal Specifications WW-401. The joints shall be rubber type elastomeric as per ASTM C425.

PVC pipe shall be schedule 40 or greater supplied in 18 foot lengths. The pipe may be joined by elastomeric gaskets.

Ductile iron pipe shall be used for sanitary sewer services with less than 3 feet of cover or in excess of 20 feet of cover.

Services for new lines shall use in-line wyes of like material unless otherwise approved by the Executive Director of Utilities and Infrastructure Services.

Service saddles for existing PVC or ABS lines shall be of the same material as the main, solvent welded and fastened with double stainless steel bands as shown on the Standard Details Section of these Standards.

Service saddles for existing cast iron soil pipe services may be "ROMAC C" sewer saddles consisting of a virgin SBR gasket compounded for sewer service, a ductile iron saddle casting, a 304 stainless steel adjustable strap for fastening the gasket and the saddle casting to the sewer main and a 304 stainless steel adjustable circle clamp for securing the service line into the SBR gasket.

B. Installation

Individually owned structures shall require individual sewer taps to public sewer. All service connections to existing sanitary sewer mains shall be made by the Town of Holly Springs Utilities and Infrastructure Services Department.

Service taps into mains shall be made on the top quarter of the main with the wye angled with the direction of flow in the main. All services installed on new lines shall be inline wyes unless otherwise approved by the Executive Director of Utilities and Infrastructure Services.

All service lines shall require Class I bedding from 6 inches below service line to 6 inches above the service line. All service lines shall have a minimum of 8 inches separation from other utilities. Service lines greater than 20 feet or less than 3 feet in depth must be ductile iron.

Service connections to the main lines shall be perpendicular to the main line to the edge of the right of way or easement line. Services shall have a minimum slope of 1.0 feet per 100 feet. Cleanouts shall be required on all sewer services at a maximum spacing of 75 feet on 4-inch services and 100 feet on 6-inch services. A cleanout shall be placed on all service lines at the right of way line or at the edge of the easement. All cleanouts shall extend a minimum of 6 inches above finished grade or meet the optional installation requirements in accordance with the Standard Details Section of these Standards. Sewer cleanouts located in paved areas must have traffic load bearing mini-manhole.

All 6-inch service lines shall tie directly into a manhole.

All service lines which are connected into manholes shall be installed less than 2½ feet above the invert or shall be installed with a standard drop as shown on the Standard Details Section of these Standards. Service lines shall not be installed through manhole cone sections or manhole joints. The use of service saddles will only be permitted for connection to existing sewer lines.

Service connections made using a “ROMAC C” sewer saddle shall be made only when the service line is cast iron soil pipe and only when the sewer main is 8, 10, or 12-inch diameter concrete, ductile iron, or PVC sewer pipe. This service connection shall not be used when the sewer main material is truss sewer pipe.

The opening in the sewer main for the “ROMAC C” sewer saddle shall be cut with a hydraulically driven or a pneumatically driven circular tapping saw of the same nominal diameter as the sewer service line.

C. **Grease Interceptor**

All grease traps/interceptors shall be designed according to minimum standards of the North Carolina Plumbing Code and any requests of the Town. The Town prohibits joint use of a tap or interceptor between establishments. All cooking establishments shall have grease interceptors installed and maintained at the User's expense. Non-cooking establishments or other commercial, institutional and/or industrial establishments may also be required to install a grease-handling device(s) when deemed necessary by the Town.

The discharge from the following fixtures shall be connected to the grease interceptor: all sinks, dishwashers, floor drains in food preparation and storage areas, and any other fixtures through which grease may be discharged. See Detail HS725.

7.05 TESTING AND INSPECTION

All materials used must be inspected by the Construction Inspector before they shall be allowed to be installed. Materials rejected by the Construction Inspector shall be immediately removed from the job site.

The Contractor shall furnish all materials, labor, and equipment, and shall pay for the water used to perform all testing and inspection to the satisfaction of the Construction Inspector. The Contractor shall obtain a meter from the Town of Holly Springs for use.

Sanitary sewer lines shall be free and clean from obstructions and shall be visually inspected from every manhole to ensure all lines exhibit a fully circular pattern. Lines which do not exhibit a true line and grade or have structural defects shall be corrected. All sewer mains shall require internal visual inspection by TV Camera at the expense of the developer prior to the beginning of the 1-year warranty and at the end of the warranty period if deemed necessary. Sanitary sewer service connections shall be visually inspected prior to backfilling. Contractor shall supply a DVD to inspector of line camera.

See Section 7.01 C for additional testing requirements for flexible and semi-rigid pipe.

Low-pressure air testing shall be performed after all laterals or stubs are installed on the line and after the main has been backfilled to finished grade. Plugs shall be installed at each manhole to seal off the section of line to be tested. The line will be pressurized with a single hose and monitored by a separate hose connection from the plug. Air shall be slowly introduced into the sealed line until the internal air

pressure reaches 4.0 psig. The air pressure shall then be allowed to stabilize for a minimum of 2 minutes to no less than 3.5 psig (plus groundwater pressure, if any). When the pressure reaches 3.5 psig, the time required for the pressure to drop 1.0 psi shall be observed and recorded. The line shall be termed "acceptable" if the pressure does not drop more than 1.0 psi in the time prescribed for the test in the following table:

STANDARD AIR TEST TABLE

Specification time (min:sec) required for pressure drop from 3½ to 2½ psig when testing one pipe diameter only

Length of Time (feet)	Pipe Diameter (inches)								
	4	6	8	10	12	15	18	21	24
25	0:04	0:10	0:18	0:28	0:40	1:02	1:29	2:01	2:38
50	0:09	0:20	0:35	0:55	1:19	2:04	2:58	4:03	5:17
75	0:13	0:30	0:53	1:23	1:59	3:06	4:27	6:04	7:55
100	0:18	0:40	1:10	1:50	2:38	4:08	5:56	8:05	10:34
125	0:22	0:50	1:28	2:18	3:18	5:09	7:26	9:55	11:20
150	0:26	0:59	1:46	2:45	3:58	6:11	8:30		
175	0:31	1:09	2:03	3:13	4:37	7:05			
200	0:35	1:19	2:21	3:40	5:17				12:06
225	0:40	1:29	2:38	4:08	5:40			10:25	13:36
250	0:44	1:39	2:56	4:35			8:31	11:35	15:07
275	0:48	1:49	3:14	4:43			9:21	12:44	16:38
300	0:53	1:59	3:31				10:12	13:53	18:09
350	1:02	2:19	3:47			8:16	11:54	16:12	21:10
400	1:10	2:38			6:03	9:27	13:36	18:31	24:12
450	1:19	2:50			6:48	10:38	15:19	20:50	27:13
500	1:28			5:14	7:34	11:49	17:01	23:09	30:14

If the section of line tested fails to meet these requirements, the source of leakage shall be determined and repaired. The section of line shall then be retested.

The Construction Inspector may require that an infiltration test be performed. Infiltration shall not exceed 100 GPD per inch per mile.

At the discretion of the Executive Director of Utilities and Infrastructure Services, sanitary sewer manholes in areas of special concern may be required to be vacuum tested in accordance with ASTMC-1244 as shown.

C 1244 – 05a [e1]																		
Table 1 Minimum Test Times for Various Manhole Diameters (30-120 in.) in Seconds										Table 1 Minimum Test Times for Various Manhole Diameters (30-120 in.) in Seconds (continued)								
Diameter, in.										Diameter, in.								
Depth (ft)										Depth (ft)								
	30	33	36	42	48	54	60	66	72		78	84	90	96	102	108	114	120
Time, in seconds										Time, in seconds								
<4	6	33	7	9	10	12	13	15	16	<4	18	19	21	23	24	25	27	29
6	9	10	11	13	15	18	20	22	25	6	26	29	31	34	36	38	41	43
8	11	12	14	17	20	23	26	29	33	8	35	38	41	45	48	51	54	57
10	14	15	18	21	25	29	33	36	41	10	44	48	52	56	60	63	67	71
12	17	18	21	25	30	35	39	43	49	12	53	57	62	67	71	76	81	85
14	20	21	25	30	35	41	46	51	57	14	62	67	72	78	83	89	94	100
16	22	24	29	34	40	46	52	58	67	16	70	76	83	89	95	101	108	114
18	25	27	32	38	45	52	59	65	73	18	79	86	93	100	107	114	121	128
20	28	30	35	42	50	53	65	72	81	20	88	95	103	111	119	126	135	142
22	31	33	39	46	55	64	72	79	89	22	97	105	114	122	131	139	148	156
24	33	36	42	51	59	64	78	87	97	24	106	114	124	133	143	152	161	170
26	36	39	46	55	64	75	85	94	105	26	114	124	134	144	155	164	175	185
28	39	42	49	59	69	81	91	101	113	28	123	133	145	155	167	177	188	199
30	42	45	53	63	74	87	98	108	121	30	132	143	155	166	178	189	202	213

7.06 REPAIR OF SANITARY SEWER LINES

The repair of damaged sanitary sewer lines shall be as follows:

1. PVC Pipe - Replace damaged section with PVC pipe. Install PVC couplings or ductile sleeves and mechanical bolt at each end (encased in concrete).

2. ABS/PVC Truss Pipe - Replace damaged section with D.I.P. Install PVC couplings or ductile sleeves and mechanical bolt at each end (encased in concrete).

All repairs to damaged sanitary sewer lines shall be backfilled with ABC stone (crusher run) to a density of 95% Standard Proctor.

7.07 WASTEWATER PUMP STATIONS

A. General

In situations where gravity sewer is not feasible, the Town of Holly Springs will consider allowing the installation of a wastewater pump station and force main. If a pump station is permitted, it is the Town's goal that the station will meet the following criteria:

1. The station will provide the pumping capacity and configuration required to pump all wastewater flows tributary to the station.

2. The design and construction of the station will ensure reliable, continuous, and consistent operation, even during adverse operating conditions such as flooding or loss of utility system power.

3. The station's design will allow for easy operation and maintenance of the installed equipment.

4. The design of the station will readily accommodate future expansion requirements, when applicable.

5. The station will avoid septic conditions and excessive release of odors in the collection system and at the pump station.

6. The design and construction of the station will be compliant with all applicable federal, state, and local regulations.

7. The station will minimize impacts on the environment and on the neighborhoods of the Town of Holly Springs.

Wastewater pump stations shall meet all requirements of these standards. In addition, the *Minimum Design Criteria for the Permitting of Pump Stations and Force Mains* and *Alternative Design Criteria for Minimum Separation for Sewer Systems to Wetlands*, prepared by the Division of Water Resources of NC DEQ, and *North Carolina Administrative Code Title 15A Chapter 02 Subchapter T Waste Not Discharged to Surface Waters* (15A NCAC 02T) are hereby incorporated into the Town's standards for pump station. This specification section identifies minimum equipment and construction requirements for a wastewater pumping station that is to be owned and operated by the Town of Holly Springs. This section does not address every aspect of a pump station design; it is the pump station design engineer's (Designer's) responsibility to supplement these requirements as necessary to produce a complete set of plans and specifications.

