TOWN OF HOWEY-IN-THE-HILLS

CONSTRUCTION SPECIFICATION MANUAL

STANDARDS FOR:

POTABLE WATER
WASTEWATER
RECLAIMED WATER
STORMWATER
ROADS

February 2022

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TABLE OF CONTENTS

SECTION 1
GENERAL PROVISIONS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Purpose: The Town of Howey-in-the-Hills (Town) Construction Specification Manual (CSM) establishes the minimum standards, construction specifications, submittal requirements, and approval or acceptance procedures for potable water, wastewater, reclaimed water, and stormwater systems. The Town CSM is not intended to address every situation that may arise. The application of engineering/surveying principles, construction techniques, and best practices, combined with information contained in this CSM are necessary to complete projects and protect the safety, health, and welfare of the public and the Town. The approval of Construction Specifications, Construction Drawings, and submittals shall not relieve the Engineer or Developer from required compliance with the provisions of this CSM.

B. Jurisdiction: This CSM shall apply to:

1. All privately constructed development projects containing potable water, wastewater, reclaimed water, and/or stormwater systems that will be dedicated to the Town for ownership, operation, and maintenance.
2. All privately constructed development projects subject to the jurisdiction of the Land Development Regulations that proposed to contain potable water, wastewater, reclaimed water, and/or stormwater.
3. All Town potable water, wastewater, reclaimed water, and stormwater capital improvement project, including all rehabilitation and replacement projects.

C. All potable water, wastewater, and reclaimed water system components must be flood proofed against the 100-year flood occurrence and against inflow and infiltration.

D. Intent and Scope of Town CSM and Drawings: It is the intent of the Town CSM and the Construction Specifications (Specifications) and Construction Drawings (Drawings) that one shall supplement the other, but not necessarily replace one another. Any work called for in one and omitted in the other shall be executed as if called for in both in order that the work be fully-completed according to the design as determined by the Design Engineer (Engineer) and approved by the Town's Project Manager. Should any discrepancy appear between the Town CSM and the Specifications and Drawings, the Town CSM, shall govern. The

Contractor shall provide all items of labor and materials necessary for the satisfactory completion of the project in accordance with the Town CSM, Construction Specifications, and Construction Drawings. Any provisions contained in the Town CSM, Construction Specifications, or shown on the Construction Drawings which are not applicable to the work pertaining to the Project shall be disregarded. All testing shall be accomplished in accordance with the Town of Howey-in-the-Hills CSM Specifications and Drawings and only at the discretion of the Town shall any portion of the testing be waived.

E. The Contractor shall check all dimensions, elevations, quantities and instructions shown on the Construction Drawings or given in the Specifications and shall notify the Engineer of Record should any discrepancy of any kind be found in the Drawings, Specifications or conditions at the site. If any discrepancy, error, or omission is discovered by the Contractor or others, they should notify the Engineer of Record, Town, and Town's Representative. The Engineer of Record, with the Town's and/or Town's Representative approval, will issue full instructions pertaining thereto to resolve any discrepancy, error or omission and the Contractor shall carry out these instructions.

F. The Town CSM and Construction Specifications are divided into Sections for convenience of reference. The materials, work, etc., mentioned or specified in one part are not intended to be limited to that part only, but shall be applied with equal force to any other part or division of work where such materials, work, equipment, etc., are mentioned or required to properly provide acceptable work according to the true intent of the drawings and specifications. Reference to standard specifications (ASTM, AWWA, ANSI, etc.), national codes, and local or state codes, laws, and ordinances shall mean the latest edition of said document in effect at the project approval or bidding unless specifically stated otherwise.

G. Construction Drawings shall be followed in construction of the work and all dimensions and elevations shown on the Drawings shall be accurately maintained. The Contractor shall field verify all measurements and elevations. Scaled measurements will not be allowed and no work shall be performed when dimensions or elevations are not indicated until such dimensions or elevations are obtained from the Engineer.

H. Time Period of Approved Construction Specifications and Drawings: Construction Specifications and Drawings shall be valid for construction for a period of 1 year from the date of Town approval only. All items not under construction within 1 year of the approval date shall require a new approval before the commencement of construction.

I. Utility Coordination: It shall be the Developer's and/or Engineer's responsibility to coordinate all utilities within the development.

J. Town Standards and Specifications: Copies of the Town CSM may be obtained from the Utility Department or online at the Town of Howey-in-the-Hills website.

K. Definitions and Terminology: Wherever used in the Town CSM and printed with initial capital letters, the terms listed below will have the meaning indicated which are applicable to both the singular and plural thereof. In addition to terms specifically defined, terms with initial capital letters in the Town CSM include references to identified articles and paragraphs, and the titles of other documents or forms.

Definitions:

1. *Application for Payment* – The form acceptable to Engineer which is to be used by Contractor during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

2. *As-Built Survey* – Field measurements of vertical and horizontal dimensions of constructed improvements certified by a Surveyor, licensed in the State of Florida, so that the constructed facilities can be delineated in such a way that the location of the construction may be compared with the approve Construction Drawings.

3. *Boundary and Topographical Survey* – Boundary and topographical survey, map, and report certified by a Surveyor licensed in the State of Florida that meet the requirements of Chapter 61G17-6 ‘Minimum Standards’, FAC.

4. *Change Order* – A document recommended by the Engineer that is signed by the Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, issued on or after the Effective Date of the Agreement.

5. *Construction Drawings (Drawings)* – That part of the Contract Documents prepared or approved by the Engineer that graphically shows the scope, extent, and character of the Work to be performed by Contractor. Shop Drawings and other Contractor submittals are not Drawings as so defined.

6. *Construction Specifications(Specifications)* – That part of the Contract Documents consisting of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable thereto.

7. *Town* – The Town of Howey-in-the-Hills, Florida, the entity for whom the work is being performed.

8. *Contract* – The entire and integrated written agreement between the Owner and Contractor concerning the Work. The Contract supersedes prior negotiations, representations, or agreements, whether written or oral.

9. *Contract Documents* – Those items so designated in the Agreement. Only printed or hard copies of the items listed in the Agreement are Contract Documents. Approved Shop Drawings, other Contractor submittals, and the reports and drawings of subsurface and physical conditions are not Contract Documents.

10. *Contract Price* – The moneys payable by the Town to the Contractor for completion of the Work in accordance with the Contract Documents as stated in the Agreement.

11. *Contract Times* – The number of days or the dates stated in the Agreement to:

    a. Achieve Milestones, if any.
    b. Achieve Final Completion.
    c. Complete the Work so that it is ready for final payment as evidenced by Engineer's written recommendation of final payment.

12. *Contractor* – The individual or entity with whom the Town or the Developer has entered into the Agreement.

13. *Design Engineer* – The Florida-registered Professional Engineer responsible for preparation of Construction Drawings, Specifications, and permits.

14. *Engineer of Record* – The Florida-registered Professional Engineer responsible for Construction Administration and Florida Department of Environmental Protection (FDEP) Notification of Completion of Construction.

15. *Laws and Regulations; Laws or Regulations* – Any and all applicable laws, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

16. *Notice of Award* – The written notice by the Town to the Successful Bidder stating that upon timely compliance by the Successful Bidder with

the conditions precedent listed therein, the Town will sign and deliver the Agreement.

17. *Project* – The total construction of which the Work to be performed under the Contract Documents may be the whole or a part.

18. *Samples* – Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and which establish the standards by which such portion of the Work will be judged.

19. *Shop Drawings* – All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for the Contractor and submitted by the Contractor to illustrate some portion of the Work.

20. *Site* – Lands or areas indicated in the Construction Drawings and Construction Specifications where the Work is to be performed, including rights-of-way and easements for access thereto, and such other lands designated for the use of the Contractor.

21. *Standard Details* – Drawing details that are contained in this CSM (Appendix B) related to potable water, wastewater, reclaimed water, and stormwater.

22. *Subcontractor* – An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work at the Site.

23. *Supplier* – A manufacturer, fabricator, supplier, distributor, materialman, or vendor having a direct contract with the Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by the Contractor or Subcontractor.

24. *Underground Facilities* – All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.

25. *Unit Price Work* – Work to be paid for based on unit prices.

26. *Work* – The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work

includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction, and furnishing, installing, and incorporating all materials and equipment into such construction, all as required by the Contract Documents.

Terminology: When the following words or phrases are used in Town CSM, They shall have the indicated meaning.

1. *Intent of Certain Terms or Adjectives*: The CSM includes the terms "as allowed," "as approved," "as ordered," "as directed" or terms of like "effect" or "import" to authorize an exercise of professional judgment by the Town, Developer, or Engineer. The adjectives "reasonable," "suitable," "acceptable," "proper," "satisfactory," are used to describe an action or determination of the Town, Developer, or Engineer as to the Work. It is intended that such exercise of professional judgment, action or determination will be solely to evaluate, the work for compliance with the information in the Town CSM, Specifications and Drawings and the overall design concept and intent of the Project as a functioning whole (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to assign to the Town, Developer, or Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to provisions of the Specifications, Drawings, and/or Town CSM.

2. *Day*: The word "day" means a calendar day of 24 hours measured from midnight to the next midnight.

3. *Defective*: The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient in that it:

    a. Does not conform to the Contract Documents or Town CSM.
    b. Does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents.
    c. Has been damaged before the Engineer's recommendation of final payment.

4. *Furnish, Install, Perform, Provide*:

    a. The word "furnish," when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.

b. The word “install,” when used in connection with services, materials, or equipment shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.

c. The words “perform” or “provide,” when used in connection with services, materials or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.

d. When “furnish,” “install,” “perform,” or “provide” is not used in connection with services, materials, or equipment in a context clearly requiring an obligation of the Contractor, “provide” is implied.

5. Unless stated otherwise in the Town CSM and Construction Specifications and Drawings, words or phrases that have a well-known technical, construction industry, or trade meaning are used in accordance with such recognized meaning.

1.02 PRE-DESIGN CONFERENCE

A. Pre-design conference between the Developer, the Engineer and the Town shall be required to be held prior to submittal of utility system plans (Maps, Construction Specifications, and Construction Drawings).

1. A complete set of conceptual drawings and/or maps indicating the proposed utility system should be provided for the meeting (one hard copy and one electronic copy on CD/DVD in a potable digital file (*.pdf) format capable of being printed as 11”x17” page size).

2. For phased projects, a conceptual master utility plan/map of the entire project shall be provided that shows the proposed phase lines, utility main sizes, pump station locations, roadways, utility easements (onsite and offsite), right-of-ways, and lot lines.

1.03 SUBSTITUTIONS

A. Manufacturers and model numbers that the Contractor would like to use as a substitution the ones listed in Appendix A, Approved Manufacturer’s List will be reviewed and approved by the Town on a case-by-case basis.

1.04 SUBMITTAL PROCESS

A. The following is the general process for submitting utility system plans (Maps, Drawings, Specifications, etc.), permit applications, and supporting information for a typical development project to the Town for review, approval, and acceptance of the utility system for ownership, operation, and maintenance. A "Submittal Checklist Form" is provided at the end of this Section for the Engineer and Developer use.

B. It shall be the responsibility of the Engineer, Developer, and/or Contractor to obtain and comply with all applicable federal, state, and local regulatory permits.

C. The submittal package shall contain the following items:

1. A completed Construction Drawing set (one full size 22"x34" hard copy and one electronic copy in potable digital file (*.pdf) on a CD/DVD capable of being printed as 11"x17" page size), including the project Construction Drawings (cover sheets, general sheets, site plans, profiles, sections, details, etc.) of the project and utility system, signed, dated, and sealed by a Florida-registered Professional Engineer and in accordance with Part 1.04, Project Documents and Submittals, of this Section.

2. If applicable, one hard copy (22"x34") and one electronic copy in potable digital file (*.pdf) on a CD/DVD (capable of being printed as 11"x17" page size) of the Draft Final Plat showing the approved utility easements, rights-of-way, street names, lot numbers, etc.

3. One hard copy and one electronic copy in potable digital file (*.pdf) format on CD/DVD of a Master Plan for water, wastewater, reclaimed water, and/or stormwater prepared and submitted in accordance with Part 1.04, Project Documents and Submittals, of this Section.

4. FDEP Wastewater Construction Permit Applications. Submission shall be delayed until the Town notifies the Engineer or Developer that the Submittal Package has been reviewed and approved by the Town. Submit one electronic copy in potable digital file (*.pdf) format on CD/DVD.

5. FDEP Public Water System Construction Permit Applications. Submission shall be delayed until the Town notifies the Engineer or Developer that the Submittal Package has been reviewed and approved by the Town. Submit one electronic copy in potable digital file (*.pdf) format on CD/DVD.

6. FDEP Stormwater Permit Applications. Submission shall be delayed until the Town notifies the Engineer or Developer that the Submittal Package

has been reviewed and approved by the Town. Submit one electronic copy in potable digital file (*.pdf) format on CD/DVD.

7. St. Johns River Water Management District (SJRWMD) Environmental Resource Permit Applications. Submission shall be delayed until the Town notifies the Engineer or Developer that the Submittal Package has been reviewed and approved by the Town. Submit one electronic copy in potable digital file (*.pdf) format on CD/DVD.

8. If applicable, Florida Department of Transportation (FDOT) Utility Permit Applications. Submission shall be delayed until the Town notifies the Engineer or Developer that the Submittal Package has been reviewed and approved by the Town. Submit one electronic copy in potable digital file (*.pdf) format on CD/DVD.

9. Town of Howey-in-the-Hills applicable permit applications. Submission shall be delayed until the Town notifies the Engineer or Developer that the Submittal Package has been reviewed and approved by the Town. Submit one electronic copy on a CD/DVD.

10. Electronic copy on a CD/DVD of all models and calculations used to design the potable water, wastewater, reclaimed water, grease inceptor sizing, and stormwater systems. Specification Sections 12, 14, 16, 17, 21, and 22 provide specific design calculation requirements. Calculations shall be signed, dated, and sealed by a Florida-registered Professional Engineer and in accordance with Part 1.04, Project Documents and Submittals, of this Section.

1.05 PROJECT DOCUMENTS AND SUBMITTALS

A. Overview: This Section outlines the project documents that are required to be submitted for review and approval by the Town for proposed potable water, wastewater, reclaimed water, and stormwater systems that will be owned, operated, and maintained by the Town upon final acceptance.

B. The Town uses geographic information system (GIS) technologies to manage the Town's utility assets geographically and spatially. GIS-related work and submittals shall be in accordance with Section 3, Utilities Digital and CAD Requirements.

C. All Construction Drawings must be prepared in AutoCAD format. The version of AutoCAD used shall be compatible with the current version used by the Town at the time of submission. No other CAD software shall be used in preparation of Construction Drawings unless authorized in writing the Town Public Services

Director, or their designee. AutoCAD related work and submittals shall be in accordance with Section 3, Utilities Digital and CAD Requirements.

D. System Modeling and Analysis: The Engineer/Developer shall submit one electronic copy on CD/DVD of all system modeling and calculations to the Town Utilities Department along with the Construction Drawings for the Potable Water, Wastewater, and Reclaimed Water Systems. The modeling and calculations shall have the following:

1. Address the calculated demands and flows with the properly sized systems in accordance with the requirements of the Town CSM and the Federal, State, FDEP, and other permitting requirements.

2. Show the proposed connection points to the Town's utilities.

3. The Potable Water System modeling and calculations shall demonstrate that the system satisfies the fire flow demand, maximum day demand, and peak hourly demand in accordance with the requirements of the Town CSM and the Federal, State, FDEP, and other permitting requirements.

4. The Engineer/Developer shall coordinate with the Town Utilities Department on all connection points.

5. Modeling results and calculations shall be signed, dated, and sealed by a Florida-registered Professional Engineer.

E. Master Plan: Shall be to be submitted (one hard copy and one electronic on CD/DVD in a potable digital file (*.pdf) format) by the Engineer/Developer for projects constructed in multiple phases.

1. The Master Plan shall include the layouts and the design calculations.

2. The Master Plan shall be signed, dated, and sealed by a Florida-registered Professional Engineer.

3. The Master Plan shall include separate layouts for the potable water, wastewater, reclaimed water, and stormwater lines superimposed on a project map. The Master Plan sheet(s) shall include the following general items:

   a. Minimum Scale of 1 inch equals 200 feet.
   b. Topography.
   c. Lines indicating planned development phasing.
   d. Development phase numbering/coding.

e. Existing/proposed improvements in sufficient detail for demonstration of design intent.
f. Identity of utility service providers.

4. Potable Water:

a. Calculations for potable water demand shall be based on the projected ultimate development. A minimum of two flow scenarios shall be estimated and provided:

(1) Maximum day demand plus fire flow.
(2) Peak hour flow.

b. A summary of each unit or tract stating type of use (single-family residential, multi-family or mobile home dwellings, commercial, etc.) and unit flows shall be calculated based on factors provided in Section 12, Potable Water Distribution System, of the Town CSM.
c. Calculations shall include a pipe network analysis for flow and pressure distribution. The Master Plan shall include connection points to the Town water system and pipe sizes.
d. Delineate existing, approved, and future units or tracts.
e. Show all existing and proposed pipe diameters.
f. Location of the 100-year floodplain elevation.

5. Wastewater:

a. Existing manhole inverts and top of elevation for the manhole that is being connected to by the new collection system.
b. Pipe diameters (both force mains and gravity mains).
c. Total wastewater flow (both average daily flow and peak hour flow) to each lift station. A summary of each unit or tract stating type of use (single-family residential, multi-family or mobile home dwellings, commercial, etc.) and unit flows calculated in accordance with the flow factors provided in Section 14, Wastewater Gravity Sewer System, of the Town CSM.
d. If the Project will be sending wastewater flow to an existing Town lift station or gravity system the capacity of the existing lift station shall be evaluated and included in the design. If upgrades are required as a result of the increase flow, they shall be included in the design.
e. Lift station locations with top and bottom elevations.
f. Delineate existing, approved and future units or tracts.
g. Lift station and manhole nodes and numbers.
h. Location of the 100-year floodplain elevation.

6. Reclaimed Water:

    a. Calculations for reclaimed water demand shall be based on projected ultimate development utilizing flows calculated in accordance Section 22, Reclaimed Water System, of the Town CSM.
    b. Calculations shall include a pipe network analysis for flow and pressure distribution. The Master Plan shall include connection points and pipe sizes.
    c. Delineate existing, approved, and future units or tracts.
    d. Show all existing proposed pipe diameters.
    e. Location of the 100-year floodplain elevation.

7. Stormwater:

    a. Design storm calculations.
    b. Stormwater sewer pipe diameters.
    c. Stormwater pond sizing and water levels.
    d. Additional drainage calculations required for permitting.
    e. Location of the 100-year floodplain elevation.

F. Construction Drawings:

1. All Construction Drawings, including the cover page, shall be signed, dated, and sealed the Engineer of Record that is a Florida-registered Professional Engineer.

2. Typical line types and callouts shall be used to distinguish between existing and proposed utilities, structures, roads, etc. Future facilities to be constructed under a different project or phase shall be identified as not part of the current project or phase using distinguishing line types and callouts such as “not in contract” or “future”.

3. Drawings shall show location of existing and proposed underground and aboveground potable water, wastewater, reclaimed water, and stormwater piping, structures, and related appurtenances within the project area.

4. The cover sheet shall include:

    a. Full name of the project.
    b. Section(s), Township(s), and Range(s) of the project.
    c. The address of the project, if applicable.

d. A map that includes the Town of Howey-in-the-Hills limit and includes the location of the project, major roadways, and a north arrow.
e. A vicinity map that includes the project boundaries, major roadways, and a north arrow.
f. Developer's name, company name, business address, fax number, and telephone number.
g. The Engineer of Record and, as applicable, other design professionals' names, company names, business addresses, fax numbers, and telephone numbers.
h. A signature block for the Engineer of Record information and space for the Engineer's signature, date, and seal.
i. Notation on the status of the Drawings – "Construction Drawing" or "Record Drawing".

5. The Drawings shall include:

a. Index to all drawings.
b. Key map(s).
c. Abbreviations and legend that identify symbols, meaning of all line types used on the plans.
d. Graphic scales.
e. Town of Howey-in-the-Hills Standard Details and Notes.

6. Potable Water, Wastewater, Reclaimed Water shall be shown on the same Drawing sheet. Stormwater system shall be included on a separate Drawing sheet. Drawings shall include the following information:

a. General information such as project name, north arrow, Engineer of Record information and signature block, designer, revision block with dates, graphic scale(s), and Drawing sheet number.

b. The Overall plan shall be prepared at a scale not to exceed 1 inch equals 100 feet. Unless otherwise approved by the Town, plan and profile sheets shall be legible and prepared at a horizontal scale of no smaller than 1 inch equals 30 feet and at a vertical scale of no smaller than 1 inch equals 5 feet. Special details shall be of sufficiently large scale to show pertinent construction information.

c. Potable water mains, wastewater gravity sewers, wastewater force mains, reclaimed water mains, and stormwater sewers shall be drawn in plan and profile, including existing and proposed utility locations and elevations. Plan and corresponding profile shall be on the same Drawing sheet. The profile shall be vertically aligned

at the beginning station or left match line for each Drawing sheet. Utility infrastructure to be privately owned may be shown in plan view only.

d. All connections to utilities; crossings; and conflicts with other utilities, drainage systems, and structures shall be shown in detail with field-verified elevations. Drawings shall include the following note "All existing utilities have been field verified (vertically and horizontally) at all points of connection and at all areas of conflict with the Town and other utilities." **The Drawings will not be approved without this note.**

e. Manholes with invert and rim elevations shall be on the corresponding profile and/or plan view.

f. Stormwater inlets and drainage structures with invert and rim elevations shall be on the corresponding profile and/or plan view.

g. Existing and proposed pipe data including size, length, and material type. Provided slopes of wastewater gravity sewer and stormwater sewer mains.

h. Size, type, and locations of fittings, valves, hydrants, air valves, and other related appurtenances.

i. Limits of pipe joint deflections.

j. Limits of changes in pipe linings and coatings other than the standard pipe lining and coating.

k. Limits of retrained joints.

l. Limits of special bedding requirements.

m. Details of connection to the existing system, which have been field verified. Show in a detail drawing proposed fittings and restraints.

n. Location(s) and layout of wastewater lift stations. Show the top elevation of the proposed wet well and the elevation of the centerline of the road at the extension of the access driveway to the lift station.

o. Drainage system plans and locations and limits of stormwater retention ponds and water levels and outfall structures including structure types, invert elevations, and sizes.

p. Construction notes regarding cover, horizontal and vertical control, special construction requirements, and references to details.

q. Location of the 100-year floodplain elevation.

r. Existing and proposed right-of-way lines, property lines, and utility easements. Distinguish between existing and proposed utility easements and callout as public or private. Provide book and page numbers for existing easements.

7. The Drawings shall include all applicable Town Standard Details and Drawings included in Appendix B, Standard Details, of the Town CSM. Drawing sheets containing only Town CSM standard details shall not be required to be signed, dated, and sealed by the Engineer of Record. Additional details shall be prepared and included for conditions not included in the Town CSM Standard Drawings such as connections to existing mains, aerial and underwater crossings of rivers, streams, canals, and ditches.

8. The following shall be provided if applicable: recorded cross-access utility agreement; signed, dated, and sealed wastewater lift station calculations; and fire flow hydraulic calculations.

9. Survey Requirement:

a. Horizontal and vertical controls shall be shown on the Drawings sufficiently to determine locations and elevations for the Contractor to establish their Work.

b. The Surveyor’s name, registration number, and the date the survey was performed shall be indicated on the Drawings.

c. Baselines shall be parallel to the right-of-way and monumented at the beginning and end of the project and at all changes in direction. The Drawings shall indicate the types of monuments used and shall include state plane coordinates with vertical elevation (x, y, z) for all monuments.

d. All proposed utility easements and tracts shall be shown with dimensions and offsets tied to the baseline of the design survey.

e. Found or set monuments for existing right-of-ways, easements, or lift station sites shall be adequately depicted on the Drawings.

f. The Surveyor shall survey the existing underground utilities marked by the respective utility owners.

1.06 WARRANTY

A. Warranty shall be provided to the Town at the time of final acceptance.

B. For at least 1 year after final acceptance, the Contractor warrants the fitness and soundness of all work done, materials, and equipment put in place under the contract including manufacturing and/or design inadequacies, materials, and workmanship not in conformity with the Town CSM, improper assembly, hidden damage, failure of devices and/or components, excessive leakage, or other circumstances that would cause equipment failure under normal design and/or specific operating conditions.

C. In addition, the Town shall be provided 5-year warranties on all equipment such as pumps, motors, electrical panels, etc., by the manufacturer before final acceptance by the Town.

D. Warranties shall be extended by 6 months from the date of any repair to warranted items.

E. Neither the final certificate of payment nor any provision in the Town CSM nor partial or entire occupancy of the premises by the Town shall constitute an acceptance of work not done in accordance with the Contract Documents or relieve the Contractor of liability in respect to any express warranties of responsibility for faulty materials or workmanship.

F. The Contractor shall replace and install each piece of equipment, device, or component which shall fail within the above-specified term of the guarantee with reasonable promptness without increase in the Contract Price. If the Contractor fails to proceed promptly to comply with the terms of the guarantee, the Town may have the defects corrected and the Contractor and their Surety shall be liable for all expenses incurred, or the Town may issue a claim against the Contractor's Bond. In some instances, if approved by the Town, the Contractor may be allowed to repair the equipment.

G. As part of the guarantee, the Contractor shall verify compliance with the Town CSM, Specifications, and Drawings, and submit two copies to the Town of the warranties, bonds, and service and maintenance contracts executed by each of the

respective manufacturers, suppliers, and subcontractors. The submittal of warranties, bonds, and service and maintenance contracts shall be included in submittals for review and before final acceptance and shall include:

1. Table of Contents: Neatly typed, in sequence of the Specifications. Provide completion information for each item as follows:

    a. Product or work item.
    b. Firm, address, telephone and fax numbers, and E-mail and name of the principal.
    c. Scope.
    d. Date of beginning of warranty, bond, or service and maintenance contract.
    e. Duration of warranty, bond, or service and maintenance contract.
    f. Provide information for Town's personnel:

        (1) Proper procedure in case of failure.
        (2) Instances that might affect the validity of warranty or bond.

    g. Contractor, with address, telephone and fax numbers, E-mail, and the name of the responsible principal.