Engineering

The role of the pump station design engineer (Designer) for a Town of Holly Springs pump station encompasses a number of tasks and duties required to obtain the Town's final acceptance of the pump station. These specifications present the Town's expectations of the Designer's services for each phase of the project's implementation.

Pre-Design Requirements: The Designer shall prepare a Preliminary Engineering Report (PER). The PER shall be prepared prior to a preliminary site plan or subdivision plan approval. The preparation of the PER shall be preceded by a Pre-Design meeting with the Town Utilities and Infrastructure Services staff, for the purposes of generally discussing the proposed pump station and answering any preliminary questions the Designer may have.

1. The PER shall address and include the following items, at minimum:

   a) Determination of the projected and wastewater flow that would be generated by the total natural drainage basin upstream of the anticipated pump station location based upon the Town's proposed land use plan or approved developments, whichever flow is greater.

   b) Presentation of the anticipated phasing of the pump station construction [the calculated peak flow rate for the tributary drainage basin must exceed 1,000 gallons per minute (GPM) before the Town will consider phased construction]. If phased construction is allowed, the Designer shall examine possible pump selections that would allow initially selected pump impellers to be replaced by larger diameter impellers to meet the future pumping conditions. As a general statement, the initial electrical service, standby power system, solids grinder, equipment hoisting system, and odor control system must be sized for the ultimate station capacity (no phasing of these components allowed).

   c) Evaluate and identify the capacity of the receiving sewer main at the point of the proposed force main discharge and downstream to determine if the downstream collection system infrastructure can accept the pumped flow. Identify any upgrades in the existing collection system that would be required due to the addition of the pumped flow. In order to prevent a proposed pumping station requiring modifications and upgrades to existing Town pump stations, the Town will not allow a new pump station to discharge into a receiving sewer line that is tributary to an existing pump station. The Town may elect to allow exceptions to this rule in cases where the Town determines there is no feasible alternative.

   d) The estimated construction cost of the complete proposed pump station (including the related improvements to the existing gravity collection system that may be required to receive the station's discharge) shall be compared to the construction cost of a gravity sewer line alternative that would provide sewer service to the same service area (when such an alternative exists). The estimated installed cost of the gravity sewer alternative divided by the estimated installed cost of the pump station

alternative must be equal to or greater than 3.5 for the Town to consider allowing a pumping station.

e) The PER shall include preliminary pump selection calculations, based on readily available topographic mapping. The calculations shall include a preliminary system head curve, a tentative pump selection, preliminary force main sizing, and anticipated power requirements.

f) A listing of the all the permits that will be required for the implementation of the proposed pump station project.

g) The estimated concentration of dissolved sulfide in the wastewater at the force main discharge at the initial and design flow daily flows for the pump station, and the proposed liquid chemical feed system sizing (based on storing a minimum 30-day supply of the chemical). The liquid chemical in current use by the Town will be identified for the Designer at the meeting with the Town staff prior to the PER preparation.

h) The PER shall identify the anticipated methods of preventing excess positive and negative pressures in the force main piping system due to pump starts and stops. A preliminary surge/water hammer analysis shall be provided with estimates of the maximum and minimum pressures (including negative pressures) that may occur along the force main during pump starts and stops. Depending upon the estimated maximum and minimum estimated pressures, design flow, total dynamic head, force main velocities, force main length, and force main profile, the Town staff may require a detailed computer surge analysis be performed by the Designer or a consultant that routinely performs these analyses.

i) A preliminary site plan with topographic information shall be included with the PER, showing the planned arrangement of the influent sewer line(s), the solids grinder manhole (if applicable), the wet well, the valve vault, the electrical building (or electrical rack, as applicable), the chemical storage and feed systems, water service, driveway layout and turning radii dimensions, planned storm water facilities, a preliminary grading plan, required landscape buffer areas, and tentative fence and gate locations.

Five copies of the PER shall be submitted to the Town of Holly Springs for review. Review comments and questions may be returned to the Designer to clarify any aspects of the PER that are unclear, or are not in compliance with the Town's requirements. The approved PER should serve as a guide for the preparation of the final design documents, and should minimize the Town's comments and questions during the review of the final design documents.

2. Design Requirements: The Designer may proceed with the preparation of plans, specifications, and final design calculations after the PER is approved by the Town staff. The plans shall provide sufficient graphic detail to fully illustrate the extent of the construction that will be required of the Contractor. The design plans also serve to show regulators the proposed construction will meet the required standards, and to be a graphic record of the construction details for the Town. The plans shall include, at minimum, the following information:

- Title Sheet with Index of Drawings and Vicinity Map
- Site Plan with showing all property lines, fences, gates, and locations of all structures and driveway
- Grading plan showing existing contours (from field survey), proposed contours (all contours on 1foot intervals), storm water measures, and 100-year flood elevations
- Site piping plan showing gravity sewer lines, force main piping, waterlines, chemical feed lines, and storm drainage piping
- Landscaping plan with plant lists and planting/staking details
- Plan and section drawings of all precast concrete structures, including influent manhole, solids grinder manhole, wet well, valve vault, and miscellaneous structures
- Building Plan, Section, and Elevations; typical wall section
- Mechanical drawings showing pumps, valves, piping, odor control system details, ventilation systems, and heating/air conditioning systems
- Electrical plans, to include electrical site plan, one-line diagram, panel schedules, light fixture schedule, wire and conduit sizing, generator details, SCADA inputs and details, and grounding requirements and locations

The specifications shall describe the equipment and materials required for the proposed pump station, the specific installation requirements, and the start-up and testing requirements. The Designer may utilize portions of these Standard Specifications as deemed appropriate; however, these specifications do not address all of the aspects of a typical wastewater pumping station/force main construction project. The Designer is responsible for determining all of the specification requirements for the project, and supplementing these Specifications as required.
The engineering calculations to be completed during the design phase and submitted to the Town for review include:

a) Final pump selection calculations, based on field survey information and designed force main diameters and lengths. System head curves

shall be developed for Hazen-Williams "C" factors of 100 and 140, combined with pump curve for selected pump. Calculations shall indicate flow rates for one pump in operation, and for all pumps in operation. Pump selection shall be based on the "C" factor of 100, and the proposed motor sizing shall be based on the power required with a "C" factor of 140 and no utilization of the motor's service factor. Motors shall be non-overloading over the entire range of possible operation.

b) Evaluation of the capacity of the receiving gravity sewer lines.

c) Hydraulic profile from the influent manhole, through the solids grinder and associated piping, to the wet well (profile for the wet well at low level and high water alarm level).

d) The surge/water hammer analysis report, if one was required. The analysis shall be made for both pump start-up and pump shut-down (loss of power) conditions. If the analysis indicates negative pressures of less than -10 feet at any location in the force main, or positive pressures greater than 80% of the rated working pressures of the piping and valves, mitigation measures shall be required. These measures may include the use of Anti-Surge Air-Vacuum valves, a hydropneumatic surge tank, surge relief valves, surge anticipation valves, a combination of those measures, or possibly other methods the Designer may propose.

e) Wet well sizing, pump control operating levels, minimum cycle times, and maximum number of pump starts per hour.

f) Pump station buoyancy calculations, All Pump Stations are to be designed for the maximum of 100-year flood or groundwater full height of Pump Station. Each structure shall have a minimum factor of safety of 1.25, based on no installed equipment and no water within the structure. Design and drawings for buoyancy calculations (including all precast concrete manholes, wet wells, and vaults) are to be signed and sealed by a currently registered professional engineer in the state of North Carolina.

g) Electrical load calculations and generator sizing calculations

h) Final sizing of odor control system pumps and storage tank

3. Construction Phase Requirements: During the Construction Phase the Designer (or the Designer's representative) shall observe the construction as required to allow the Designer to prepare the Engineer's Certification as required by the NC DEQ. The Designer shall also review all equipment and material submittals (shop drawings) as required to confirm that the finished

construction will comply with the requirements of the approved plans and specifications. The Designer shall also be responsible for forwarding certain submittals to the Town staff for their review, comment, and approval, prior to the Designer returning them to the Contractor. This review and approval by the Town staff shall not relieve the Designer from the responsibility of ensuring that all the project components meet the Town's standards. Submittals for the following equipment shall be forwarded to the Town staff by the Designer:

- Fencing and gates
- Check valves and gate valves
- Solids grinder and control panel
- Odor control system components
- Jib crane, motorized trolley, and hoist
- Precast concrete manholes, wet wells, and vaults
- Precast concrete building
- Pumps and motors
- Pump control panel
- SCADA system
- Magnetic flow meter
- Air release and vacuum relief valves
- Generator and automatic transfer switch
- Other equipment and components as may be identified in the Pre-Design meeting

4. Post-Construction Requirements: The Designer (or the Designer's representative) shall be present during the hydrostatic pressure testing of the force main and during the operational testing of the pump station equipment.

The following documentation shall be supplied to the Executive Director of Utilities and Infrastructure Services **prior** to the Operational or "start-up" test for the pump station, and must be submitted in a complete package labeled Operation and Maintenance Manuals that is signed and sealed by the Designer.

a) Cover Sheet listing the following: Pump manufacturer; source of repair parts, complete with address and phone number; operating conditions - rated capacity and TDH of each pump; model number, serial number, impeller diameter of each pump; all data plate information from each pump motor; data on all other equipment included as components in the pump station;

b) Pump Performance Design Curve with operating conditions indicated on it; manufacturer's Certified Pump Curve for each pump:

c) Detailed dimensional drawings of the pump and pump base elbow;

d) Detailed dimensional drawings of the pump and pump motor;

e) A wiring diagram and logic diagram for each control panel;

f) Pump and Motor Installation and Service Manual;

g) Detailed information related to other components of the pump station, including but not limited to, solids grinder, odor control system, generator, automatic transfer switch, hoist system, and HVAC system;

h) Mylar as-built drawings showing all changes to the approved construction plan that were made during construction;

i) P.E. certification;

j) Warranty letter;

k) Recorded access easement and/or right of way documentation.

l) Documentation of site plus access easement dedication to Town.

m) Copy of vendor reports for the start-up testing of their equipment.

Warranties: In addition to the Town's required standard 1-year workmanship and materials warranty, the following shall apply: The developer shall warrant all pump station equipment for one year from the date of beginning of 1-year warranty of the pump station, as identified in the Letter of Acceptance for the pump station. The Town reserves the right to make necessary emergency repairs and/or perform work necessary in emergency situations within this warranty period. The developer shall be responsible for reimbursement costs associated with any such work. If a non-emergency repair or other work becomes necessary within the warranty period, the Town shall provide written notice to the Owner of need for such work. If the work is not completed within the time frame specified in the written notice, the Town shall undertake the work and the developer shall be responsible for reimbursing those costs.

Pump Station Requirements

1. **The developer and the Designer shall be required to meet with the Executive Director of Utilities and Infrastructure Services and/or their representative(s) in a "Pre-Design meeting" prior to preliminary plan-level approval of a site or subdivision requiring a pump station.** The meeting shall be to discuss the site layout and other details and requirements for any proposed pump station before design begins. Pump stations shall meet the NC Building Code and shall be designed to comply with all OSHA regulations, in addition to these Standards.