H. A second Town inspection shall be conducted 10 months after the date of final acceptance. The Contractor shall be notified of observed defects after the "10-month" inspection is conducted. The Contractor shall promptly correct any defects.

I. If in fulfilling the requirements of the Contract or of any guarantee embraced therein or required thereby, the Contractor disturbs any work guaranteed under another Contract, the Contractor shall restore such disturbed work to a condition satisfactory to the Town, and shall guarantee such restored work to the same extent as it was guaranteed under such other Contract.

J. In addition to the guarantee stipulated in the Contract, the Contractor shall fully maintain all work performed under the Contract for 60 days after final completion and acceptance of the work. The retained percentage of Contract Payments shall not be due until after the 60–day maintenance period, except that the Town may at their discretion release such retainer earlier.

1.07 MATERIALS AND WORKMANSHIP

A. It is the intent of these Specifications that the Contractor shall furnish first-class materials and do all Work in a first-class manner so that the completed job shall be thoroughly satisfactory in every respect. To this end, the Contractor shall use

all of their construction experience and shall consult with the Engineer regarding items in the Drawings and Specifications that may be altered to the benefit of the Work.

B. Materials, Services and Facilities: It is understood that except as otherwise specifically stated in the Specifications, the Contractor shall provide and pay for all materials, labor, tools, equipment, water, light, power, transportation, superintendence, temporary construction of every nature, and all other services and facilities of every nature whatsoever necessary to execute, complete, and deliver the work within the specified time. **Materials must be approved for use by the Town or the Town's Representative before being purchased by the Contractor.** The Contractor shall submit to the Engineer of Record, the Town, and the Town's Representative a list of such materials or products, and the shop drawings, together with such samples as may be necessary for determination of their acceptability and obtain material/product approval. No request for payment will be approved until this list has been received and approved by the Town. Delay caused by obtaining approvals for substitute materials will not be considered justifiable grounds for an extension of construction time.

C. Material Inspection and Testing: All materials and equipment used in the construction of this project shall be subject to adequate inspection and testing, in accordance with requirements and accepted standards. All testing shall be done after fabrication and performed within the continental limits of the United States.

1. Materials of construction, particularly those upon which the strength and durability of the structure may depend, shall be subject to inspection and testing to establish conformance with specifications and suitability for uses intended.

2. Laboratory or Inspection Agencies shall be selected, or approved, by the Town and Engineer of Record. Preparation of test samples and shipment to an independent laboratory shall be by the Contractor. The Contractor shall pay for all tests and reports, except those that may be specifically excluded by other Sections of the Specifications.

1.08 SHOP DRAWINGS

A. Shop Drawings are original drawings prepared by the Contractor, or a subcontractor or supplier, which illustrate some portion of the Work and show fabrication, layout, and setting or erection details. Shop drawings shall also include manufacturer's catalog sheets, brochures, diagrams, schedules, performance charts, illustrations and other standard descriptive data, as required. Shop drawings shall be clearly marked to identify specific materials, finishes,

products or models, and shall show all required dimensions and clearances, performance characteristics and capacities, wiring diagrams, and controls.

B. Shop drawings shall be submitted to the Town of Howey-in-the-Hills or the Town's Representative for review and approval. Shop drawings must be reviewed and approved by the Engineer of Record and the Town and/or the Town's Representative before being released for construction.

C. Submittal of shop drawings and documents for the Town or Town's Representative review shall in no way relieve the Contractor of full responsibility for providing a complete, safe, reliable, operating, and coordinated Work.

D. The Contractor shall review and check all shop drawings for accuracy and conformance with the Contract Documents. The Contractor's review shall include verifying field measurements, field construction criteria, dimensions, catalog numbers, and similar data. Before submission to the Engineer of Record and the Town, all shop drawings shall be marked, stamped, or otherwise certified as approved by the Contractor, dated, and signed or initialed. Any shop drawings not so marked will be returned to the Contractor without the Engineer of Record's and the Town or Town's Representative review.

E. The Contractor shall schedule the submission of shop drawings to allow sufficient time for review by the Engineer of Record and the Town, corrections and resubmissions by the Contractor, and re-checking by the Engineer of Record/Town, as necessary. The Engineer of Record will review shop drawings within 2 weeks from date received, unless otherwise noted.

F. Unless otherwise requested, shop drawing shall be submitted electronically to the Engineer of Record and the Town and/or the Town's Representative.

G. The Contractor shall not begin fabrication or work that requires submittals until return of submittals with the full approval from the Engineer of Record and the Town or Town's Representative.

H. Prior to submitting any shop drawings, the Contractor shall provide to the Town a list of shop drawings that will be submitted and the schedule for submittal.

I. Town or Town's Representative Submittal Review:

1. The Town/Town's Representative review of the Contractor's documents and shop drawings shall not relieve the Contractor of the responsibility for meeting all of the requirements of the contract nor of the responsibility of correcting the documents and shop drawings furnished. The Contractor shall have no claim for additional cost or extension in time because of

delays due to revisions of the documents that may be necessary for ensuring compliance with the Contract or Agreement.

2. No partial shop drawing submittals will be reviewed. A shop drawings submittal or re-submittal not complete will be returned to the Contractor for completing and re-submittal.

3. Documents submitted by the Contractor for approval by the Town/Town's Representative will be returned bearing a project-specific stamp bearing the dated signature of the reviewer and one of four boxes checked:

   a. NO EXCEPTIONS NOTED – indicates that the submittal appears to be in compliance with the requirements of the performance specifications and that the Work may proceed.
   b. MAKE CORRECTIONS NOTED – indicates that the reviewer has added a minor correction to the submission and that the Work (modified in accordance with the correction comment) may proceed. The Contractor shall accept the responsibility of the modified document and resulting Work with no additional compensation.
   c. AMEND AND RESUBMIT – indicates that the submittal will require Contractor modifications based on the reviewer's comments that accompanied the returned submittal. The Contractor will be cautioned that work may not proceed under this review status.
   d. REJECTED – indicates that the submittal is not in conformance with the requirements of the performance Specifications and cannot be modified to gain compliance. A new submittal will be required in the instance of a "reject" status and the Contractor will be cautioned that work may not proceed under this condition.

1.09 CONSTRUCTION

A. Start:

1. Notification: The Town shall be notified in writing by the Contractor of the proposed date of the beginning of construction of the potable water, wastewater, reclaimed water, roadway, and stormwater facilities. Any time that work is to stop for a period in excess of 2 working days, the Town shall be notified of such interruption.

2. Pre-Construction Conference: At least 2 days before the preconstruction conference, the Engineer of Record shall provide the Town's Project Manager with four sets of Drawings and Specifications stamped "issued for construction." Project cut sheets and applicable shop drawings shall be

provided as soon as possible after the preconstruction conference and prior to starting construction. A pre-construction conference shall be held at least 2 days before the commencement of construction. The Developer shall be responsible for arranging this conference with the Town. The conference shall be attended by:

a. Town's Project Manager.
b. Town's Construction Inspector.
c. Representative of Design Engineer and Engineer of Record.
d. Representative of the Contractor and/or the Contractor's Project Foreman.
e. Representative of any Subcontractors involved with project.
f. Other utilities servicing the project.

3. Required insurance certificates will be provided by the Developer to the Town when work involves Town property, right-of-ways, or easements. Work shall not begin until such certificates are provided. The surety shall have an A.M. Best Financial Performance rating of no less than "A-".

4. The Contractor will cause the Bonds to be recorded with the Clerk of the Circuit Court in Lake County. Failure of the Contractor to deliver required Bonds in the form prescribed may constitute and event justifying termination of construction for cause. The expense for all Bonds shall be the Contractor's responsibility.

5. During construction, the project documents shall be updated and maintained and shall be submitted to the Town.

B. Completion:

1. Record Drawings: Within 2 weeks following final inspection, the Developer shall submit Record Drawings in accordance with Part 1.13 of this Section, Record Drawings.

2. Certificates of Compliance: Certificates of compliance with the Specifications furnished by the material supplier shall be submitted on all materials used in the completion of this Work.

C. Off-Site Pollution Protection: It will be the Developer's responsibility to provide downstream siltation protection during construction. In the event such protection is inadequate, it will be the Developer's responsibility to remove any downstream siltation before final inspection. (See also Section 5, Temporary and Permanent Erosion and Sedimentation Control of the Town CSM.)

D. Verification of Dimensions and Elevations:

1. Dimensions and elevations indicated on the Drawings in reference to existing structures, location of utilities, sewer inverts, or other information on existing facilities, are the best available data obtainable but are not guaranteed by the Design Engineer. The Design Engineer or Engineer of Record will not be responsible for their accuracy. Before proceeding with any work dependent upon the data involved, the Contractor shall field check and verify all dimensions, grades, inverts, lines, elevations, or other conditions of limitations at the site of the Work to avoid construction errors or damage to existing facilities. If any Work is performed by the Contractor, or any subcontractors, before adequate verification of applicable data, any resultant extra cost for adjustment of work necessary to conform to existing conditions, or damage to existing facilities, shall be assumed by the Contractor without reimbursement or compensation by the Town.

2. If the Contractor, in the course of the work, finds any discrepancy between the Drawings and the physical conditions of the locality, or any errors or omissions in the Drawings or in the layout as given by survey points and instructions, he shall immediately inform the Engineer of Record, in writing. The Engineer of Record will promptly investigate the reported conditions and, after Town approval, shall issue such instructions as may be necessary for the proper execution of the Work. Any Work done after such discovery and before receipt of such instructions shall be at the risk of the Contractor.

E. Care of Existing Facilities: In executing the Work, the Contractor shall exert every effort not to damage any existing utilities or the Town's existing facilities or to break into them. Any damage done shall be promptly reported to the affected utility for repair. Any damage that is done thereto shall be promptly repaired by the Contractor or by the Owner, at the Owner's option, and at the Contractor's expense. The Town of Howey-in-the-Hills, at the Contractor’s expense, shall repair damage to Town of Howey-in-the-Hills utilities. The Contractor shall not interrupt or interfere with the operation of existing utilities or facilities during construction except when necessary. When this is the case, the Contractor shall notify with the Engineer of Record, the Town, and the utility company at least 1 week ahead of interruption or interference to coordinate and develop a resolution by their direction.

1. It shall be the Contractor's responsibility to locate and protect all such existing facilities before beginning construction.

2. The Contractor shall conduct their operations in a manner and sequence that will provide for the continued transportation of wastewater flows during construction of this project. The Contractor shall take all actions required to prevent discharge of sewer flow from the system to the ground or any stream. Any construction actions that impede or interrupt flow shall be carefully executed and monitored to prevent surcharging and overflow.

3. Any existing surface or subsurface improvements, such as pavement, curbs, sidewalks, pipe or utilities, footings, or structures (including portions thereof), trees, and shrubbery not indicated on the Drawings or noted in the Specifications as being removed or altered shall be protected from damage during construction of the project. Any such improvements damaged during construction of the project shall be restored to a condition equal to, or better than, that existing at time of Award of Contract.

4. Any such improvements damaged during construction of the project shall be restored to a condition equal to, or better than, that existing at time of Award of Contract. All repairs to utility services shall be coordinated with the applicable utility company, and shall be made in strict accordance with their requirements.

F. Connecting to Existing Work: It shall be the express responsibility of the Contractor to connect their work to each part of the existing work or work previously installed as required by the Drawings and Specifications to provide a complete installation. Connections to existing sewer lines, before completion, may be allowed by the Town on a case-by-case basis where requested by the Contractor and approved by the Town's Project Manager; otherwise, connections to existing sewer lines shall be made only after all inspections are completed and all punch list items have been adequately addressed. During construction of new sewer lines, no physical connection to any existing pipeline by open channel or sawed off pipe shall be allowed until all lines upstream and/or downstream of connection have been approved for use by FDEP.

1.10 INSPECTION

A. The Engineer of Record, the Town, and/or Town's Representative shall provide for the inspection of materials used and the Work by assistants and inspectors under their direction. Such inspection may extend to any or all parts of the Work and to the preparation or manufacture of materials used, whether within the limits of the Work or at any other place. The Contractor shall furnish the Engineer of Record, the Town, and/or Town's Representative all information relating to the Work and to the materials, which the Engineer of Record, the Town, and/or Town's Representative may deem necessary or pertinent and with such samples of materials as may be required. The Contractor shall, at their own expense,

supply labor and assistance as may be necessary in handling material for proper inspection.

B. The representatives of the Town, Engineer of Record, and any State, Federal or other agency having jurisdiction over the Work, shall have access to the Work wherever it is in preparation or progress, and the Contractor shall provide proper facilities for such access and inspection.

C. Town of Howey-in-the-Hills Inspectors shall be authorized to inspect all Work done and all materials furnished, including preparation, fabrication, and manufacture of the materials to be used.

1. The Town will periodically visit the project site to observe the progress of the Work and methods of construction. Upon observation of Work not done in accordance with the Drawings and Specifications, the Town will notify the Developer's Contractor, and request that necessary corrections be made or tests performed to assure compliance with the Specifications, at no cost to the Town.

2. All projects shall be subject to inspection during and upon completion of construction by an authorized representative of the Town. Presence or absence of an inspector during the construction does not relieve the Owner and/or Contractor from adherence to the approved Drawings and Specifications. The Inspector may reject materials or suspend Work until questions at issue can be referred to, and decided by, the Town's Project Manager or designated representative. The Inspector shall not be authorized to alter or waive requirements of the Drawing and Specifications.

3. The Work shall at all times be subject to inspection by authorized representatives of the Town, and materials and/or workmanship found not meeting the requirements of approved Drawings and Specifications shall be immediately brought into conformance with said Drawings and Specifications.

4. An authorized representative of the Town shall make final inspection of the project after completion to determine acceptability of the Work. Before this final inspection can be made, the Owner/Contractor shall notify the Town in writing that the Work has been completed in accordance with the approved Drawings and Specifications.

D. The Contractor shall furnish all necessary facilities and assistance to make any examination of the complete work if the Engineer of Record, the Town, and/or Town's Representative deems such examination advisable. If any of the Work is

found defective in any respect, the Contractor shall pay the expense of the examination and satisfactory reconstruction. If the Work is found acceptable, the expense of the examination shall be added to the Contractor's final estimate.

E. Work covered up without consent or approval of the Town must, if required by the Inspector, be uncovered for examination and properly restored at the Contractor's expense. Pictures of the Work that is covered up, at the discretion of the Town or Town's Representative, will be allowed in place of an in-person inspection.

F. If the Specifications, the Engineer of Record's, the Town's and/or Town Representative's instructions, codes, laws, ordinances, or any public authority requires any Work to be specially tested or approved, the Contractor shall give the Engineer of Record, the Town, and/or Town's Representative timely notice of its readiness for inspection; and, if the inspection is by an authority other than the Engineer, Town, and/or Town's Representative of the date fixed for such inspection.

G. Final Inspection: Upon 48 hours' notice from the Contractor that the Work is complete, the Engineer of Record, the Town, and/or Town's Representative will make a final inspection, and will notify the Contractor in writing of all defective, incomplete, or otherwise unacceptable Work revealed by the inspection. The Contractor shall immediately correct all such deficiencies to the satisfaction of the Engineer of Record, Town, and/or Town's Representative. The Engineer of Record will then certify the project in writing to FDEP or appropriate regulatory agency, and request a final regulatory agency inspection.

1.11 TESTING

A. It shall be the Contractor's responsibility to provide the necessary equipment and personnel for all inspections and testing, including televising the sanitary sewer laterals. This shall include all safety equipment necessary to meet OSHA requirements. Inspections will be cancelled if proper testing or safety equipment is not on site and readily available at the time of the inspection.

B. All testing shall be witnessed by the Engineer of Record, the Town, and/or the Town's Representative.

C. Access to the Work shall be provided by the Contractor for all required inspections. In cases where the Contractor has proceeded with Work which the Town had requested to inspect or witness without said requested inspection, the Contractor shall bear all costs associated with uncovering, retesting, additional testing, or any other means necessary to provide physical evidence as to the acceptability of the Work performed by the Contractor. Such costs shall be the

responsibility of the Contractor regardless of whether or not the Work is found to be defective or acceptable to the Town.

1.12 INSURANCE

The Contractor shall not start Work under this Contract until he has obtained all the insurance required under this paragraph and such insurance has been approved by the Town. The Contractor shall not allow any subcontractor to start work on their subcontract until the insurance required of the subcontractor has been so obtained and approved. **The Town shall be named as additionally insured.**

A. Compensation and Employer's Liability Insurance: The Contractor shall procure and maintain during the life of the Contract the statutory Workmen's Compensation and Employer's Liability Insurance for all of their employees to be engaged in work on the project under the Contract. The Contractor shall require all subcontractors to provide Workmen's Compensation and Employer's Liability Insurance of all their employees to be engaged in such Work.

B. General Public Liability and Property Damage Insurance: The Contractor shall procure and maintain General Public Liability and Property Damage Insurance during the life of the Contract. Insurance shall include vehicle coverage, to protect him from all claims for destruction of or damage to property, arising out of or in connection with any operations under the Contract, whether such operations are by himself or by any subcontractor under him, or anyone directly or indirectly employed by the Contractor or by a subcontractor under him. The amount of such insurance shall be not less than the following limits of liability.

1. $500,000 for all damages arising out of bodily injury, including death, at any time resulting therefrom, sustained by any one person in any one accident and $500,000 aggregate for any such damages sustained by two or more persons in any one accident.

2. $200,000 for all property damage sustained by any one person in any one accident and $200,000 aggregate for any such damage sustained by two or more persons in any one accident.

C. Special Hazards Insurance: Where special hazards are encountered in the Work under this Contract, such hazards shall be covered by a rider to the policy or policies required under subparagraph B in an amount not less than those stipulated under subparagraph B. The Contractor shall be responsible for procuring this insurance before performing any work involving special hazards.

D. Flood Insurance: The Contractor shall procure and maintain during the life of the Contract adequate flood insurance to cover all Work on this project.

E. Certificates of Insurance: Before starting any Work, the Contractor shall furnish the Town with certificates showing the type, amount, class of operations, effective dates, and expiration dates of all insurance policies. Each certificate shall contain the following statement: "The insurance covered by this certificate shall not be cancelled or materially altered, except after ten (10) days written notice has been received by the Town."

F. Railroad Insurance (if required): Insurance shall be furnished in accordance with CSX or applicable requirements

1.13 FINAL

A. Final Acceptance:

1. The Town shall be notified in writing when the project is complete. Upon receiving a written request for final inspection of the completed Work, the representatives of the Town, together with the representatives of other interested agencies, shall perform the final inspection within 2 weeks of the receipt of the request.

2. All disturbed earthen areas shall be sodded before acceptance.

3. When facilities qualify as public facilities, the Town will accept ownership of the completed facilities when the Work has passed the final inspection, proper acquisition documents are completed, and acceptable Record Drawings are submitted to the Town. The Record Drawings shall be completed by the Engineer of Record for the project in accordance with Part 1.13 of this Section, Record Drawings.

4. Final acceptance by the Town will be made in writing upon satisfactory completion of the project, including final inspection and submittal of the following documents:

a. Record Drawings in accordance with Part 1.13, Record Drawings, of this Section.
b. Certifications of Completion from all Regulatory Agencies (i.e., FDEP, SJRWMD, FDOT, etc.).
c. Recorded easement documents.
d. Maintenance Bond in the amount of 10% or all contributed assets, with a duration of 2 years. Maintenance Bond shall be accompanied by a letter prepared by the Engineer of Record documenting the Bond amount.

e. Copies of all approved Testing Results (i.e., Hydraulic Pressure Test, Air Test, Lamping, Mandrel, Densities/Compaction, copy of sanitary sewer videotape, etc.).
f. Results of Bacteriological Sampling on potable water lines.

5. Final acceptance by the Town will be made in writing upon satisfactory completion of the project, including all items above. The Developer/ Contractor shall warrantee the work for a period of at least 1 year from the date of final acceptance and shall immediately correct any deficiencies in the Work due to materials and/or workmanship, which occur during the warranty period. The date of final acceptance shall be the date on which the Developer/Contractor has fulfilled all conditions necessary for final acceptance.

B. Changes: All field changes to previously approved Construction Drawings shall be in accordance with these specifications and approved by the Town before implementation.

C. Maintenance: All items or systems must be designed in such a manner to minimize future maintenance. Warranties shall be extended by 6 months from the date of any repair to warranted items.

D. Transfer of Private Ownership: When transfer of private facilities to public ownership takes place, all such private facilities shall be brought up to the current Town standards at no cost to the Town insofar as construction and maintenance are concerned, before the Town will accept such facilities. The Town is to be furnished copies of all approvals; permits, certificates of completion, etc., to or from completion, etc., to or from other agencies such as Lake County, FDEP, SJRWMD, FDOT, railroads, etc., before proceeding with construction. Proof of satisfactory completion of water and sewer facilities, positive water bacteriological tests, and submission of quit claim deeds, bills of sale, prior and current permits, warranties, manufacturers manuals, and a 2-year maintenance bond shall be furnished to the Town before acceptance.

E. Property Ownership: All facilities to be owned or maintained by the Town shall be located on Town property, within Town right-of-way, or on easements dedicated to the Town for the uses intended.

1.14 RECORD DRAWINGS

A. General Submittal Requirements:

1. After the successful completion of the Work, a preliminary set of Record Drawings shall be submitted to the Town by the Developer/Engineer for review and acceptance before finalizing the Record Drawings.

2. Three hard copy sets, two electronic copies in portable document file (*.pdf) format, and AutoCAD format on a CD/DVD of Record Drawings. The version of AutoCAD used shall be compatible with the current version used by the Town at the time of submission.

3. The Record Drawings shall be properly signed, dated, and sealed by the Engineer of Record and the Florida Licensed Surveyor.

4. Certification: Each page of the Record Drawings shall bear the name, date, and original signature of the general Contractor responsible for the Work and the name, date, and original signature and seal of the Florida-registered land surveyor or Florida-registered Professional Engineer who provided the horizontal and vertical dimensions and elevations on the Record Drawing. The signatures shall certify that the Record Drawings do, in fact, reflect the true as-built conditions as located under the direct supervision of the Florida-registered surveyor and/or Professional Engineer. The Drawings shall be certified using the form provided by the Town (provided at the end of this Section).

5. Record Drawings shall be clearly labeled Record Drawings in 1-inch high printed letters on 22”x34” size paper.

6. The Contractor shall make documents and samples available at all times for inspection by the Town and Engineer of Record.

7. The Contractor shall have a Florida-licensed Land Surveyor certify the Record Drawings as being correct and complete.

8. Record Drawings shall be maintained in a clean, dry, and legible condition. Record Drawings shall not be used for construction purposes. The Contractor shall store documents and samples in the Contractor’s field office apart from documents used for construction and shall do the following:
   a. Provide files and racks for storage of documents.
   b. Provide cabinet or secure storage space for storage of samples.

B. At a minimum, Record Drawings shall contain:

1. Record Drawings shall show all changes in the work including verbal field changes, addenda, change orders, supplemental work authorizations and other Engineer of Record, Town, or Town's Representative directives.

2. Record Drawings shall contain a vicinity map, and street names shall be shown for all streets and right-of-ways.

3. All wastewater and reclaimed water facilities shall be located in two directions. One location shall be referenced perpendicular to the right-of-way line. The other location shall be parallel to the item being located and shall be referenced to the right-of-way line. Centerline intersections of pavement, curb, sidewalk, or utility structures are not acceptable unless these are in turn referenced to right-of-way lines. Centerline of right-of-way may be used for reference in lieu of the right-of-way line. A project base line shall be completely defined and shall be centered in the right-of-way, where possible. Stationing may be used as an alternative providing the point of beginning is referenced to an existing right-of-way line that is shown on the Drawings. A "point of beginning" and Town easements shall be defined from a known Town block corner as defined in the Town's land base maps and tied to lot/property corner. A single lot survey shall include the lot address. The horizontal and vertical datum referenced shall be clearly stated on the Record Drawings.

4. GPS coordinates shall be provided of Third Order Class I survey accuracy or 1.64-foot (50-cm) positional accuracy. Contractor's questions regarding the GPS data should be directed to the Town's GIS/CAD Standards Department.

5. Field changes of dimension and detail.

6. Details not on original Construction Drawings.

7. Changes made by change order or supplemental Work Authorizations.

8. Record Drawings shall contain horizontal dimensions to the nearest 0.10 foot and vertical dimensions shall be to the nearest 0.010 foot.

9. Record Drawings shall contain horizontal locations perpendicular to the right-of-way at 100-foot intervals.

10. Wastewater Gravity Sewers and Stormwater Sewers:

    a. The location of all piping, fittings, valves, manholes, drainage inlets, cleanouts, points of deflection, and points of connection to

the existing system shall be referenced in two perpendicular directions.

b. Storm retention pond contours and topography and outfall locations and inlets shall be identified.

c. Runs of gravity and stormwater sewers shall be identified (i.e., 300 feet of 8-inch PVC SDR35 at S = 0.004).

d. Elevations shall be given for the north rim of the top of all manhole covers and all manhole inverts.

e. Elevations on the service piping and finished grade shall be required at the property line for only those sewer service laterals which result in more than 60 inches of cover or less than 30 inches of cover (these exceptions must be Town approved).

f. For wastewater sewer service laterals that are totally perpendicular to the main, the location of the end of sewer services shall be given to the plug and be located from the side property line or by station and offset. For sewer service laterals, which include bends and off-sets that result in a service that is not totally perpendicular to the main, the location of all fittings between the sanitary tee and the plug (at the property line) shall be provided.

g. All wastewater service connections shall be measured from the downstream manhole. Each stub-out shall be accurately referenced to the center of the manhole, and the actual invert elevation of each end of the stub out shall be accurately recorded. For service connections not located perpendicular to the main, locate the end of the service from two property corners.

11. Potable Water, Wastewater Force Mains, and Reclaimed Mains:

a. The location of hydrants, valves, fittings, air valves casings, and points of connection to the existing system shall be referenced in two perpendicular directions.

b. Elevations on the main and finished grade shall be required at points of connection to the existing system, fittings (bends, valves, tees, plugs, etc.), 500-foot intervals, at high points, and where the standard depth of cover is not provided.