2. All stations shall be submersible pump stations consisting of piping, valves, solids grinder, odor control, hoisting equipment, wet well and other precast concrete structures, duplex pumps and rails, pump controls and related appurtenances.

3. The duplex pumps shall be of equal capacity and capable of handling flows in excess of the expected peak flow. The peak flow for design shall be equal to 2.5 times the average daily flow. If the design pumping requirements for the station exceed a flow of 1,000 GPM, or if the motor sizes exceed 100 HP, the Designer shall investigate and compare the duplex pump station requirements to the requirements of a triplex pump station. Where three pumps are required, they should be of such capacity that with any one unit out of service, the remaining units will have capacity to pump the peak sewage flows when operating in parallel. Any stations that may require more than three pumps for the ultimate design capacity shall also utilize dual wet wells, with the ability to isolate each one for maintenance. Pumps and the sewage force main shall be sized to provide a minimum velocity in the force main of 2.5 feet per second with one pump operating and a maximum velocity of 8 feet per second at firm capacity. The Town reserves the right to require a larger force main size at no cost to the Town based upon operating (power) costs.

4. All pump stations with ultimate pump motor sizes in excess of 10 Horsepower (HP) shall have a precast concrete building to house the control and electrical panels. Buildings with climate control systems shall have ventilation fans with automatic controls to protect equipment.

5. Pump stations with ultimate pump motor sizes of 10 HP and less may utilize an aluminum backplate, under a weatherhood and mounted on galvanized posts, to mount all control and electrical panels.

6. All sewage pump stations shall be equipped with an alternate power source. Alternate power sources include on-site standby power.

7. Force mains shall be as specified in this section as well as Section 7.02.

8. Small package type pump stations or grinder pumps may be approved by the Executive Director of Utilities and Infrastructure Services for private pump stations which serve only one site. These pump stations will be allowed only if the flow rate is less than 100 GPM and the force main is less than or equal to 4 inches in diameter. Private pump stations shall meet Town and NC DEQ minimum design criteria. Documentation of future maintenance of both the station and the force main by owner of record shall be required.

9. The Town reserves the right on any pump station to perform the design and/or construction inspection and administration, with the developer reimbursing the Town in full.

10. The Town reserves the right to disallow pump stations where, in the Town's opinion, it is not efficient or desirable to have another pump station.

11. New developments may be required to take downstream or upstream pump stations off line, or upgrade them per the Town's Master Sewer Plan or as directed by the Executive Director of Utilities and Infrastructure Services.

B. <u>Site Work</u>

Wastewater pump stations, all related structures and controls, shall be protected from physical damage by the 100-year and 500-year local and FEMA flood plains and shall be elevated to 2 feet above the most restrictive elevation. Flood elevations shall be supported by a flood study on the tributary basin based on future land uses in accordance with the Town's Comprehensive Land Use Plan. Stations shall be designed to remain fully operational and accessible during the 100-year flood. Both flood elevations shall be shown on all site plans.

Pump station sites shall be conveyed to the Town via deed and/or recordation, as specified by the Town, for Town ownership and operation. A site plan for all pump stations shall be laid out with the Town in a separate Pre-Design meeting at preliminary plan review stage of any development project requesting installation of a pump station. The pump station site location as shown on the subdivision plan shall require Town Council approval.

The site shall consist of a fenced-in hard surfaced area, a gravel vehicular area, plus required landscape buffers, per Standard Details. The site shall be stabilized by crushed stone, low maintenance vegetative ground cover or other suitable materials. The site shall be graded generally to drain away from the pump station and to remove stormwater runoff from site in a non-erosive manner.

All components of the pump station shall be surrounded by a concrete slab with minimum HS-20 loading flush with surrounding grade. Concrete slab and hatches shall be HS-20 loading. All access hatches shall be provided with a fall protection system meeting current NC Building Code and OSHA Requirements. Note: HS-20 hatches are only required in areas that could allow for vehicular traffic

A 12-foot (minimum) wide access road to the site with vertical grades not to exceed 10% shall be provided. Access road shall consist of an all-weather surface (minimum of 8 inches ABC) with minimum 40-foot long paved strip from roadway. No driveways may be located off of access road. Access road shall be fully contained within a minimum 20-foot wide combined access and utility easement, platted by the Developer. The site shall be designed to accommodate both a WB-50 and an SU design vehicle in a traffic pattern as directed by the Executive Director or Utilities & Infrastructure Services.

The site shall be designed to accommodate **both** a WB-50 and an SU design vehicle in a traffic pattern as directed by the Director of Public Works. In certain instances, remote fill ports may be required.

The site area shall be secured by a 6-foot high chain link fence topped with 3 strands of barbed wire, or of a material as approved by the Executive Director of Utilities and Infrastructure Services. Fence products shall be only new materials using hot dipped green vinyl coated galvanized iron or steel components and aluminum coated fence. Gates shall permit 180° opening and shall be located so as to provide vehicle accessibility for lifting the pumping units and any other operational tasks as required. There shall be a minimum gate opening of 12 feet to facilitate truck access. Larger gates may be required to accommodate other design vehicles' turning radii.

The site shall feature locks and security features as dictated by the TOHS Utilities and Infrastructure Services Department along with all necessary OSHA signage. Additionally, signage shall be provided on the gate which provides the name of the station, its address, and emergency number of 919-557-9111 (green lettering on a utility sign).

The site shall feature LED fixtures. The new style LED lights shall include high light cut-off features to provide illumination only where the light is needed and avoid neighbor complaints and have the capacity to illuminate the pump station area. The light shall be mounted on a Class V utility pole at a height of 30 feet and controlled by means of a photo cell and an HOA switch located on the light pole, unless otherwise approved by the Executive Director of Utilities and Infrastructure Services.

C. Landscaping and Appearance

Buffers shall be provided along both sides of the access road and surrounding the gravel vehicular area of the pump station site. Buffers shall extend 50 feet in all four directions from the required gravel vehicular area, plus 25 feet along both sides of the 20-foot access easement, and shall be included within the site dedicated to the Town for the station. Buffers shall either be supplemented to be equivalent to or planted with an opaque buffer as defined in The Town of Holly Springs UDO.

Color of crane shall be determined by the Town.

The Town shall reserve the right to establish other appearance requirements.

Buffers shall be maintained by the developer for two years from date of final (end of year) acceptance of pump station.

D. Water Service

A minimum 2-inch public water service or well shall be provided to supply water at a minimum flow rate of 50 GPM with a residual pressure of 30 psi to a yard hydrant located on the pump station site. A Town water meter and an above-ground RPZ in a heated hot box shall be required.

A freeze proof yard hydrant, sized for a flow of 50 GPM, shall be provided to allow the wet well and solids grinder manhole to be washed down periodically. The potable water supply to the hydrant shall have a reduced pressure backflow preventer, installed in a heated, above ground fiberglass enclosure.

A freeze proof eyewash and shower shall be provided adjacent to the chemical storage facility. Its water supply shall be upstream of the RPZ serving the yard hydrant.

E. Piping and Valves

Suction and discharge piping shall be minimum Class 53 ductile iron flanged pipe and as manufactured under AWWA Specification C141.

Discharge piping shall be flanged ductile pipe (Class 53 minimum) sized to produce a minimum head loss while maintaining a minimum velocity of 2.5 feet per second. All exposed piping shall have adequately sized and located thrust restraint.

Gate valves for wastewater piping systems shall meet all requirements of AWWA C509 and be resilient wedge type. Each valve gate shall be encapsulated with synthetic rubber which has been bonded and vulcanized in accordance with ASTM B429, Method B. Valves shall be NRS for buried service and OS&Y for above ground or

exposed service and have "O" ring packing. Provide resilient wedge valves with full fusion-bonded epoxy coating on the interior, exterior, and valve bonnet, per AWWA C550.

Check valves shall be cast iron body, bronze mounted full opening swing check valves in conformance with ASSA C508. Valves shall have renewable bronze or stainless steel seat ring and resilient faced clapper. Provide valve with outside weight and lever unless noted otherwise. Provide valve body constructed with a solid bronze or stainless steel shaft extending through bronze brushed bearings and "O" ring seals or adjustable graphite/composition packing. Provide valves with minimum of 175 psi working pressure rating and 350 psi hydrostatic pressure rating for all valve sizes up to and including 12 inches; for valves larger than 12 inches provide minimum 150 psi working pressure rating with 300 psi hydrostatic pressure rating.

Gate valves and check valves on the discharge side of each pump shall be located in a valve vault separate from and adjacent to the wet well. A dresser coupling shall be installed on each discharge main between check valve and the gate valve. The valve vault shall consist of a cast in place or a precast concrete rectangular structure at least 6 feet square, complete with a drain line (with backwater valve) into the wet well. An access ladder or manhole steps (attached to the vault wall), and an access cover shall be provided. The access cover for the valve vault shall be a square hatch of ¼" aluminum diamond pattern plate with steel hinges on an aluminum frame cast in place in the cover slab. The access cover for the valve vault shall be provided with fall protection system meeting requirements of NC Building Code and OSHA

Each discharge line through the valve vault shall have a ¾ inch 316 stainless steel nipple 3-inch long direct-tapped into the line between the check valve and gate valve. Each of these nipples shall have a ¾ inch stainless steel ball valve installed. A 3 inch or larger pressure gauge with a stainless steel case and mechanism, liquid-filled, and 3% accuracy shall be located at each nipple. The gauge shall operate in the middle one-third of its scale with both pumps running. Pressure gauges should be located upstream of isolation valves. One single isolation valve is not acceptable. Contractor shall provide one-(1)-dedicated pressure gauge on each discharge header The gauge shall be oriented so that it is easily legible from the valve vault access.

For all buried valves, provide cast iron valve boxes of proper dimensions to fit it over valve bonnets and to extend to such elevation, at or slightly above the finished ground surface. Provide tops complete with covers that are fully adjustable. Set valve boxes vertical and concentric with valve stem. In event valve box has to be moved from its original position to allow application of valve key, reset complete box at no cost to the owner. Secure valve box with concrete collar as noted on the plans.

Valve boxes for the force main, that are located outside of the pump station fencing, shall have locking valve box lids. The lids shall be marked "SEWER".

For all valves with the operating nut more than 4 feet below ground, provide shaft extensions as required to provide an operating nut that is within 24 inches of finished grade.

F. Solids Grinder/Screening

Pump stations with an ultimate design flow of less than 100 GPM may be designed utilizing grinder pumps and a removable screening basket. However, solids handling pumps and solids cutter are required for all pump stations with a design flow equal to or exceeding 100 GPM**.** The solids grinder shall be installed in a precast concrete manhole with a concrete channel constructed to fit the selected unit. A grinder support frame with adjustable mounting brackets shall also be provided.