12. Wastewater Lift Stations:

a. Wet well size and location shall be indicated and located to property lines and/or right-of-way lines.

b. All lines within the pump station site shall be located to property lines and/or right-of-way lines.

c. Elevations shall be indicated at inverts, wet well top and bottom, and at ground adjacent to wet well. All types and sizes of lines and fittings shall be indicated.

d. All schedules that show pump, motor, and electrical data shall be corrected to show the as-built condition and submitted with the pump station Drawings.

e. As-built information should be provided for the lift station site plan. Within the pump station boundaries, the following shall be located horizontally: pump-out, water spigot and cross-connection control device, wet well, control panel, bends, fittings, manholes, generator and fuel tank (if applicable), transformer, irrigation system, fence, and auxiliary electrical enclosures, as applicable.

f. The Contractor shall provide a boundary survey of the lift station site showing above- and below-ground improvements. This survey shall be prepared by a Florida-licensed Land Surveyor in accordance with Chapter 472 of the Florida Statutes. The boundary survey shall be submitted with the Record Drawings.

g. All buried electrical conduit shall be labeled and located to property lines and/or right-of-way lines including electrical service from utility transformer to station meter and to control panel.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SUBMITTAL CHECKLIST FORM

Project Name:

Town Representative:

Engineer:

Contractor/Developer:

Date:

HARD COPY:

Submittals shall conform to all requirements in Section 1, General Provisions of the Town CSM. It shall be the responsibility of the Engineer, Developer, and/or Contractor to obtain and comply with all applicable federal, state, and local regulatory permits.

☐ One 22”x34” hard copy of the completed design plan set.

☐ If applicable, one hard copy (22”x34”) of the Draft Final Plan showing the approved utility easements, rights-of-way, street names, lot numbers, etc.

☐ One hard copy of a Master Plan for water, wastewater, reclaimed water, and/or stormwater prepared and submitted in accordance with Project Documents and Submittals of this section. Only required to be submitted by the Engineer/Developer for projects constructed in multiple phases.

ELECTRONIC COPY:

The following shall require one electronic copy to be submitted on a CD/DVD. Submission shall be delayed until the Town notifies the Engineer or Developer that the submittal package has been reviewed and is approved by the Town. All Construction Drawings shall be prepared in AutoCAD format. The version of AutoCAD used shall be compatible with the current version used by the Town at the time of submission.

☐ One electronic copy of the design plan set, capable of being printed as 11”x17” pages.

☐ One electronic copy of the Draft Final Plan showing the approved utility easements, rights-of-way, street names, lot numbers, etc.

☐ One electronic copy of a Master Plan for water, wastewater, reclaimed water, and/or stormwater prepared and submitted in accordance with Part 1.04, Project Documents and Submittals of this section. Only required to be submitted by the Engineer/Developer for projects constructed in multiple phases.

☐ Florida Department of Environmental Protection (FDEP) Wastewater Construction Permit Applications.

SUBMITTAL CHECKLIST FORM

Project Name:

Town Representative:

Engineer:

Contractor/Developer:

Date:

☐ FDEP Public Water System Construction Permit Applications.

☐ FDEP Stormwater Permit Applications.

☐ St. Johns River Water Management District Environmental Resource Permit Applications.

☐ If applicable, Florida Department of Transportation (FDOT) Utility Permit Applications.

☐ If applicable, Town of Howey-in-the-Hills Building Permit.

☐ If applicable, Town of Howey-in-the-Hills Demolition Permit.

☐ If applicable, Town of Howey-in-the-Hills Development Application.

☐ If applicable, Town of Howey-in-the-Hills Commercial Electric Service.

RECORD DRAWINGS

INFORMATION PROVIDED BY:	
Date:	
Name:	
Address	
Phone No:	
IN ACCORDANCE WITH CHAPTERS 471 AND 472 OF FLORIDA STATUTES AND CHAPTER 61G1523 OF THE FLORIDA BOARD OF PROFESSIONAL ENGINEERS, I HEREBY CERTIFY THAT THE:	
Chilled Water	Water Main
Pavement	Reclaimed Water Main
Curb & Gutter	Wastewater Force Main
Storm & Drainage System	Wastewater Gravity Sewer
Lake or Pond	Wastewater Lift Stations
Underdrain Connections	
ARE AT THE HORIZONTAL AND VERTICAL LOCATIONS AS SHOWN ON THESE "RECORD DRAWINGS."	
SIGNATURE:	
NAME:	
FLORIDA LICENSED PROFESSIONAL ENGINEER NO.:	

RECORD DRAWINGS

INFORMATION PROVIDED BY:	
Name:	
Address	
Phone No:	
I HEREBY CERTIFY THAT THE :	
Chilled Water	Water Main
Pavement	Reclaimed Water Main
Curb & Gutter	Wastewater Force Main
Storm & Drainage System	Wastewater Gravity Sewer
Lake or Pond	Wastewater Lift Stations
Underdrain Connections	
ARE AT THE HORIZONTAL AND VERTICAL LOCATIONS AS SHOWN ON THESE "RECORD DRAWINGS" AND MEET THE MINIMAL TECHNICAL STANDARDS SET FORTH BY THE FLORIDA BOARD OF PROFESSIONAL SURVEYOR'S AND MAPPERS IN CHAPTER 61G17-6, FLORIDA ADMINISTRATIVE CODE, PURSUANT TO SECTIONS 471 AND 472 OF FLORIDA STATUTES.	
DATE OF FIELD SURVEY	
SIGNATURE:	
NAME:	
FLORIDA-LICENSED LAND SURVEYOR'S NO.:	

SECTION 2
MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section covers methods of measurement and payment for items of work under this Contract.

1.02 MEASUREMENT AND PAYMENT

A. The total Contract Price shall cover all work required by the Contract Documents. All cost in connection with the proper and successful completion of the work, including furnishing all materials, equipment, tools, transportation, overhead, profit, insurance, taxes, and performing all necessary labor and supervision to fully complete the work, shall be included in the unit price and lump-sum bid prices. All work not specifically set forth as a pay item in the Bid Form or Bid Schedule shall be considered a subsidiary obligation of the Contractor and all costs in connection with these subsidiary obligations shall be included in the Bid(s) to provide a complete and functional Project. No additional compensation shall be considered, except for extensions of unit price quantities beyond those shown in the bid or for work classified as authorized supplemental work or change orders. Payment shall not be made for work considered incomplete or unsatisfactory by the Town.

B. Except where otherwise specified, the unit price or lump-sum price bid for each item of work which involves excavation, trenching, clearing, grubbing, or disposal of cleared and grubbed materials shall include all costs for such work. No direct payment shall be made for clearing, grubbing, disposal of cleared or grubbed materials, excavation, trenching, trench boxes, shoring or bracing, disposal of surplus excavated material, handling water (and groundwater), and purchasing and hauling of required fill material.

C. Lump Sum: For lump-sum items, payments shall be made to the Contractor in accordance with an accepted Progress Schedule of Values on the basis of actual work completed and accepted by the Town at the final acceptance of the Project.

D. Unit Price

1. For unit price items, payment shall be made based on the actual amount of work accepted by the Town and for the actual amount of materials in

place at the final acceptance of the Project, as confirmed by the final measurements.

2. After the work is completed and before final payment is made, the Town or Engineer of Record shall make final measurements, with all required assistance from the Contractor, to determine the quantities of various items of work accepted as the basis for the final unit price payment.

E. Payment for Increased or Decreased Quantities

1. When alterations in the quantities of unit price work not requiring a Change Order(s), as herein provided for, are ordered and performed, the Contractor shall accept payment in full at the Contract Unit Price multiplied by the actual quantities of work constructed and accepted by the Town at the completion of the project.

2. The actual percentage of each lump sum bid item completed by the Contractor and accepted by the Town at the final acceptance of the Project shall be paid to the Contractor.

F. Deleted Items: Should any items contained in the Bid Schedule(s) be found unnecessary for the proper completion of the work contracted, the Town or Engineer of Record may eliminate such items from the Contract. This action shall in no way invalidate the Contract and no financial allowance or compensating payment for anticipated profit, overhead, etc. shall be made for items so eliminated in making final payment to the Contractor.

G. Partial Payments: Partial payments may be made monthly as the work progresses. Partial payment shall be made subject to the provisions of the General and Supplementary Conditions.

H. Payments for Stored Material Delivered to the Project

1. When requested by the Contractor and at the discretion of the Town, payment may be made for all or part of the value of acceptable materials and equipment to be incorporated into bid items, which have not been used, and which have been delivered to the construction site or placed in storage places acceptable to the Town. The Contractor shall provide receipts for all stored material items requested for reimbursement which clearly identify the stored material item, where it is to be constructed, the unit cost of the item, as well as the total cost of the delivered item(s), the quantity of the item, the brand name of the item, and the supplier. Note that there are additional documentation requirements and storage

requirements within the Contract Documents that must also be met before the Contractor can be reimbursed for these stored materials.

2. No payment shall be made for fuels, supplies, installation or connection hardware, lumber, false work, or other similar materials or on temporary structures or other work (items) of any kind which are not a permanent part of the Contract. Items having a value of less than $2,500 shall not be compensated for as a stored material item.

I. Final Payment: If requested by the Town or Engineer of Record, the Contractor shall field verify all quantities in dispute by using visual observation, taped measurements, or other methods designated by the Town or Engineer of Record. The field verification shall be made in the presence of the Town or Engineer of Record and agreed to by both the Town or Engineer of Record and the Contractor. The Town or Engineer of Record shall prepare a final adjusting Change Order which shall adjust the final quantities of the project Bid Schedule to reflect the actual work accepted by the Town and for which the Contractor shall be compensated.

J. Schedule of Values: A schedule of values for the lump-sum bid items and some of the unit price bid items as required by the Town or Engineer of Record shall be submitted and accepted before the first pay request is approved by the Town or Engineer of Record. The schedule of values shall be based on the prices bid in the Bid Schedule(s). Prices bid in the Bid Schedule(s) cannot be changed in the schedule of values; they can only be broken down into more detail so that the Town can more accurately pay the Contractor for the completed work.

K. Pay Item Descriptions: The descriptions provided in the following paragraphs are to be used by the Bidder in preparing the Bid Schedule(s). They generally indicate how the major work scope items and their respective costs are to be separated into the line items listed in the Bid Schedule(s). These descriptions are neither fully representative nor all-inclusive of the work required to complete the project in accordance with the Contract Documents. It is the Bidder's responsibility to include all required costs within the most appropriate line item(s).

ITEM 1. SEWER PIPING

Measurement of new sewers for payment shall be the horizontal distance between manholes with no deduction made for those spaces occupied by manholes, tees, or other appurtenances. The depth of cut of sewers shall be measured from existing grade elevations along the center line of the pipe, taken on 50-foot stations, down to the sewer invert elevation. The depth of cut shall be divided into steps: first step – 2 to 4 feet, second step – 4 to 6 feet, and so on, at 2-foot intervals, unless otherwise specified in the Contract Documents. The method of measurement shall be the same for each of the specified pipe materials. Payment for sewers shall be at the unit price stated in the

Contract for the size and class of pipe, type of material, and depth of sewer actually installed, measured as previously specified. The unit prices set forth in the Contract shall constitute full compensation for excavation, native soil backfilling, dewatering, bedding, sheeting and shoring of trenches, placing and removing all traffic signs and barriers and maintaining traffic, furnishing, laying, jointing, and testing the sewers, plus all incidental work including all labor, materials, tools, and equipment. The unit price shall also include stoppers for all ends of pipe and fittings, and transition couplings.

ITEM 2. GRAVITY SEWER PIPING REMOVAL AND REPLACEMENT

Measurement of removal and replacement of sewers for payment shall be the horizontal distance between manholes with no deduction made for those spaces occupied by manholes, tees, or other appurtenances. The depth of cut of sewers shall be measured from existing grade elevations along the center line of the pipe, taken on 50-foot stations, down to the sewer invert elevation. The depth of cut shall be divided into steps: First step – 2 to 4 feet, second step – 4 to 6 feet, and so on, at 2-foot intervals, unless otherwise specified in the Contract Documents. The method of measurement shall be the same for each of the specified pipe materials. Payment for sewers removal and replacement shall be at the unit price stated in the Contract for the size and class of pipe, type of material, and depth of sewer actually installed, measured as previously specified. The unit prices set forth in the Contract shall constitute full compensation for excavation; native soil backfilling; dewatering; sheeting and shoring driven and pulled, and drag shields for trenches of all depths; placing and removing all traffic signs and barriers and maintaining traffic; as-builts; furnishing, laying, jointing, and testing the sewers; removal and disposal of the existing sewer pipe; stoppers for all ends of pipe and fittings; transition couplings; bypass pumping plus all incidental work including all labor, materials, tools, and equipment.

ITEM 3. ABANDONMENT OF PIPING BY SEALING

Payment for excavating and sealing ends of abandoned pipe shall be at the unit price set forth in the Contract Documents for each concrete seal actually installed as indicated on the Drawings or as directed by the Town or Engineer of Record. Payment shall be full compensation for removal of grassing; excavating; sealing; grout/mortar and brick; placing and removing all traffic signs and barriers; maintaining traffic; backfilling and compacting, as required, for a complete abandonment.

ITEM 4. ABANDONMENT OF PIPING BY PLUGGING

Payment for excavating and plugging ends of abandoned pipe and associated active mains with a plugged fitting shall be at the unit price set forth in the Contract Documents for each plug actually installed as indicated on the Drawings or as directed by the Town or Engineer of Record. Payment shall be full compensation for removal of grassing; excavating; plugging; placing and removing all traffic signs and barriers; maintaining traffic; backfilling and compacting, as required, for a complete abandonment. The cost associated with valve box and cover abandonment (for grass areas – removal and disposal and backfill of the box void areas; for paved areas – removal and disposal of cover and

grout filling valve box) shall not be paid for separately but shall be included in the cost of the associated main to be abandoned.

ITEM 5. ABANDONMENT OF PIPING BY GROUT FILLING

Payment for excavating and grout filling abandoned mains shall be at the per linear foot unit price as set forth in the Contract Documents. Payment for grout filling sewer laterals shall be included in the per foot price of grout filling gravity sewer main. Payment shall be compensation in full for removal of grassing; excavating as required; grout; grout filling; backfilling and compacting; placing and removing all traffic signs and barriers; maintaining traffic, as required, for a complete abandonment. The cost associated with valve box and cover abandonment (for grass areas – removal, disposal, and soil backfill of the box void areas; for paved areas – removal and disposal of cover and grout filling valve box) shall not be paid for separately but shall be included in the cost of the associated main to be abandoned.

ITEM 6. SEWER LATERAL PIPING

Measurement of sewer lateral pipe for payment shall be measured by the linear foot on a horizontal plane along the projection of the center line of the lateral pipe, from the center of the sewer main to the terminal point of the lateral pipe, unless specified otherwise in the Contract Documents. Payment for sewer lateral piping shall be at the per linear foot price stated in the Contract for the size, class, and type of pipe actually installed. The unit price set forth in the Contract shall constitute full compensation for excavation; native soil backfilling; dewatering; sheeting and shoring driven and pulled, and drag shields for trenches of all depths; placing and removing all traffic signs and barriers and maintaining traffic; as-builts; furnishing and installing the sewer lateral piping and fittings; electronic marker (if required); stoppers for future connections, plus all incidental work including all labor, materials, tools, and equipment.

ITEM 7. SEWER LATERAL PIPING REMOVAL AND REPLACEMENT

Measurement of sewer lateral pipe removal and replacement for payment shall be measured by the linear foot on a horizontal plane along the projection of the center line of the lateral pipe, from the center of the sewer main to the terminal point of the lateral pipe, unless specified otherwise in the Contract Documents. Payment for sewer lateral piping shall be at the per linear foot price stated in the Contract for the size, class, and type of pipe actually installed. The unit price set forth in the Contract shall constitute full compensation for excavation and native soil backfilling; dewatering; sheeting and shoring driven and pulled, and drag shields for trenches of all depths; placing and removing all traffic signs and barriers and maintaining traffic; record drawings; furnishing and installing the sewer lateral piping and fittings; stoppers for future connections pressure-treated wood markers (new development projects only) and electronic marker (if required). The unit price shall also be full compensation for locating existing lateral piping; the removal and disposal of the existing sewer lateral piping; locating existing yard piping and connecting to existing yard piping including PVC adapters plus all incidental work including all labor, materials, tools, and equipment.

ITEM 8. LATERAL CONNECTIONS AT SEWER MAIN

Payment shall be made for each sewer lateral connection furnished and installed at the Contract Unit Price for the type and size of the lateral connection actually installed as shown on the Contract Drawings. The unit prices set forth in the Contract shall constitute full compensation for excavation; native soil backfilling; de-watering; sheeting and shoring, driven and pulled; drag shields for trenches of all depths, and furnishing and installing lateral connections of all depths. Payment shall consist of the cost of the tee or saddle, over and above the price paid for pipeline length measured through the tee or saddle. The unit price shall also be full compensation for locating existing lateral piping and all incidental work including all labor, materials, tools and equipment.

ITEM 9. YARD PIPING SERVICE

Measurement of privately owned sewer service (yard piping) shall be in linear feet measured from the right-of-way line, through private property, to the connection point of the existing yard piping as indicated on the Drawings. Payment for yard piping shall be full compensation for excavation; backfilling; furnishing and installing piping; fittings; sleeves; adapters; landscape restoration; concrete and asphalt removal and replacement; clean outs; plugging existing yard piping; locating and connecting to existing yard piping; abandoning existing yard piping; notifying property owner and resident, and obtaining a plumbing permit. Payment shall be at the per linear foot unit price as set forth in the Contract measured, as previously specified.

ITEM 10. FURNISHING AND INSTALLING SEWER FORCE MAINS

The quantity to be paid for shall be the actual number of linear feet of each size, class, and type of pipe actually installed. Measurement shall be made along the horizontal projection of the center line of pipe. No deduction in length shall be made for the space occupied by valves or fittings. Payment for the work shall be at the Contract unit price shown for each respective item and shall be full compensation for the item of work completed, including all required removal of grassing; excavation; dewatering; native soil backfilling; laying and jointing pipe; pressure and leakage testing; potable water (if required); flushing (if required); furnishing and placing steel decking over excavations; all sheeting, shoring, and bracing required to maintain excavations in a safe condition; protecting existing structures, utilities, and property both public and private; placing and removing all traffic signs and barriers and maintaining traffic; record drawings; cleaning up the site; furnishing and installing locate wiring, locate wire test stations, locate wire related appurtenances, and locate wire testing; furnishing all material, labor, tools, and equipment, and all incidental and related work required to complete the work of the item. No additional payment shall be made for vertical deflection of the proposed pipeline to accommodate the installation (minimum required cover) of the gate valves, but all costs shall be merged with the associated line item in the Bid Form. Cost incurred by the Contractor to provide 2-inch fittings associated with any 2-inch pipe work shall not be paid for separately, but shall be included in the cost of furnishing and installing the 2-inch piping.

ITEM 11. FURNISHING AND INSTALLING RECLAIMED WATER PIPELINE

The quantity to be paid for shall be the actual number of linear feet of each size, type, and class of pipe actually installed. Measurement shall be made along the horizontal projection of the center line of pipe. No deduction in length shall be made for the space occupied by valves or fittings. Payment for the work shall be at the Contract unit price shown for each respective item and shall be full compensation for the item of work completed, including all required removal of grassing; excavation; dewatering; native soil backfilling; laying and jointing pipe; pressure and leakage testing; potable water (if required); furnishing and placing steel decking over excavations; all sheeting, shoring, and bracing required to maintain excavations in a safe condition; protecting existing structures, utilities and property both public and private; placing and removing all traffic signs and barriers and maintaining traffic; cleaning up the site; furnishing and installing locate wiring, locate wire test stations locate wire related appurtenances and locate wire testing; furnishing all material, labor, tools, and equipment; record drawings; and all incidental and related work required to complete the work of the item. No additional payment shall be made for vertical deflection of the proposed pipeline to accommodate the installation (minimum required cover) of gate valves, but all costs shall be merged with the associated line item in the Bid Form.

ITEM 12. FURNISHING AND INSTALLING PIPE CASING

The quantity to be paid for shall be the actual number of linear feet of each size casing and method of installation actually installed. Measurement shall be made along the horizontal projection of the center line of the casing. Payment for the work shall be made at the Contract Unit Price and shall be full compensation for the items of work, complete, including casing pipe; all casing spacers; pipe joint restraints and total restraining system required on the carrier pipe; locate wiring; excavation; dewatering; placing and removing all traffic signs and barriers and maintaining traffic; record drawings; and all incidental work required to complete the work including all materials, labor, tools and equipment.

ITEM 13. FURNISHING AND INSTALLING FITTINGS

The quantity to be paid for shall be the actual number of fittings furnished and installed. Payment for the work shall be made at the Contract Unit Price and shall be full compensation for the items of work including furnishing and installing fittings and mechanical restraints at fitting joint, complete and in place, with all necessary incidental work required to complete the work and all materials, labor, tools and equipment.

ITEM 14. FURNISHING AND INSTALLING POLYETHYLENE WRAP

The quantity to be paid for shall be in linear feet of polyethylene wrap actually installed. Measurement shall be made along the horizontal project of the center line of the pipe being wrapped including fittings and valves. Payment for the work shall be made at the Contract Unit Price and shall be full compensation for the items of work, complete, including all incidental work required to complete the work and all materials, labor, tools, and equipment.

ITEM 15. FURNISHING AND INSTALLING PIPE SUPPORTS

The quantity to be paid for shall be the actual number of supports furnished and installed. Payment for the work shall be made at the Contract Unit Price and shall be full compensation for the items of work, complete, including furnishing and installing supports, with all incidental work required to complete the work and all materials, labor, tools, and equipment.

ITEM 16. FURNISHING AND INSTALLING PIPE JOINT RESTRAINT

The quantity to be paid for shall be the actual number of bell restraints or ductile iron pipe (DIP) joint restraint gaskets (or Town-approved restraint device from pipe manufacturer), installed as indicated in the Town of Howey-in-the-Hills Restraint Joint Standard Detail, counted in full 20-foot segments extending from the fitting or for carrier piping bell restraints as required. Payment for the work shall be made at the Contract Unit Price and shall be full compensation for the items of work including furnishing and installing the bell restraint, or DIP joint restraint, complete, with all necessary incidental work required, including all materials, labor, and equipment. No payment shall be made for thrust restraints used for the Contractor's convenience in addition to the bell restraints called for in the Restraint Joint Schedules.

ITEM 17. FURNISHING AND INSTALLING THRUST COLLAR

If thrust collar (dead man) is used instead of bell restraints, tie rods to length indicated on the in the Town of Howey-in-the-Hills Restraint Joint Standard Detail on dead end pipelines, payment shall be for each thrust collar installed (by size of pipe).

ITEM 18. FURNISHING AND INSTALLING VALVES

The quantity to be paid shall be the actual number of units of each size and type valve furnished and installed. Payment for the work shall be made at the Contract Unit Price and shall be full compensation for the item of work including furnishing and installing the valve, complete, with all required excavation and backfill, necessary jointing, adapter pieces, blind flanges (if required), concrete supports (if applicable), mechanical restraints at valve; nuts, bolts, socket clamps, sleeves; valve box and cover, valve tags, valve keys, valve stem extension (if applicable), tracing wire, debris shield, placing and removing all traffic signs and barriers and maintaining traffic, furnishing all material, labor, tools, and equipment, flushing, performing hydrostatic and leakage testing, ground surface restoration, and all incidental and related work required to complete the item. For high-density polyethylene (HDPE) installations, payment shall also include mechanical or flange connection joint adapters and associated electro-fused couplings.

ITEM 19. FURNISHING AND INSTALLING TAPPING SLEEVES AND VALVES

The quantity to be paid for shall be the actual number of units of each size furnished and installed. Payment for the work shall be made at the Contract Unit Price for each respective item and shall be full compensation for the item of work, complete, with all necessary excavation and backfill; jointing; adapter pieces; concrete supports (if

applicable), mechanical restraints at valve; nuts, bolts, socket clamps, sleeves; valve box, valve box extension (if applicable) and valve box cover; debris shield; placing and removing all traffic signs and barriers and maintaining traffic; record drawings; furnishing all material, labor, tools, and equipment; performing flushing and hydrostatic and leakage testing, and all incidental and related work required to complete the item. For HDPE installations, payment shall also include mechanical or flange connection joint adapters and associated electro-fused couplings.

ITEM 20. FURNISHING AND INSTALLING VALVES OR FITTINGS IN EXISTING PIPELINES

The quantity to be paid shall be the actual number of each size and type valve or fitting furnished and installed. Payment for the work shall be made at the Contract Unit Price for each respective valve and shall be full compensation for the item of work, complete, including all required excavation; backfill; shutting down and de-watering the pipelines; bypass pumping; cutting openings in the pipelines to accept the new valve or fitting and removing, stockpiling, or otherwise disposing of the existing pipe section or existing valve or fitting removed; furnishing and installing the new valve or fitting; furnishing and installing all necessary pipe, couplings, sleeves, pipe adapters, concrete supports, mechanical restraints on valve or fitting, nuts, bolts, glands, socket clamps; furnishing and installing access box and cover; valve box extension (if applicable); furnishing all material, labor, tools, and equipment; and all incidental and related work required to complete the work of the item.

ITEM 21. FURNISHING AND INSTALLING AIR VALVES

The quantity to be paid shall be the actual number of air valve assemblies (as detailed) furnished and installed. Payment shall be made at the Contract Unit Price for each air valve assembly in manhole (and not in manhole) and shall be full compensation for the item of work, complete, including all excavation; backfill; tapping or cutting opening in pipelines; furnishing and installing air valve with all required appurtenances, manhole with specialty liner, frame and cover or aluminum door, all piping fittings and valves (gate, corp. stops, etc.) between air valve and main, saddle, sleeve, or tee fitting in main, all material, labor, tools, and equipment, and all incidental and related work to complete the air valve assembly and associated piping between the air valve and the main.

ITEM 22. MANHOLES

Manholes shall be paid per foot of depth at the respective manhole diameter unit price. The price shall include the cost of necessary excavation, backfill, table and invert, castings, steps, frames, and covers, testing and incidental work required for satisfactory installation of the manhole. Depth of Manholes shall be paid for at the unit price per foot measured from the invert at the center of manhole to the bottom of the frame, and shall include the cost of necessary excavation and incidental work necessary of complete installation of manholes.