The grinder pump station wet well shall feature a 316 stainless steel or 6063 alloy aluminum screening basket in front of the influent pipe. The basket shall be rectangular in shape and formed from ¼ x 3-inch bars on 2½ inch centers on a channel or angle frame. Grating, wire mesh, or perforated plates are not acceptable substitutes. Baskets shall be fabricated with cross members and bracing to provide structural stability under full loading. All bolted connections in the wet well shall be made using stainless steel nuts, bolts and washers. Baskets shall have a minimum capacity of two cubic feet below the influent pipe invert, and shall be raised and lowered by means of a stainless steel chain or wire rope with rings. A specially designed hatch shall be provided that will permit the raised basket screen to be maneuvered into or out of the wet well. This access hatch shall be a square hatch of ¼ inch aluminum, 6063 alloy, diamond pattern plate with steel hinges on an aluminum frame cast in place in the cover slab.

There shall be an influent sewer manhole on the pump station site to collect all the influent sewers into one line discharging to the solids grinder manhole. A gate valve (or a sluice gate) shall be provided in the influent piping to stop the influent flow to the grinder manhole and wet well, in the event of an unusual maintenance requirement. In this situation, Town shall utilize a portable diesel driven pump to transfer wastewater from the influent manhole to the pump around connection in the force main.

Solids cutter, immersible motor, and motor controller shall be factory tested to ensure satisfactory operation. Solids cutter, motor, and motor controller shall be installed in accordance with the supplier's installation instructions and in compliance with all OSHA, local, state and federal codes and regulations.

Submittals shall include equipment descriptions, specifications, dimensional and assembly drawings, parts lists, and job specific drawings.

G. Odor Control

Pump stations are required to incorporate a chemical feed and storage facility for both downstream and proximity odor control purposes. The chemical feed system shall be capable of reducing the hydrogen sulfide concentration estimated to occur (with no treatment) in the pump station force main discharge at the receiving gravity sewer down to or below 0.1 mg/L by the use of the chemical designated by the Town in the Pre-Design meeting.

Chemical feed facilities should consist of the following at a minimum:

- Double walled liquid chemical storage tanks with a minimum capacity of 2,500 gallons or 30-day chemical storage capacity, whichever is greater;
- Chemical feed system with variable dose controller;
- Modular building with lights, thermostat and controlled vent to house tanks and pumps. Heater and sump pump may be required;
- Containment system, in case of tank or piping failure, may also be required.

The Town reserves the right to require mechanical ventilation and treatment of exhaust from the wet well to address anticipated or existing proximity odors.

H. Hoisting Equipment

A pedestal-mounted jib crane with an electric chain hoist and motorized trolley of 360-degree swing shall be provided. The minimum capacity of the hoisting system shall be equal to the combined weight of the pump, motor, chains, and cables, times a factor of 1.25. Jib crane must be tall enough to lift pumps so that there is a 4-foot minimum clearance from the bottom of the pump to the concrete slab. Jib crane must be capable of accessing and lifting both pumps and the trash basket and it must be certified to the Town to be in accordance with OSHA. Crane shall be equipped with chain buckets in accordance with OSHA. Pump lift chains are required to be stainless steel and must extend a minimum of 5 feet above normal wet well operating level.

I. Wet Well and Other Precast Structures

The wet well shall have a minimum diameter of 6 feet, and shall be large enough to easily accommodate the location and removal of each pump and the basket strainer. The wet well shall be designed to have a diameter sufficient to provide

storage for a pump operating cycle of at least 3 minutes without being excessively deep and to allow for 6-10 starts per hour for the pump.
Excavation will be made to the required depth, and shall include the removal of unstable materials unsuitable for a good foundation. The excavation shall allow for a 6-inch thick bedding of #57 stone under the precast concrete base and 12 inches beyond the outer wall of the base section. Each base section shall have an extended base (projects beyond the outside face of the walls by a minimum of six inches).

The barrels of the structures shall be constructed from precast, reinforced sections, stacked to form the structure and manufactured according to the latest revision of ASTM C478. Top slabs of flat top manholes shall be designed to support street traffic and H-20 loadings. Precast structures sections shall be joined with mastic material, such as Ram-Nek or a butyl rubber sealant, to show both inside and outside.

The precast sections for the wet well and valve vault shall have their joints further waterproofed on the outside of the wet well by application of liquid asphalt, overlapped by a 12-inch wide band of butyl joint wrap, and then coated with a final mopping of liquid asphalt (the contractor shall may elect to seal the exterior of the joints with ConSeal CS 212 polyolefin-backed exterior joint wrap – 6 inch minimum width – with compatible primer, in lieu of the specified liquid asphalt system).

Wet Wells and manholes (including ARVs) shall be coated with a Microbiologically Induced Corrosion (MIC) resistant Elastomeric Polyurethane or epoxy coating. Final submittal must be approved by the Executive Director of Utilities and Infrastructure.

All vaults shall either drain to daylight or have a submersible pump. Power outlets shall be above ground.

Grout fillets shall be installed in the wet well on a 1H to 1V slope, leaving a flat floor surface under and adjacent to the pump intakes.

The wet well shall have a vent made from ductile iron, with flanged joint pipe fittings. An insect screen shall be included at the exposed end of the vent pipe. The insect screen shall be bronze or aluminum.

Wastewater lines are to be connected to the precast structures by means of flexible connectors cast into the structure. Flexible connectors are to be manufactured of high-quality rubber or synthetic rubber and all strap clamps or draw bolts are to be manufactured from stainless steel.

All details for the precast concrete structures proposed for use on this project must be submitted to the engineer (shop drawings) for approval prior to being offered on this project.

J. Submersible Pump Systems

Certified Pump Tests: The approved pumps shall be tested by the manufacturer. Certified pump tests are to be made for each pump and submitted in accordance with the procedures as set forth in the Hydraulic Institute Standards. Test points shall include the specified Design Points.

The pump manufacturer shall furnish, with each pumping unit, all lubricants (oils and greases) necessary for the initial lubrication of the pump and the drive motor. The lubricants furnished shall be appropriately identified by viscosity and/or class number; also, each lubricant furnished shall be identified by the name of the producer of the lubricant and by the trade name given the lubricant by the producer.

The pump motor shall be a 3-phase induction submersible motor, UL listed explosion proof for Class 1, Division 1, Groups C and D; hazardous locations as defined by the National Electrical code

Motor voltage, frequency, and speed shall be 460 VAC, 60 CY, 1800 RPM (nominal). 1200 RPM (nominal) speed motors shall be permitted for certain lower head applications, if that motor selection results in the best wire to water efficiency for the pump selection.

The pumps shall be capable of handling raw, unscreened wastewater. The pumps shall be fabricated so that they automatically connect to the discharge connection elbow when lowered into place, so that there is no leakage or blow-by at the connections when the pumps are operating, and so that they can be easily removed for inspection or service by the hoisting equipment (and without personnel having to enter the wet well). The weight of the pump unit shall press tightly against the discharge connection elbow, creating a watertight connection. No portion of the pump shall bear directly on the floor of the wet well.

The pumps, motors, power cables, and sensor cables shall be suitable for submersible applications and FM approved for Class 1, Division 1, Group C and D locations. The cables shall be sized in accordance with NEC and ICEA standards. The cables shall be of sufficient length to reach the existing pump cable termination cabinets on the top slab of the wet well.

All pumps, with the appurtenances and cables, shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet.

General: Major pump components shall be of gray cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blow holes or other irregularities. All exposed fasteners shall be AISI type 316 stainless steel construction. All metal surfaces coming into contact with the pumped media (other than the stainless steel

components) shall be protected by a factory applied spray coating of high solids two part epoxy paint finish on the exterior of the pump.

Sealing design for the pump/motor assembly shall incorporate machined surfaces fitted with Nitrile (Buna-N) rubber O-rings. Sealing will be the result of controlled compression of rubber O-rings in two planes of the sealing interface. Housing interfaces shall meet with metal to metal contact between machined surfaces, and sealing shall be accomplished without requiring a specific torque on the securing fasteners. Rectangular cross sectioned gaskets requiring specific torque limits to achieve compression shall not be considered equal. No secondary sealing compounds shall be required or used.

The pump volute shall be single piece gray cast iron (ASTM A-48, Class 35B) non-concentric design with centerline discharge. Passages shall be smooth and large enough to pass any solids which may enter the impeller. The discharge flange design shall be as required to allow leak proof connection to the discharge elbow connections in the wet well, and to allow repeated pump removals and pump re-installations in the wet well. The suction flange shall be integrated into the volute and its bolt holes shall be drilled and threaded to accept standard 8-inch ANSI class 125 flanged fittings. The minimum working pressure of the volute and pump assembly shall be 145 psi.

Shaft: The pump shaft and motor shaft shall be an integral, one-piece unit adequately designed to meet the maximum torque required at any normal start-up condition or operating point in the system. The shaft shall have a full shutoff head design safety factor of 1.7, and the maximum shaft deflection shall not exceed 0.002 inches at the lower seal during normal pump operation. Each shaft shall be stainless steel 1.4021 (AISI 420) material, and shall have a polished finish with accurately machined shoulders to accommodate bearings, seals and impeller.

Impeller: The impellers shall be of gray cast iron, ASTM A-48, Class 35B, dynamically balanced, double shrouded non-clogging multiple-vane design that provides for a minimum solids passage size of 3 inches. The impellers shall be capable of handling solids, fibrous materials, heavy sludge and other matter found in wastewater. The impeller shall have a slip fit onto the motor shaft and drive key, and shall be securely fastened to the shaft by a stainless steel bolt which is mechanically prevented from loosening by a positively engaged ratcheting washer assembly. The head of the impeller bolt shall be effectively recessed within the impeller bore or supporting washer to prevent disruption of the flow stream and loss of hydraulic efficiency. The impeller shall be dynamically balanced to the ISO 10816 standard to provide smooth vibration free operation.

Wear Ring: A replaceable wear ring of cast iron (ASTM A48, Class 40) shall be securely fitted into the pump volute.

Mechanical Seals: Each pump shall be equipped with a triple seal system consisting of tandem mechanical shaft seals, plus a radial lip seal; providing three complete levels of sealing between the pump wet end and the motor. The mechanical seal system shall consist of two totally independent seal assemblies operating in a lubricant reservoir that hydro-dynamically lubricates the lapped seal faces at a constant rate. The mechanical seals shall be of non-proprietary design, and shall be manufactured by a major independent manufacturer specializing in the design and manufacture of mechanical seals. The lower, primary seal unit, located between the pump and the lubricant chamber, shall contain one stationary industrial duty solid silicon-carbide seal ring and one rotating industrial duty solid silicon-carbide seal ring. The stationary ring of the primary seal shall be installed in a seal holding plate of gray cast iron (ASTM A-48, Class 35B). The seal holding plate shall be equipped with swirl disruption ribs to prevent abrasive material from prematurely wearing the seal plate. The upper, secondary seal unit, located between the lubricant chamber and the sensing chamber, shall contain one stationary industrial duty solid silicon-carbide seal ring, and one rotating one rotating industrial duty solid silicon-carbide seal ring. Each seal interface shall be held in contact by its own spring system. A radial lip seal shall be positioned above the sensing chamber, preventing any liquid which accumulates in the sensing chamber from entering the lower bearing and motor. The seals shall not require routine maintenance, or adjustment, and shall not be dependent on the direction of rotation for proper sealing. Each pump shall be provided with a lubricant chamber for the shaft sealing system which shall provide superior heat transfer and maximum seal cooling. The lubricant chamber shall be designed to prevent overfilling, and to provide lubricant expansion capacity. The drain and inspection plug shall have a positive anti-leak seal, and shall be easily accessible from the outside of the pump. The seal system shall not rely upon the pumped media for lubrication and shall not be damaged when the pump is run dry. Lubricant in the chamber shall be environmentally safe nontoxic material.