ITEM 23. INSIDE MANHOLE DROPS
Shall be paid for at the unit price for each drop manhole. The price shall include the cost of the manhole pipe, fittings, and straps.

ITEM 24. TIE-INS
Tie-ins to existing manholes shall be paid per occurrence and include all work necessary to excavate, break into existing manhole, rebuild invert, re-grout manhole walls, and other incidental work necessary for satisfactory connection to the existing system.

ITEM 25. SUBMERSIBLE SEWAGE PUMPING STATIONS
The Contractor's lump sum bid shall constitute full compensation for the work necessary for satisfactory completion of pump station as shown on the Contract Drawings, including, but not limited to, wet well, pumps, standby power generator if applicable, piping, electrical and controls, security fencing of the construction area, tree removal, clearing and grubbing as required, grassing of disturbed areas, reinforced concrete driveway and site slab, all electrical conduit and service conductor to the service pole unless other established/indicated boundary is indicated. Lump sum price includes the work and improvements inside the landscape zone and those items listed above which are outside the landscape zone (including driveway, sod work, underground, power conduit, water service and associated service piping, etc.).

ITEM 26. JACK-AND-BORE MOBILIZATION AND SETUP
Jack-and-bore mobilization and set up shall only be paid for 6-inch-diameter and larger carrier pipe. Only one Jack-and-Bore Mobilization and Setup Bid Unit Price shall be paid for each road crossing actually constructed. The Contractor shall furnish all labor, materials, equipment, and services necessary to complete the jack-and-bore mobilization and set up for the jack-and-bores as shown on the Drawings in accordance with the Contract Documents, including but not limited to mobilization, jacking pits as required on each side, dewatering, any temporary fencing, excavation, backfill, compaction, grading, testing, sodding/seeding.

ITEM 27. JACK-AND-BORE
The Contractor shall be paid for each linear foot of carrier casing installed complete. The Contractor shall furnish all labor, materials, equipment, and services necessary to complete the jack-and-bore crossings as shown on the Drawings in accordance with the Contract Documents, including but not limited to casing pipe, casing spacers, end seals, and installing carrier pipe in the casing.

ITEM 28. DIRECTIONAL DRILLING HDPE LINE
The quantity to be paid for shall be the actual number of linear feet of each size and class of pipe actually installed and tested complete. The Contractor shall furnish all labor, materials, equipment, and services for constructing and placing into operation the horizontal directional drill (HDD) installed as shown on the Drawings or as otherwise specified in accordance with the Contract Documents, including but not limited to bore

pits, pipe, bore, reaming, back-reaming, slurry, slurry relief holes, installing the pipe in the bore, connections, fittings and transition couplings, HDPE reducers, removing or avoiding obstructions in the path of the HDPE pipe, excavation, backfill, compaction, sodding/seeding, dirt drive restoration, testing, and all associated appurtenances. Concrete, asphalt, or limestone repairs required for the HDD installation shall be paid under their corresponding Bid Unit Price items.

ITEM 29. ASPHALT CONCRETE RESTORATION

The Contractor shall be paid for each square yard of asphalt concrete restoration installed complete as measured in place. The Contractor shall furnish all labor, materials, equipment, and services for constructing the asphalt restorations as shown on the Drawings in accordance with the Contract Documents, including but not limited to removing and disposing of existing asphalt, surface preparation, earth work, grading, fill, backfill, prime and tack coats, leveling (where required), asphalt pavement, striping, marking, reflectors, and related appurtenances to the satisfaction of the Town and permitting agencies. Trench width shall be paid according to the Specifications and detail widths.

ITEM 30. MILLING ROADWAY

The Contractor shall be paid for each square yard milled complete as agreed in writing before the work shall begin. The Contractor shall furnish all labor, materials, equipment, and services for milling the existing asphalt roadway surface as shown on the Drawings in accordance with the Contract Documents and as directed in writing by the Town or Engineer of Record, including but not limited to milling or grinding of the road surface to a minimum depth of 1 inch or as shown on the Drawings, removing and disposing of existing asphalt, surface preparation, sweeping, and related appurtenances, all maintenance of traffic (MOT) plan and Florida Department of Transportation (FDOT) permit requirements, flagmen, jersey concrete barriers, signage, temporary facilities, and local notifications to the satisfaction of the permitting agencies. Asphalt areas or paved areas that are removed for pipe installation shall not be paid for milling.

ITEM 31. ASPHALT CONCRETE OVERLAY

The Contractor shall be paid for each square yard of asphalt concrete overlay installed complete. The Contractor shall furnish all labor, materials, equipment, and services for constructing the asphalt overlay as shown on the Drawings in accordance with the Contract Documents and as directed in writing by the Town or Engineer of Record, including but not limited to surface preparation, temporary pavement, prime and tack coats, leveling (where required), asphalt pavement, base course, stabilization, any MOT plan and FDOT permit requirements, flagmen, jersey concrete barriers, signage, temporary facilities, local notifications, concrete paving, excavation, backfill, compaction, striping, marking, reflectors, and related appurtenances, to the satisfaction of the Town and permitting agencies.

ITEM 32. CONCRETE RESTORATION

The Contractor shall be paid for each square yard of concrete restoration installed complete. Curbing shall be paid 1 square yard (SY) for each 3 linear feet (LF) repaired. The Town shall not pay for curbing or sidewalk that the Contractor could have saved using reasonable care and precautions. The Contractor shall furnish all labor, materials, equipment, and services for constructing the concrete pavement, pavers, brick pavement, sidewalks, and curbing restorations as shown on the Drawings in accordance with the Contract Documents, including but not limited to removing and disposing of existing materials, surface preparation, earthwork, grading, fill, backfill, reinforcement, concrete, pavers, brick, testing, and all associated appurtenances. The Contractor shall match the existing grade, thickness, reinforcing, and finishes.

ITEM 33. RECORD DRAWINGS

Once the Record Drawings have been determined to be complete according to the Specification requirements, the entire unit price shall be paid to the Contractor. The Contractor shall furnish all labor, materials, equipment, and services for composing and providing Record Drawings in accordance with the Contract Documents, including but not limited to updating the electronic copy of the Drawings, identifying items that were revised during the project or addenda, having all Drawings signed and sealed by a Florida-certified Professional Engineer or land surveyor, and providing signed and sealed paper copies of the Record Drawings.

ITEM 34. GRANULAR BACKFILL

The quantity of granular material and AASHTO A-3 soil used for backfill (including bedding) below and/or above the normal grade measured for payment shall be the same as the number of cubic yards of unsuitable material ordered removed. Computation shall be based on applicable trench sections as specified below. Length shall be equal to the horizontal distance between vertical planes representing the average ends of the granular materials as placed in the trench, or to pay line limits of an intermediate structure as shown on the Contract Drawings or as required and to a depth equal to the average depth of the unsuitable material removed. Computation shall be based on computed volume of unsuitable material ordered removed, less the volume associated with any utility mains over 12 inches in diameter. Native material suitable for use as backfill shall be separated from unsuitable material and stockpiled for use on the Project. No measurement for payment shall be made outside of the pay line width. Actual trench dimensions less than defined as maximum herein, shall be used when applicable. Unless approved otherwise by the Town or Engineer of Record, the quantity calculation for granular material and A-3 soil used for the roadway construction (sub-base, and base) shall be excluded (temporary and/or permanent use) from this pay item.

a. For excavations 5 feet or less in depth and pipe diameters of 4 inches and greater shall be based on vertical side walls, maximum trench width of 3 feet for pipe diameters up to 12 inches. For pipe diameters larger than 12 inches, trench width shall be the pipe diameter plus 2 feet, in 6-inch

increments. Trench width for pipe diameters smaller than 4 inches shall be 2 feet with vertical side walls.

b. Excavations greater than 5 feet in depth, where no trench box or other protection is used, shall be based on a trench bottom width equal to the pipe diameter plus 2 feet, in 6-inch increments, minimum width shall be 3 feet. Trench side walls shall be vertical from the trench bottom to a height of 5 feet. Remaining trench wall shall be sloped to grade 1 to 1.5, vertical to horizontal.

c. Excavations greater than 5 feet in depth and using a trench box shall have a maximum trench box width of 8 feet. Trench side walls shall be vertical from the trench bottom to a height of 5 feet, or top of trench box, whichever is greater. The remaining trench wall shall be sloped to a grade of 1 to 1.5, vertical to horizontal.

d. When roadway replacement is indicated, unsuitable fill material replacement measurement for roadway bedding shall be made for a cross-section 2 feet below the sub-grade and extending to 1 foot beyond outside edge of pavement or curbing. Applicable trench section widths, as specified herein, shall be measured below the roadway bedding.

e. Maximum measurement for unsuitable fill material disposal and replacement for structures shall be based on an excavation extending 3 feet from the outside wall or bottom slab projection of the structure. Unprotected excavation walls shall be vertical from the bottom of the structure to a height of 5 feet. Remaining trench wall shall be sloped to grade 1 to 1.5, vertical to horizontal.

f. Granular material used to backfill unauthorized excavation or for any temporary drainage proposed shall not be measured for payment.

g. The unit price per cubic yard as set forth in the Contract for AASHTO Class A-3 soil used as backfill shall constitute full compensation for removal from the job site and disposal of all unsuitable material and furnishing, placing and compacting backfill as specified herein. The cost of excavation of unsuitable backfill and dewatering shall be included with the regular cost of pipe installation.

ITEM 35. FLOWABLE BACKFILL

Flowable fill in accordance with FDOT Index 307 shall be used as backfill as noted on the Drawings or in accordance to FDOT permit conditions, and shall be paid for at the unit price allowed in the Bid Form for flowable fill. Flowable fill shall be measured in cubic yards. Flowable fill used to backfill in areas unauthorized by the Town shall not be

measured for payment. The unit price per cubic yard as allowed in the Bid Form for flowable fill used as backfill shall constitute full compensation for removal and disposal of material from the project site, and includes furnishing and installing flowable fill, complete with temporary backfill and steel plates covering the trench. The maximum quantity of flowable fill used for backfill for utilities shall be computed based on the limits as shown on the Drawings or, if no limits noted, on the trench configuration outlined in the Measurement and Payment Item 34, Granular Backfill, less the volume associated with any utility mains.

ITEM 36. GRASSING

The unit price per square yard as set forth in the Contract Documents for sodding, sprigging, or seeding and mulching shall constitute full compensation for furnishing and installing, fertilizing and maintaining, the sodding, sprigging, or seeding and mulching. If a planted area must be replanted due to the Contractor's negligence, excessive amount of damage for type of construction, or failure to provide routine maintenance of the area, such replacement shall be at the Contractor's expense.

ITEM 37. EXISTING PAVEMENT – ASPHALT OVERLAY

Measurement shall be made for the actual square yards of asphalt overlay installed (minimum of 1 inch final overlay thickness). Payment shall be made for the actual square yards of asphalt installed and shall be full compensation for the asphalt paving installed complete including all temporary and permanent pavement markings; placing and removing all traffic signs and barriers; MOT; cleaning up the site and furnish all labor, material, and equipment. Required thickness of asphalt shall be 1 inch final overlay thickness (minimum) unless noted otherwise on the Contract Documents or Drawings.

ITEM 38. EXISTING PAVEMENT – MILLING AND RESURFACING

Milling and resurfacing of asphalt surfaces shall be performed with prior approval of the Town, and in accordance with the Town of Howey-in-the-Hills Standards or the FDOT Standard Specifications and Details. Measurement shall be the amount of square yards to be milled and resurfaced within the limits shown on the Drawings. Payment shall be for the actual number of square yards of asphalt surface that is milled and replaced with new asphalt mix (1 inch minimum thickness) including all temporary and permanent pavement markings (MOT), markers, signing, delineators, buttons, stripe, placing and removing all traffic signs and barriers, maintenance of traffic, clean up at the site, and furnishing all labor, material, and equipment.

ITEM 39. REMOVAL OF SIDEWALK

Payment for the removal of sidewalk shall be at the square yard unit price set forth in the Contract Documents and shall include and be full compensation for complete removal and disposal of sidewalk, including handicap ramps, placing and removing all traffic signs and barriers and maintaining traffic. Payment for sidewalk removal shall be the actual square yards of sidewalk removed with a maximum corresponding to the nearest construction joint unless indicated otherwise.

ITEM 40. REMOVAL OF DRIVEWAY

Payment for the removal of driveway shall be at the square yard unit price set forth in the Contract Documents for either asphalt or concrete driveway removal. Payment shall include and be full compensation for complete removal and disposal of driveway including placing and removing all traffic signs and barriers and maintaining traffic. Payment for driveway removal shall be the actual square yards of driveway removed with a maximum corresponding to the nearest construction joint unless indicated otherwise.

ITEM 41. REMOVAL OF CURB AND GUTTER

Payment for the removal of curb and gutter shall be at the linear foot unit price set forth in the Contract Documents and shall include and be full compensation for complete removal and disposal of curb and gutter including placing and removing all traffic signs and barriers and maintaining traffic. Payment for curb and gutter removal shall be the actual linear feet of curb and gutter removed with a maximum corresponding to the nearest construction joint unless indicated otherwise.