Mechanical Seal Protection System: The primary mechanical seal shall be protected from interference by particles in the wastewater, including fibrous materials, by an active Seal Protection System integrated into the impeller. The back side of the impeller shall be equipped with a sinusoidal cutting ring, forming a close clearance cutting system with the lower submersible motor housing or seal plate. This sinusoidal cutting ring shall spin with the pump impeller providing a minimum of 75 shearing actions per pump revolution. Large particles or fibrous material which attempt to lodge behind the impeller or wrap around the mechanical seal, shall be effectively sheared by the active cutting system into particles small enough the prevent interference with the mechanical seal. The Seal Protection System shall operate whenever the pump operates, and shall not require adjustment or maintenance in order to function.

The integrity of the mechanical seal system shall be continuously monitored during pump operation and standby time. The pump manufacturer's standard system to

detect water in the oil chamber shall be provided with each pump. Two additional moisture sensing probes, one in the electrical connection chamber (junction box), and one in the motor stator housing shall be provided if so directed by the Town staff. These sensing systems shall send separate signals to the Sensor Systems Panel as described below, so that maintenance personnel are given an early warning of the presence of moisture in the respective sensing chambers.

Motors: The Premium Efficiency motor shall meet efficiency standards in accordance with IEC 60034-30, level IE3 and NEMA Premium. Motor rating tests shall be conducted in accordance with IEC 60034-2-1 requirements and shall be certified accurate and correct by a third-party certifying agency. A certificate shall be furnished upon request.

The Premium Efficiency motor shall be housed in a water tight gray cast iron (ASTM A-48, Class 35B) enclosure capable of continuous submerged operation underwater to a depth of 65 feet, and shall have an IP68 protection rating. The motor shall be of the squirrel-cage induction design, NEMA type B, Premium Efficiency. The copper stator windings shall be insulated with moisture resistant Class H insulation material, rated for 180ºC (356ºF). The stator shall be press fitted into the stator housing. The use of bolts, pins or other fastening devices requiring penetration of the stator housing is unacceptable. The rotor bars and short circuit rings shall be made of cast aluminum.

The motor shall be designed for continuous duty. The maximum continuous temperature of the pumped liquid shall be 40ºC (104ºF), and intermittently up to 50ºC (122ºF). The motor shall be capable of handling up to 15 evenly spaced starts per hour without overheating. The service factor (as defined by the NEMA MG1 standard) shall be **1.3**. The motor shall have a voltage tolerance of +/- 10% from nominal, and a phase to phase voltage imbalance tolerance of 1%. The motor shall have a NEMA Class A temperature rise, providing cool operation under all operating conditions. The Premium Efficiency Motor shall be FM and CSA approved, and UL listed, for use in NEC Class I, Division I, Groups C & D hazardous locations. The surface temperature rating shall be T3C.

The motor shall be capable of operating completely submerged, partially submerged, or unsubmerged. For submerged applications, the motor shall be self-cooling via the process fluid surrounding the motor.

Each phase of the motor shall contain a normally closed bi-metallic temperature monitor switch imbedded in the motor windings. These thermal switches shall be connected in series and set to open at 140ºC +/- 5ºC (284ºF), and shall be used by the Owner to provide a high stator temperature shutdown signal. In addition to the bi-metallic switches, each motor shall have a stator RTD to provide motor temperature data (if so directed by the Town staff) to the sensor systems panel described below.

Bearings: Each pump shaft shall rotate on high quality permanently lubricated, greased bearings. The upper bearing shall be a cylindrical roller bearing. The lower bearings shall be a matched set of at least three heavy duty bearings; two angular contact ball bearings and one cylindrical roller bearing. All three lower bearings shall have identical outer race diameters to provide maximum bearing load capacity. Designs which utilize a roller bearing with a smaller outer diameter than the other bearings in the assembly do not provide maximum load capacity and shall not be considered equal. Bearings shall be of sufficient size and properly spaced to transfer all radial and axial loads to the pump housing and minimize shaft deflection. L-10 bearing life shall be a minimum of 100,000 hours at flows ranging from ½ of BEP flow to 1½ times BEP flow (BEP is best efficiency point). The bearings shall be manufactured by a major internationally known manufacturer of high-quality bearings, and shall be stamped with the manufacturer's name and size designation on the race. Generic or unbranded bearings from other than major bearing manufacturers shall not be considered acceptable.

Each motor shall be provided with an RTD in the upper and lower bearing, to provide bearing temperature data to the sensor systems panel described below, if so directed by the Town staff.

Cable Entry/Junction Chamber: The cable entry design shall not require a specific torque to insure a watertight seal. The cable entry shall consist of cylindrical elastomer grommets, flanked by stainless steel washers. A cable cap incorporating a strain relief and bend radius limiter shall mount to the cable entry boss, compressing the grommet ID to the cable while the grommet OD seals against the bore of the cable entry. The junction chamber shall be isolated and sealed from the motor by means of sealing glands. Electrical connections between the power cables and motor leads shall be made via a compression or post type terminal board, allowing for easy disconnection and maintenance.

Power Cables: The power cables shall be sized according to NEC and CSA standards and shall be of sufficient length to reach the junction box without requiring splices. The outer jacket of the cable shall be oil, water, and UV resistant, and shall be capable of continuous submerged operation underwater to a depth of 65 feet. The cables shall be extended to an explosion-proof junction box adjacent to the wet well (one for each pump). The cables shall be spliced to the wiring from the motor starters in the junction box. Strain relief shall be provided for the cables from the junction box.

Pilot Cables: The pilot cables shall be designed specifically for use with submersible pumps and shall be type SUBCAB (SUBmersible CABle). The cable shall be multi-conductor type with stainless steel braided shielding, a chlorinated polyethylene rubber outer jacket and tinned copper conductors insulated with

ethylene-propylene rubber. The conductors shall be arranged in twisted pairs. The cable shall be rated for 600 Volts and 90°C (194°F) with a 40°C (104°F) ambient temperature and shall be approved by Factory Mutual (FM). The cable length shall be adequate to reach the explosion-proof junction box without the need for splices. Strain relief shall be provided for the cables from the junction box. The pilot wiring from the junction boxes to the Pump Station Control Panel shall be installed in separate conduit from the power wiring.

Lifting Bail: The pump shall be equipped with an open lifting hoop suitable for attachment of standard chain fittings, or for hooking from the wet well surface. The hoop shall be ductile cast iron ASTM A536 (60-40-18), and shall be rated to lift a minimum of four times the pump weight. A 6-foot length (minimum) of stainless steel chain shall be attached to the bail with a stainless steel shackle. A length of 1/4 inch diameter stainless steel cable shall be attached to the end of the chain and shall have the other end secured at the wet well hatch above the pump. The cable will be used to guide the grip-eye device to the lifting chain, where a chain link can be engaged by the grip eye device provided with the pumps.

Sensor Systems Panel (only required for stations that the Town has determined the additional moisture detection and bearing temperature features are required): The pump manufacturer shall furnish one Sensor Systems Panel with the pumps. The panel enclosure shall be a NEMA 1 enclosure suitable for wall mounting in the building. The panel shall include:

- UL listed disconnect switch for the 115 VAC single phase power supply
- RTDs to monitor the motor, upper, and lower bearing temperatures for each pump. Each RTD shall have a digital display mounted through the panel door, indicating the temperature value of the monitored device.
- Relays to detect water in the seal chamber, stator housing, and electrical connections junction box for each pump.
- Six alarm condition red lights for each pump. The alarm conditions shall be identified as:

  Motor Over-Temp
  Upper Bearing Over-Temp
  Lower Bearing Over-Temp
  Oil Chamber Seal Alarm
  Stator Housing Seal Alarm
  Electrical Conn Box Seal Alarm

Control relays, power supplies, and any other devices as required shall be provided, to accept the inputs from the specified moisture and thermal sensors, and to display the alarm conditions and real-time temperatures on the Sensor Systems Panel door.

The Sensor Systems Panel shall also provide one set of dry contacts to be utilized by the SCADA system RTU.

The bi-metallic switches in the stator windings of each motor shall cause two sets of dry contacts in the Sensor Systems Panel to open, should the motor temperature rise above the switch settings. One set of dry contacts shall be utilized by the Pump Control Panel to interrupt that pump's operation, and the other set shall be used to notify the SCADA system of a motor over-temperature condition.

The Sensor Systems Panel shall be provided with labeled terminal strips to accept all required field wiring to the panel. Terminal strip shall have 30% excess capacity. Engraved plastic labels shall be provided on the panel door to identify the alarm lights and digital displays. Details of the panel construction, components, and wiring diagrams shall all be included in the submittals furnished with the pumps. A laminated as-built wiring diagram shall be provided in the panel door.

The contractor shall install the pumps, piping, supports, etc. as shown on the plans and specified herein. The contractor shall be responsible for bringing the pump power and pilot cables, and float switch cables, up into the splice box.

The pump supplier shall furnish a factory representative for one day (8 hours) at the station during the start-up of station.

Pump-motor units shall be thoroughly inspected by the representative prior to starting, and shall be checked for proper operation after starting. A written report for the station shall be furnished to the engineer, stating the representative's findings, noting any deficiencies, and how they are to be corrected. A follow up inspection and report will be furnished, at the contractor's expense, after the deficiency has been corrected.

Contractor shall furnish one (1) set of spare parts as follows:

- One (1) spare pump with guide rail bracket attached to pump discharge flange
- One (1) lower seal assembly
- One (1) upper seal assembly
- One (1) set of bearings
- One (1) set of wear rings (unless an adjustable wear plate is provided in each pump.
- One (1) complete set of O-rings
- One (1) float switch with 50 feet of cable

A chain grip device shall be provided with each pump that can be lowered to the bottom of the pump lifting chain, engage a chain link, and then be used to hoist the

pump out of the wet well without re-positioning the hoist hook. A stainless steel chain shall be provided with each pump, to guide and engage the chain grip device. The chain shall be provided by the pump supplier and shall be rated for the weight of the pump and motor, plus the manufacturer's standard safety factor.

Polypropylene encased, direct acting sealed float switches (quantity as required by controls description) shall be furnished and installed. Floats shall have sufficient cable length to reach from the splice box panel to the bottom of the wet well. Float switches shall be securely attached to a weighted stainless steel cable, in the location indicated in the drawings.

Float switches shall be flexibly supported by means of heavy neoprene or PVC jacketed, three conductor sensor cables. Level switches shall be immersed in wastewater and/or other nonreactive liquids with specific gravities in the range of 0.95 to 1.05. Mercury float switch shall provide for normally open operation, unless otherwise noted. Activation angle shall be 5° above and 5° below horizontal. Float switches shall be SPDT, rated for 10A (minimum), 115 VAC capacity.

The pump station wet well shall have an aluminum hatch of the size indicated on the plans, if the pump manufacturer confirms to the Contractor that the indicated size is adequate for the furnished pumps. If the manufacturer indicates a larger is required, the Contractor shall provide the larger size hatch at no additional cost.

K. Electrical

Electrical service to all pump stations shall be 3 phase, 480 Volt AC (but if the ultimate pump motor size will be less than 10 HP, the Town may consider acceptance of a single-phase electrical service). 208 VAC, three phase services will not be allowed. No open delta services are allowed. The electrical power entrance shall be through a CT cabinet or meter base, as directed by the Power Company, followed by a service entrance rated main circuit breaker; followed by an automatic transfer switch as specified herein. All of these electrical components shall be suitably sized for the total electrical load of the pump station, and shall be furnished in NEMA 1 or 12 enclosures for installation inside a building, or NEMA 3R enclosures for exterior locations (unless noted to be NEMA 4 enclosures on the plans).

A locking hasp shall be provided in addition to screw clamp type latches. Enclosures shall be fabricated from 14-gauge steel. The top of the enclosure shall serve as a drip shield and the seam-free sides shall prevent rain and sleet from entering exterior enclosures. Inner panel, where required, shall be made of 12-gauge steel and shall be painted white. The enclosure and interior panel shall be painted with heat fused modified polyester powder, electrostatically applied over a phosphatized base. Enclosure shall be ANSI/ASA 61 grey.

All conduit protecting cables from pump wet well shall have approved removable duct seals to prevent passage of gases from the wet well into the disconnect switches. NFPA 820 requires each conduit to have an approved conduit seal off fitting. To alleviate the concerns and passage of gases and NFPA compliance, conduit seals shall include modifications to the conduit system to provide an air gap between the conduit end and the disconnect switches with the pump cables being connected directly to the disconnect switch with sealing gland fittings. These fittings eliminate the need for traditional conduit seals and are much easier to disconnect and remove for pump replacement.

L. Pump Station Control Panel (PSCP)

Controls shall be housed in a NEMA 12 enclosure. The control panel shall be powered by a 120 VAC, 1-phase branch circuit. The panel shall have a main disconnect switch, with the operating handle extending through the panel door. All disconnect switches, control switches, reset buttons, indicating lights, and other control features shall be located through the panel door and be operable with the door closed.

Each pump shall have thermal switches in the windings of each pump. Panel shall be designed to interrupt the control power to the pump starter to stop the pump when one of the thermal switches opens. The panel shall also have pilot lights in the panel door to indicate the high temperature conditions. If a thermal switch opens, the relay that causes that pump to stop shall maintain power to its coil until it is manually reset through an "Overtemp Reset" pushbutton in the panel face.

The liquid level float switches shall be powered through intrinsically safe relays. These relays shall provide contact closures as required to start and stop the pumps, and to illuminate one white light in the panel face for each float switch when that switch in closed.

The electrical probe sensor in the moisture sensing chamber shall detect seal leakage. When moisture is detected, relays shall illuminate a warning light on the PSCP face and close a set of dry contacts for the SCADA system.

Elapsed time meters shall be provided in the panel door to record pump run times. Elapsed time meters shall be six-digit, non-resettable type mounted through the hinged inner door. A relay (or auxiliary contacts) shall be provided for each pump that will be energized when the starter is closed. These contacts shall be used for the elapsed time meters and the pump run lights in the panel door, and SCADA inputs.

Pumps shall automatically alternate for each pumping cycle. Should the controls engage both the lead and lag pumps, both pumps shall operate until the wet well level has fallen such that the "Pumps Off" float switch opens. High water level alarm light and horn shall be installed on the building exterior, as indicated on the drawings.

Other features of the Pump Station Control Panel shall include:

1. A Phase and Voltage Monitor that monitors incoming power for phase failure, phase reversal, and under voltage conditions. A control switch shall be provided in the panel to allow the PVM to be switched to "Active" (will interrupt control power to PSCP if three phase power supply quality is outside of PVM settings) or to "Bypassed" (will allow control power to PSCP regardless of three phase power quality).

2. Condensation strip heater with thermostat.

3. Seal leakage relays and indicating lights (one per pump).

4. Duplex alternating relay that may be switched from alternating to designating either pump as the lead pump.

5. Terminal block with properly sized lugs to accept all required load side wiring requirements, with shielding of exposed, energized components.

6. Industrial grade oil-tight switches with transparent polycarbonate contact blocks.

7. Industrial grade oil-tight pilot lights with insulated sockets and lexan lens.

8. Control relays with sockets by the same manufacturer and with hold-down clips.

9. External red flashing light for the high-water alarm indication, mounted on the building exterior as described on the drawings.

10. A continuous sounding alarm horn for the high-water alarm indication, mounted on the building exterior as described on the drawings.

11. Pushbutton to silence audible alarm.

12. Terminal blocks for connection of all external wiring and cables to the panel.

13. Plastic wiring troughs for neat and orderly containment of panel wiring.

14. Engraved phenolic plastic nameplates for the PSCP and all indicator lights, alarms, switches, pushbuttons, circuit breakers, and other major control components. Nameplates shall be secured using countersunk screws.

15. A laminated wiring/control diagram.
16. Dry contacts (and terminals for connection of field wiring) for:

    a) The Hand and Automatic positions for each pump HOA switch

    b) Pump Overtemp for each pump

    c) Pump starter engaged for each pump

    d) Seal Leakage for each Pump

    e) High Level alarm

    f) One common contact for either pump starter engaged (for chemical feed pumps)

The panel shop drawings shall include a scale drawing of the panel face showing the proposed arrangement of pilot lights, switches, and nameplates. Engineer shall review and approve prior to fabrication.

Combination motor starters (with overload relays) and disconnect switches shall be installed in NEMA 12 enclosures separate from the Pump Station Control Panel. A NEMA-rated across-the- line magnetic contactor and overload relay shall be furnished for each pump motor of 40 HP and less. Each leg of the overload relay shall be equipped with a properly sized overload heater. Through the door reset buttons shall be provided for overload relays. Contactor and overload relay shall be properly sized for the required horsepower, voltage and phase. Solid State Reduced Voltage starters will be required for motor sizes over 40 HP or when the power company requires reduced voltage starters. Reduced voltage auto-transformer starters will not be allowed.

A Type 2 surge protection device for the pump station electrical service shall be provided. An integral circuit breaker shall be provided to allow the unit to be de-energized for maintenance or replacement.

M. Flow Meter

The unit shall be FM approved for installation in a Class 1, Division 2 hazardous service location.

System shall be operable at velocity ranges from 0 to 2.0 feet per second through 0 to 50 feet per second. System shall have an accuracy of 0.25% of rate of flows when the velocity through the meter is greater than or equal to 1.64 feet per second. Accuracy shall be unaffected by electrode coatings such as grease, calcium carbonate, or bacterial slime. The Designer may propose during the Pre-Design meeting a meter of a smaller diameter than the force main to improve the velocity profile, if the projected station flows make that a viable option.

The mag meter shall be installed in a precast concrete manhole with sump pump, as indicated on the plans. There shall be valved bypass piping (3 valves required) around the mag meter manhole, to allow the meter to be serviced or replaced without interrupting the pump station's operation.

Submit shop drawings that include information on the construction of the flow tube and liner, junction box, and amplifier.

Flow meter O&M manual shall include complete parts lists, troubleshooting procedures, maintenance schedules, as-built wiring diagrams, and all other information necessary to maintain the equipment item in proper working order.

N. Force Main

The force main within the pump station site shall be constructed of ductile iron pipe and fittings with interior coating. The force main piping at the pump station site shall also include an emergency bypass pumping connection with a flanged connection for a portable, diesel driven pump. The bypass connection shall be the same size as the force main, and shall include a gate valve to isolate the flange connection from the force main.

For ductile iron force mains, the Designer shall submit calculations confirming the anticipated operating and surge pressures will be within the pressure ratings of the proposed ductile iron force main and fittings.

Force mains outside of the pump station site may be constructed of ductile iron pipe or PVC pipe, as specified in Section 7.02 and this section of the specifications. The Designer may consider using AWWA C900 PVC force mains (outside of the pump station site), if the combination of anticipated force main working pressures, surge pressures, wastewater temperature, and estimated number of pump cycles confirm:

1. That the working pressure in the pipe is less than the pressure class rating, derated by a temperature coefficient if appropriate.

2. That the working pressure in the pipe plus the recurring surge pressure is less than the pressure class rating, derated by a temperature coefficient if appropriate.

3. That the working-class rating in the pipe plus the occasional surge pressure is less than the pressure class rating times a factor of 1.6, derated by a temperature coefficient if appropriate.

4. That the estimated number of pump cycles (pump "on" and pump "off" equals two cycles) that will occur in 75 years will not exceed the cyclic strength of the selected pipe

The Designer shall submit calculations confirming the four conditions listed above have been met by following the calculation procedure provided in the "Handbook of PVC Pipe Design and Construction" as published by the Uni-Bell Pipe Association.

The Designer shall utilize PVC force main piping in all sections of a force main that flow less than full pipe, or that drain or partially drain to less than full pipe between pump operations (such as intermediate high points, downhill segments to the force main discharge point, etc.). In these locations the operating and surge pressures will be minimal, and the calculations described above will not be required for these sections of PVC force main.

O. Air Release and Air-Vacuum Valves

Combination air/vacuum and air release valves shall be designed to permit air flow into the pipeline when the line pressure drops below atmospheric, and to exhaust air in the pipeline through a large orifice when the pipe is filling, and to exhaust air through a small orifice when the pipe contents are pressurized. Valves shall be manufactured in accordance with AWWA C512 Air Release, Air/Vacuum, and Combination Air Valves for Waterworks Service.

Valve shall have male NPT end, suitable for connection to a 90-degree lever actuated stainless steel ball valve. The ball valve shall be installed on a threaded stainless steel nipple connected into a tapping saddle on the force main. Each air/vacuum combination valve shall be installed in a precast concrete manhole that has its interior coated as described elsewhere in these specifications.

Valves shall have full size NPT inlets and outlets equal to the nominal valve size. The valve shall be furnished with backwash accessories, which include an inlet shut off valve, a blow off valve, a clean water inlet valve, rubber supply hose, and quick

disconnect couplings. Accessory valves shall be quarter turn, full ported bronze ball valves.

The valve shall have a full port orifice, a double guided plug, and an adjustable threaded orifice button. The plug shall be protected against direct water impact by an internal baffle and an extended float system. The plug shall have a precision orifice drilled through the center stem. The float shall include a sensitivity skirt to minimize spillage. The floats shall be unconditionally guaranteed against failures, including pressure surges. The resilient seat shall provide drop tight shut off to the full valve pressure rating.

The valve shall be furnished with the optional regulated exhaust device. This device shall be mounted on the outlet of the wastewater combination air valve to allow free air flow in and out of the valve, to close upon rapid air exhaust and thereby reduce the rate of the exhausting air flow. The disc in the regulated exhaust device shall have threaded holes to provide a means of adjusting the exhaust air flow rate. The regulated exhaust device shall have a stainless steel body and trim, to match the wastewater combination valve. The Contractor shall furnish and install a Schedule 80 PVC 90-degree bend on the outlet of the regulated exhaust device to prevent any dirt or debris from entering the device.

The valve body and baffle shall be constructed of ASTM A351 grade CF8M stainless steel. The float, guide shafts, and bushings shall be constructed of Type 316 stainless steel. Resilient seats shall be Buna N.

P. Standby Power Generator and Automatic Transfer Switch

The generator shall be sized to sequentially start all pumps, after allowing for an initial loading of all other electrical loads in the station. The automatic transfer switch shall start the generator and transfer the load to the generator in case of utility power under or over-voltage, power loss, phase reversal, or loss of phase. The generator diesel fuel tank shall be a UL listed double-wall with leak detection. The tank shall be sized to store fuel for 48 hours of operation of the generator at 100% rated capacity. Low fuel and leak detection status shall be available at the site. The generator control panel shall have a common “Generator Trouble Alarm” to indicate engine fail, engine warnings, low fuel level, and leak of primary fuel cell. The Generator Trouble Alarm shall be an input to the SCADA system.

There shall be a circuit breaker provided within the generator enclosure for the generator output. There shall also be a disconnect switch provided on the generator output circuit; the disconnect switch shall be located immediately adjacent to the automatic transfer switch.

The generator shall be capable of continuous service at rated output for the duration of any utility power failure. The engine and generator shall be the product of one company, and that company and its authorized dealer shall have sole responsibility for the performance of the diesel engine generator set and its accessories. It shall be a new, factory assembled and tested set as manufactured. It is the intent and purpose of these specifications to also secure for the purchaser the necessary controls and accessories to the extent that this equipment, in conjunction with the diesel engine generator set, will comprise a complete operating package for installation at the proposed project elevation above sea level, in an ambient temperature of 100° F maximum, 10° F minimum.

Rating of the diesel engine generator set as indicated on the drawings shall be the real electric power output (in kilowatts at 0.8 power factor) when equipped with all necessary operating accessories, such as radiator, fan, air cleaners, lubricating oil pump, fuel transfer pump, fuel injection pump, jacket water pump, governor, charging generator, alternating current generator, and exciter regulator. The diesel engine generator set shall be capable of producing a minimum of the indicated electrical power at 0.8 power factor continuously for standby power applications at the ambient and altitude conditions stated above.

Engine generator set shall consist of a diesel engine direct connected to an alternating current generator mounted on suitable rigid steel skid supports with spring vibration isolators. The manufacturer of the unit shall have been engaged in the manufacture of similar generator sets for a period of at least ten years.

The unit shall be completely assembled and tested at the factory, and certified copies of factory test report on the unit shall be furnished and approved by the engineer prior to shipment. The test shall consist of incremental loading at 1/4, 1/2, 3/4, and full load and shall include functional testing of all control and safety devices on the equipment.

The engine shall be a full compression ignition engine. It shall be a two or four stroke cycle, solid injection engine of either vertical in-line or V-type. The engine speed shall not exceed 1800 RPM at normal full-load operation. The engine shall be capable of satisfactory performance on a commercial grade of distilled petroleum fuel oil, such as No. 2 fuel oil.

A suitable silencer or silencers to provide critical grade silencing shall be furnished with each engine. A seamless stainless steel flexible exhaust adapter shall be furnished for each exhaust outlet to the mufflers.

All electrical wire on engines shall be installed in rigid conduit or in flexible heat resistant electrical tubing, with wiring terminating in identified terminals on a terminal strip in NEMA 12 junction boxes. Use only stranded copper with THHN insulation.

The engine shall be equipped with an engine driven battery charging alternator and voltage regulator to maintain the battery at full charge when the engine is running.

The engine shall be equipped with automatic safety controls which will shut down the engine in the event of low lubricating oil pressure, high jacket water temperature, and engine overspeed and energize alarm lights on the control panel. Alarm lights shall be manually resettable.

The engine starting panel shall automatically provide four cranking and three rest periods. Operation shall be initiated by a maintained contact in the automatic transfer switch. The automatic starting panel control switch shall include the positions of "Automatic", "Off", and "Manual". The automatic starting panel shall contain 24-volt alarm lights energized by the safety controls. A 24-volt alarm light shall also be energized if the engine has not started by the end of the fourth cranking cycle. In addition, a normally open contact shall be provided to close when the engine crank system has automatically shut down, or the coolant temperature is above normal, or the oil pressure is below normal, or upon engine over speed. This contact closure shall be available on an identified pair of terminal block points and shall be wired by the contractor to the alarm annunciator, if indicated. This contact closure shall be a "pre-alarm" and shall occur before actual shutdown of the engine generator set.

All accessories needed for the proper operation of the generating set shall be furnished and installed. These shall include but are not limited to a muffler, flexible exhaust connection, exhaust pipe, starting batteries, battery cables, battery rack, battery charger, fuel tank and lines, flexible fuel line connections to engine, weatherproof housing, and detailed operation and maintenance manuals with parts lists. Provide full charges of engine oil, antifreeze, and No. 2 diesel fuel. Leave fuel tank full of fuel after all testing is complete.

A weather protective sound attenuating enclosure shall be provided. The engine-generator shall be factory enclosed in a 12 gauge steel enclosure constructed with corner posts, uprights and headers. The roof shall be made of aluminum, shaped to aid in the runoff of water, and include a drip edge. The enclosure shall be coated with electrostatisically applied powder paint baked and finished to manufacturer’s specifications. The color will be tan-standard. The enclosure shall be completely lined with 1” thick UL 94 HF-1 listed sound deadening material. This material must be of a self-extinguishing design. The enclosure is to have large, hinged, removable doors to allow access to the engine, alternator and control panel. Hinges and all exposed fasteners will be stainless steel. Each door will have lockable hardware with identical keys. Padlocks do not meet this specification.

The exhaust silencer(s) shall be provided of the size as recommended by the manufacturer and shall be of critical grade. The silencer(s) shall be mounted within the weather protective enclosure for reduced exhaust noise and provide a clean,

smooth exterior design. It shall be connected to the engine with a flexible, seamless, stainless steel exhaust connection. A rain cap will terminate the exhaust pipe. All components must be properly sized to assure operation without excessive back pressure when installed.

The generator enclosure shall be furnished with an access platform with safety railing, grating, and stairs, to provide safe and convenient access to all parts of the generator and controls that require operator maintenance or inspection. The access platform shall be designed and located so that all generator maintenance can be performed without the need for ladders. The access platform shall be located within five vertical feet of the top of the uppermost maintenance access door/panel in the sidewalls of the generator enclosure. If the top of the uppermost maintenance access door/panel is within six vertical feet of the generator's concrete slab, the access platform and stairs are not required. The platform design shall preclude the use of any ladders for maintenance purposes.

After the installation of the engine generator set is complete and prior to acceptance by the owner, the engine generator set shall be subjected to a full load test. Any defects, which become evident during this test, shall be corrected by the Contractor at his expense.

Safety shutdown features shall be tested by simulating the primary device contact closure.

The automatic transfer switch shall be furnished as shown on the drawings with full load current rating as indicated at 3 phase, 3 pole, 60 Hertz AC normal and standby. The transfer switches shall be capable of switching all classes of load and shall be rated for continuous duty when installed in a non-ventilated enclosure constructed in accordance with Underwriters' Laboratories, Inc., Standard UL-508.

The transfer switch shall be equipped with dual operators to provide a 5 second delay in neutral position to permit pump motors to completely stop during transfer from the normal source to the standby source, and from the standby source to the normal source. The normal and standby contacts shall be positively interlocked mechanically and electrically to prevent simultaneous closing.

Main contacts shall be mechanically locked in position in both the normal and standby positions without the use of hooks, latches, magnets, or springs, and shall be silver tungsten alloy protected by arcing contacts, with magnetic blowouts on each pole. Interlocked molded case circuit breakers are not acceptable.

The transfer switch shall be equipped with a manual operator that is designed to prevent injury to the operating personnel if the electrical operator should suddenly become energized during manual transfer.

The manual operator shall provide the same contact-to-contact transfer speed as the electrical operator to prevent a flashover from switching the main contacts slowly.

Engine starting contacts shall be provided to start the generating plant if any phase of the normal source drops below 80% of rated voltage, after a non-adjustable time delay period of 3 seconds, to allow for momentary dips. The transfer switch shall transfer to standby as soon as the voltage and frequency have reached 90% of rated voltage. After restoration of normal power on all phases to 90% of rated voltage, an adjustable time-delay period of 0-30 minutes shall delay retransfer to normal power until it has had time to stabilize.

If the standby power source should fail during the time delay period, the time delay shall be bypassed, and the switch shall return immediately to the normal source. After the switch has re-transferred to normal, the engine generator shall be allowed to operate at no load for an adjustable period of time (0-15 minutes) to allow it to cool before shutdown. The transfer switch shall include a test switch to simulate normal power failure, pilot lights on the cabinet door to indicate the switch closed on normal or standby, and two auxiliary contacts on the main shaft, one closed on normal, and the other closed on emergency. In addition, one set of relay contacts shall be provided to open on loss of the normal power supply. All relays, timers, control wiring and accessories to be front accessible.

As a precondition for approval, all transfer switches, complete with timers, relays and accessories shall be listed by Underwriters' Laboratories, Inc. in their Electrical Construction Materials Catalogue under Standard UL-1008 (automatic transfer switches) and approved for use on Emergency Systems. UL label shall be affixed to switch.

In addition to the above, the transfer switch must have a short circuit with capability in excess of the UL minimum requirements as follows:

100-150 amperes	16,000 RMS amperes symmetrical
150-225 amperes	20,000 RMS amperes symmetrical
400-800 amperes	40,000 RMS amperes symmetrical
1000-1600 amperes	50,000 RMS amperes symmetrical
2000-3000 amperes	73,000 RMS amperes symmetrical

To establish conformance with the above, the manufacturer must produce certified test reports from an independent testing laboratory to verify that identical samples have been subjected to three phase short circuit currents at 480 VAC, for a minimum of 3 cycles duration, without contact damage or contact welding and without the use of current limiting fuse protection. Oscillograph traces are to be supplied to verify that the test parameters have been met.

All transfer switches shall be provided by the same vendor as the generator. Transfer switches fabricated using molded case circuit breakers or interlocked contactors shall not be acceptable.

The transfer switch shall be furnished with auxiliary contacts on the switch mechanism, to be used as inputs to the SCADA system to relay the switch's position. The Contractor shall be responsible for furnishing and installing all required wiring and conduits from the SCADA termination cabinet to the transfer switch.

The automatic transfer switch shall be furnished in a NEMA 12 enclosure for indoor installation, or a NEMA 4 enclosure for exterior exposure, where permitted by the Town staff.

Q. SCADA

The Contractor shall furnish a complete SCADA system that is in complete conformance with the Town of Holly Springs Standards and is compatible with the existing equipment.

R. Testing and Inspection

Hydrostatic Testing of Force Main: The force main shall be completely filled with water, all air shall be expelled from the pipe, and the discharge end of the pipeline shall be plugged and adequately blocked before the hydrostatic test begins.

The force main shall be tested to a pressure of 200 psi or 3 times the rated Total Dynamic Head of the pumps in psi, whichever is larger, as measured at the lowest elevation of the pipeline, for a duration of 2 hours. The pressure gauge used in the hydrostatic test shall be calibrated in increments of 10 psi or less. At the end of the test period, the leakage shall be measured with an accurate water meter.

PIPE SIZE ALLOWABLE LEAKAGE

Pipe size (inches)	Leakage per 1000 feet of pipe (gallons)
4	0.85
6	1.28
8	1.70
12	2.56
16	3.40
20	4.25

All visible leaks are to be repaired regardless of the amount of leakage.

Operational Test: A full operational test is required in conjunction with the punch list inspection before the pump station can be accepted by the Town of Holly Springs for routine maintenance. The Town of Holly Springs Field Inspection Test and Report (at end of Section 7.00) shall be completed during the test. The wet well shall be thoroughly cleaned to remove dirt, mud, gravel, and other foreign debris. The force main must be full and the wet well must be full to the high-water alarm mark. The operational test shall check the proper functioning of the pumps, pump controls, and other pump station equipment. The pump and motor serial numbers shall be verified. All components of the pump station shall be checked to ensure that they are capable of performing the service intended. Contractor shall pull and reset both pumps in the presence of Town staff before approval of the guide rail system. The operational test shall be performed by the Town of Holly Springs. The Contractor or Developer shall ensure that a representative from the various pump station equipment manufacturers are present at the operational test to review proper operation of the equipment with the Town of Holly Springs personnel.

Contractor's Responsibility: The Contractor shall furnish all materials, labor, and equipment to perform all testing. The Contractor shall coordinate with the Town of Holly Springs for the use of water for testing.

S. Equipment Manufacturer List

The table on the following page identifies equipment manufacturers that are considered most suitable for the anticipated service in wastewater pump stations. Alternate manufacturers may be proposed for the Town's approval, with supporting information, demonstrating the alternate manufacturers equipment is equal to the named manufacturers equipment.

EQUIPMENT	MANUFACTURER
VALVES	American, Mueller; APCO swing check valve (ValMatic)
REDUCED PRESSURE ZONE (RPZ) BACKFLOW PREVENTION VALVES	Watts, Hersey, Wilkens
SUBMERSIBLE GRINDER PUMPS	Muffin Monster with guide rails (JWC Environmental)
ACCESS HATCH	Halliday, Bilco
ODOR CONTROL SYSTEM	Evoqua
HOISTING EQUIPMENT	Acco Industries, Yale, Lift-Tech International (outdoor rated)
SUBMERSIBLE PUMP SYSTEMS	ABS USA (Sultzer), Fairbanks Morse Pumps (Pentair Water), Flygt USA (Xylem)
ELECTRICAL CABINETS & ENCLOSURES	Integrated Controls
FLOAT SWITCHES	Roto Float (Anchor Scientific, Inc), compatible (SJE Rhombus, Conery)
FLOW METER, ELECTORMAGNETIC	Badger M-3000
FORCE MAIN AIR VACUUM/AIR RELEASE VALVES	Val-Matic stainless steel ball valve and handle with flushing hardware, model to be determined at time of review
PACKAGED DIESEL ENGINE GENERATOR SYSTEM (TRANSFER SWITCH TO BE PROVIDED BY GENERATOR MANUFACTURER)	Caterpillar, Inc., Cummins Power Generation, Onan Division, Detroit Diesel Corp., Kohler
SCADA	Micro-Comm, Inc.
INTERNAL PIPE LINING	Protecto (401)
POLYUREA COATINGS	Duramer 1030 (SewerCote)
PRECAST CONCRETE BUILDINGS	Easi Span Building

7.8 INDIVIDUAL SEPTIC TANK SYSTEMS

Individual septic tank systems, where approved, shall be required to meet Wake County Standards and permitted through Wake County. No low pressure-type septic systems shall be allowed.

(CHECKLIST FOLLOWING)

TOWN OF HOLLY SPRINGS
GUIDELINES FOR
PUMP STATION FINAL FIELD INSPECTION AND OPERATIONAL TEST

Project:_____

The following items shall be provided by the Developer to the Utilities and Infrastructure Services Department *before* the Final Field Inspection and Operational Test begins:

- ☐ Four (4) copies O&M Manuals signed and sealed by the design engineer, including:
- ☐ Cover sheet with the following listed:
- ☐ Pump manufacturer
- ☐ Source of repair parts (phone and address)
- ☐ Rated capacity (GPM) of pumps
- ☐ Total dynamic head (TDH) of pumps
- ☐ Model number of pumps
- ☐ Serial number of each pump
- ☐ Impeller diameter each pump
- ☐ Data plate information from each motor
- ☐ Data on all other pump station equipment
- ☐ Pump Performance Design Curves
- ☐ **CERTIFIED** pump performance curves (including pump cut-off lines) with operating conditions on it
- ☐ As-built detailed, dimensioned drawings of pump and pump base elbow
- ☐ As-built detailed, dimensioned drawings of pump motor
- ☐ As-built control panel wiring diagram
- ☐ Pump and motor Installation and Service Manual
- ☐ Detailed information on:
- ☐ Control panel
- ☐ Alarm dialer
- ☐ Generator
- ☐ Mylar as-built one (l) copy plus three (3) blueprints
- ☐ PE certification
- ☐ Warranty Letter
- ☐ Recorded Easement or Right of Way documentation for access
- ☐ Documentation of site dedication
- ☐ Pump Station Maintenance Agreement
- ☐ Crane Certification will be required to document compliance with OSHA Standards
- ☐ Ownership of power with Duke Energy transferred to Town of Holly Springs
- ☐ Ensure the pump station address is the permanent address.

Date of Inspection: _____ ***Inspector:***_____

Attendees:_____

_____

Final Field Inspection and Operational Test-Required Inspections:

(Check off as completed/passed):

The following items should be field inspected for compliance with approved plans and Town Standards. All employees shall conform to the Town of Holly Springs Safety Policies and Procedures in the course of making the following inspections. Attention is directed especially to the Town's existing policies pertaining to electrical systems and confined space entry. Owner shall ensure that design engineer, subconsultant design professionals, equipment representatives, and labor is present for the field inspection.

☐ **Pumps**

- ☐ Two pumps - field check the plates on pumps to insure conformance with design plans and O&M manuals (Manufacturer, GPM, TDH, Model Number, Serial Number, Impeller Size)
- ☐ Pump start-up (both pumps) on regular power feed
- ☐ Pump start-up (both pumps) on back-up power feed (generator)
- ☐ Verify automatic switch to back-up power source during power failure
- ☐ Verify automatic cycling between two pumps

☐ **Valve Vault**

- ☐ Valve Vault
  - ☐ Check valve as designed
- ☐ Gate valve as designed
- ☐ Pressure gauge
- ☐ Vault drain back to wet well with Back Flap

☐ **Site**

- ☐ Positive drainage away from station
- ☐ 12' access road (min. 8" depth stone) with good drainage & cross drainage
- ☐ Adequate gravel area for vehicular turn-around installed
- ☐ 6' chain link fence with 3 strands barb wire (galvanized or aluminum)
  - ☐ Signage "Town of Holly Springs _____ [station to be named by the Town] Pump Station, [address here], Emergency 919-557-9111" (white on blue lettering)
- ☐ Ground cover outside fence
- ☐ Vehicular accessibility to pumps
- ☐ Concrete pad inside fence area
- ☐ 12" minimum width gate with 180 degree opening (non-obstructed)
- ☐ 600-watt sodium vapor light with photocell (30' mounting height) with switch on pole
- ☐ Opaque buffers installed
  - ☐ Power to PS converted to Town of Holly Springs account with Duke Energy.
  - ☐ Water service converted to Town of Holly Springs account

☐ **Odor Control**

- ☐ Chemical feed facility for odor control (if required)
- ☐ 2500-gallon liquid chemical storage tank
  - ☐ Evoqua Bioxide® chemical feed system complete with a VersaDose® LT(VDLT) control system
- ☐ Modular building (neutral colors) to house tanks and pumps; with lights, heater, and sump pump

☐ Containment system in case of chemical spill
☐ Eye wash
☐ Mechanical ventilation (if required)

☐ **Crane/wrench/chain horse**
☐ For pumps < 7hp, provide wrench
☐ For pumps > 7hp, provide chain horse
☐ Provide lifting rings every 6’ on lifting chain
☐ Chain bucket

☐ **Wet Well**
☐ Cleaned of all debris and filled with water
☐ 6’ minimum diameter
☐ Interior joints grouted
☐ Koppers super service black coating (2 coats)
☐ Aluminum trash basket with rope chain
☐ All bolts stainless steel
☐ Independent hatch for raising basket
☐ Access hatch and steps (check location)
☐ D.I. vent with bronze insect screen
☐ Class 50 DIP suction discharge and piping

☐ **Electrical**
☐ Generator-field check plate on generator to ensure conformance with design plans and O&M Manual
☐ 3 Phase 240 VAC or 480 VAC
☐ Meter Base
☐ Nema 3R single throw safety switch
☐ Nema 3R double throw safety switch
☐ Building: electrical inspector has approved
☐ Automatic maintenance operation on timer (minimum weekly)

☐ **Alarm Dialer/SCADA**
☐ Lockable Nema 4 enclosure
☐ 120 VAC electrical supply
☐ Backup battery
☐ Surge protectors on power and telephone lines
☐ Dialer programmed with emergency phone numbers
☐ Approved model in accordance with plans
☐ Telephone line installed
☐ SCADA installed

☐ **Pump Motor Controls**
☐ Aluminum weatherhood 7’ height with 4’ overhang with severe service paint
☐ Nema 3R enclosure with locking hasp
☐ Hinged inner door with overload reset buttons, circuit breakers, switches, 2nd pilot lights as the only accessible components when closed

- ☐ Line terminal block
- ☐ Circuit breaker for each pump motor
- ☐ 10,000 rms for 200-240 VAC
- ☐ 5,000 rms for 440-480 VAC
- ☐ Transformer primary circuit breaker (when required)
- ☐ Control power transformer (when required)
- ☐ Magnetic contactor and overload relay for each motor
- ☐ Six-digit, non-resettable elapsed time meters
- ☐ Condensation strip heater with thermostat in control panel enclosure
- ☐ Phase & voltage monitor
- ☐ Lighting arrestor
- ☐ Thru-door overload reset push buttons
- ☐ Two "hands-off-automatic" switches
- ☐ Two green pilot lights
- ☐ Two seal failure circuit test push buttons
- ☐ Pump alternator circuit
- ☐ Control relays
- ☐ High wet well level alarm device (flashing red light)
- ☐ Aluminum float switches
- ☐ High temperature shutdown circuit
- ☐ Groundings

☐ **Force Main**

- ☐ Force main including air release valves – Verify all valves are open
- ☐ Force main hydrostatic testing
- ☐ Air Release manholes are epoxy coated

Development Construction Manager **Date**

Development Inspector **Date**

Public Utilities Director **Date**

Executive Director of Utilities and Infrastructure Services **Date**

Owner's Representative **Date**

END OF SECTION 7.00