ITEM 42. INSTALLATION OF SIDEWALK

Payment for the installation of sidewalk (including handicap ramps) shall be at the square yard unit price set forth in the Contract Documents and shall include preparation and construction of new sidewalk including forming and vibrating (if required), placing and removing all traffic signs and barriers and maintaining traffic. Payment for the sidewalk shall be the actual square yards of sidewalk installed with a maximum corresponding to the nearest construction joint unless indicated otherwise. Sidewalk installation shall include handicap ramps. No separate pay item for construction of handicap ramps. No payment shall be made for sidewalk through concrete driveways.

ITEM 43. INSTALLATION OF DRIVEWAYS

Payment for the installation of driveways shall be at the square yard unit price set forth in the Contract Documents for the type of driveway to be installed. If directed by the Town or Engineer of Record, the Contractor shall furnish and install a concrete apron for all existing dirt and aggregate driveways. Payment shall include preparation and construction of driveway including forming and vibrating (if required), placing and removing all traffic signs and barriers and maintaining traffic. Payment for driveway shall be the actual square yards of each type of driveway installed with a maximum corresponding to the nearest construction joint unless indicated otherwise or as directed by the Town or Engineer of Record.

ITEM 44. INSTALLATION OF CURB AND GUTTER

Payment for the installation of curb and gutter shall be at the linear foot unit price set forth in the Contract Documents for the type of curb and gutter to be installed. Payment shall include preparation and construction of curb and gutter including forming and vibrating (if required), placing and removing all traffic signs and barriers, and maintaining traffic. Payment for curb and gutter shall be the actual linear feet of each

type of curb and gutter installed with a maximum corresponding to the nearest construction joint unless indicated otherwise.

ITEM 45. FENCING

Payment shall include removal and disposal of existing fencing system (if applicable); the furnishing, preparation, and installation of new fence and gates as required in the Contract Documents. Payment for fencing shall be the actual linear feet of each size and type of fencing installed as indicated on the Contract Documents. Payments for gates shall be at the unit price for each size and type actually installed as indicated on the Contract Documents.

ITEM 46. CONNECTION TO EXISTING SEWAGE MANHOLE

Payment for standard connections, drop connections, service lateral connections, and force main connections to existing manholes shall be at the unit price set forth in the Contract Documents for the size and type of connection. The unit price shall constitute compensation in full for each connection actually furnished and installed including excavation; native soil backfill; compaction; coring; piping; fittings; rubber boot or sand sleeve; grouting and repair to existing manhole wall section; placing and removing all traffic signs and barriers and maintaining traffic plus all incidental work including all labor, materials, tools, and equipment.

ITEM 47. GENERATOR AND ELECTRICAL FACILITIES

The Contractor shall furnish all labor, materials, equipment, and services for constructing and placing into operation the generator, automatic transfer switch, fuel tank, transformers, electrical power service, electrical shown on the Drawings in accordance with the Contract Documents, including but not limited to all electrical wires, conduit, duct banks, instrumentation, SCADA system, telemetry path study (if applicable), site lighting, controls, testing, and related appurtenances. The Contractor shall be paid by the lump sum for the generator and electrical facilities installed complete.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 3
UTILITIES DIGITAL AND CAD REQUIREMENTS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Electronic files are shared and referenced by many departments and must satisfy various needs. The electronic files must be available in formats that all parties can utilize. Therefore, digital requirements have been established. The Town of Howey-in-the-Hills Digital Requirements outlines the required standards, conventions, and formats necessary to be followed with submittals.

1.02 ELECTRONIC SUBMITTALS

A. Initial Submittal: Electronic data must be submitted on a CD/DVD. The entire submittal package and engineering drawings must be provided as .TIFF or .PDF formats with resolution of 300 DPI (dots per inch) or higher. The electronic data submitted must be identical to the hard copy provided. Other digitally formatted documents relevant to the projects (i.e., Word.doc, Excel.xls, PowerPoint.ppt) may be included. Each CD/DVD shall be clearly labeled with the appropriate project number, project location, client name, date, and file names included on each CD/DVD. If files are compressed, a description of the compression software must be included along with a copy of the appropriate uncompressing software.

B. Final Submittal: Electronic data must be submitted on a CD/DVD. The entire submittal package and engineering drawings must be provided as .TIFF or .PDF formats with resolution of 300 DPI (dots per inch) or higher. Engineering drawings must include all MSCAD drawings (.dgn, .dwg, .dxf, etc.) or GIS files (.shp, .gdb, etc.) and meet the requirements detailed below. Each CD shall be clearly labeled "Final Submittal" with the appropriate project number, project location, client name, date, and file names included on each CD/DVD. If files are compressed, a description of the compression software must be included along with a copy of the appropriate uncompressing software.

C. The project will not be issued a final development order until all of the AutoCAD or GIS information is correct and complete.

1.03 AUTOCAD REQUIREMENTS

A. Any Drawing submitted shall be AutoCAD format compatible with the Town's latest version. No other AutoCAD software or format will be accepted. It is the

submitter's sole responsibility to ensure that the Record Drawings conform to the following AutoCAD requirements:

1. One set of hard copy Drawings signed and sealed by Florida-registered Professional Engineer shall be submitted to the Town as well as digital AutoCAD (Town's latest version) and a potable digital file (*.pdf) format on a CD/DVD.

2. All Drawings must be submitted in accordance with the following:

    a. Projection: Transverse Mercator
    b. Coordinate System: State Plane Florida East (Feet)
    c. Datum: NAD 1983
    d. Spheroid: GRS 80
    e. Units: US Feet
    f. Model Space Scale: 1:1
    g. Layout Per Tab: 1
    h. Nomenclature: Each drawings file must be titled to match its content (e.g. base.dwg, stormwater.dwg, sanitary.dwg, water.dwg, soils.dwg, topography.dwg, etc.)
    i. Layer Colors:

Description	**Color**	**AutoCAD Color Index Number**
Potable and Raw Water Piping	Blue	5
Meter (Potable Water)	Blue	5
Valve (Potable Water)	Blue	5
Reclaimed Water Piping	Violet	6
Meter (Reclaim)	Violet	6
Valve (Reclaim)	Violet	6
Force Main and Sanitary Sewer Piping	Green	3
Manhole (Sanitary)	Green	3
Valve (Wastewater)	Green	3
Pump/Lift Station	Cyan	4
Stormwater Piping	Yellow	2
Manhole (Stormwater)	Yellow	2
Fire Hydrant	Red	1

3. Drawings shall include Cover sheet, Drawing Index, and all Town CSM or references thereto. Special fonts, custom shape files, or custom graphic files shall be included in the AutoCAD files or included as a separate x-ref on the CD/DVD submitted. Feature information shall be clearly labeled including, but not limited to, pipe size, material, and depth.

4. Layouts and Title Blocks in model space will not be accepted

1.04 GIS REQUIREMENTS

A. Any files submitted in Geographical Information System (GIS) shall be ESRI shape file (.shp) or geodatabase (.gdb). The Town will provide the Town's current GIS schema for consultants to update or populate. All GIS data edits will be tracked in the Edited by and Created by fields provided in the schema.

B. The topology of these files will be free of errors. Data will be free of undershoots, overshoots, overlaps and sliver polygons unless necessary to describe the specific spatial data. Depending on the features being worked on the Town may have more specific rules and criteria to follow.

C. All feature classes must be submitted in accordance with the following:

1. NAD_1983_StatePlane_Florida_East_FIPS_0901_Feet.
2. WKID: 2236 Authority: EPSG.
3. Projection: Transverse Mercator.
4. Coordinate System: State Plane Florida East (Feet)
5. Datum: NAD 1983.
6. Spheroid: GRS 80.
7. Units: US Feet.
8. Elevation: NAVD 88 Feet.

D. Points, lines, and polygons will have a single unique user-ID number.

E. All GIS features will include metadata.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 4
RIGHTS-OF-WAY AND EASEMENTS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section covers the requirements and work pertaining to the rights-of-way and easements necessary for the construction of the project.

1.02 WORK ON RIGHTS-OF-WAY AND EASEMENTS

A. The Town will obtain all land and rights-of-way necessary for all work under this contract. If all land and rights-of-way are not obtained before construction begins, the Contractor shall start work only upon such land and rights-of-way previously obtained by the Town, and no claims for damages will be allowed because of such delay. If the Town is unable, for any reason, to obtain the land and rights-of-way necessary for the work, the contract time will be extended as required to cover the time lost by such delay. The Contractor shall secure copies of all applicable right-of-way plats to be kept at the job site during construction.

B. The Contractor shall confine his construction operations to the immediate vicinity of the location shown on the Drawings and in no case shall the Contractor encroach beyond the limits of the Town's property or rights-of-way. The exact location of the rights-of-way limits shall be shown on the rights-of-way plats which will be furnished to the Contractor. The Contractor shall place materials, equipment, supplies, etc., so as to cause the least possible damage to property and interference with traffic. His method of operation and placing of equipment shall be subject to the approval of the Engineer of Record. Any damage done to property outside the rights-of-way limits shall be the financial responsibility of the Contractor. Any vehicular access to right-of-way which crosses private property shall be by written permission of the property owner with copy of same provided to the Town Inspector.

C. It shall be the duty of the Contractor to locate the limits of the rights-of-way, or property lines, before beginning construction. The Contractor shall be solely responsible for any damage to trees, crops, or other property outside the boundaries of the rights-of-way and shall make satisfactory settlement for any damage directly with the property owner involved.

D. Clearing and Grubbing. The Contractor shall consult with the Town and Engineer of Record before beginning clearing and a full understanding is to be reached as to procedure. The Contractor shall then conduct clearing and grubbing operations

in strict accordance with these agreements, the specifications herein and Specification Section 5, Temporary and Permanent Erosion and Sedimentation Control.

1. Clearing and grubbing along pipelines shall be done before pipe installation. Where a temporary construction easement is obtained, clearing shall be limited to that which is absolutely necessary for construction of the project. The entire permanent right-of-way shall be cleared and grubbed, unless otherwise noted. All timber cut shall be completely removed and disposed of by the Contractor within 10 days, unless otherwise noted on the Drawings.

2. Grubbing of stumps shall be done in any convenient manner satisfactory to the Engineer of Record and which will not cause damage to the remaining trees or adjacent property. No burying of construction debris will be allowed in right-of-way limits. If burying is done outside right-of-way limits, written permission from the property owner must be obtained.

3. Minor structures within rights-of-way limits shall be removed and disposed of as directed by the Engineer of Record. Fences shall be removed as required by construction and replaced to property owners' satisfaction with materials as good as or better than that which was removed. Temporary fencing, as required, shall be installed to property owners' satisfaction until permanent fencing can be erected.

4. Burning of cleared material shall be accomplished in strict compliance with all applicable Local, State, and Federal regulations pertaining to open burning and smoke abatement. The Contractor shall contact the local Fire Department for a burning permit.

1.03 WORK ON STATE AND COUNTY HIGHWAYS OR ROADS, TOWN OR TOWN ROADS OR STREETS, RAILROAD, AND OTHER UTILITY RIGHTS-OF-WAY

A. The Contractor shall not begin excavation, grading, fill, storm drainage, paving, and any other construction or installations on any property or in any right-of-way of streets, highways, public carrier lines, utility lines (either aerial, surface, or subsurface), etc., until the necessary permits are secured. The Contractor shall conform to all requirements of the authorities having jurisdiction and to the applicable requirements of the specifications. The Contractor shall make all necessary arrangements with the proper authorities, including approval of construction methods, etc., and shall pay all costs charged in connection with work. The Contractor shall notify the Florida Department of Transportation (FDOT) at least 48 hours in advance of any work performed on State roads and

shall notify Lake County at least 24 hours in advance of any work performed on County roads in accordance with the respective permits.

B. The Contractor shall provide full time flagmen, with appropriate red flags, at all times when work is in progress along highways. Suitable warning and descriptive signs shall be placed at each end of the working area while work is in progress along highways. These signs shall be well tended, and shall be placed at sufficient distances from the work so that ample warning is given to approaching traffic. Signs shall be adequately lighted at night. During construction, all safety regulations of the FDOT shall be observed and the Contractor must take measures, including placing and the display of safety devices that may be necessary in order to safely conduct the public through the project area in accordance with the Federal Manual on Uniform Traffic Control Devices (MUTCD), as amended for highways, the requirements of the Standard Application Package for railways, including flagging services and Railroad Protective Insurance or acceptable alternative, when applicable, and the FDOT's Design Standards, Indexes 600-670, and Standard Specifications for Road and Bridge Construction, Section 102, as amended by the Utility Accommodation Manual (UAM). When the Contractor deems it necessary to conduct traffic control activities and methods significantly different from those addressed in the above references, the Contractor must submit to the Town an alternative plan signed and sealed by a licensed Florida Professional Engineer qualified to develop a Traffic Control Plan in accordance with the provisions of Chapter 8 of the UAM and the plan must be approved by the state (FDOT) or local entity (Town or County) before implementation.

C. Where pipe is installed in open cut across a highway, the cut shall be immediately backfilled and all work of repairing the pavement completed within the same week that it is cut. The Contractor shall keep at least one full lane open for traffic at all times. Any subsequent settlement shall be immediately corrected and repaired.

D. Where a pipeline crossing under a highway is installed within casing pipe, the casing pipe shall be provided as specified in Section 9, Boring, Jacking, and Tunneling.

E. Unless otherwise indicated, no excavated material shall be placed on the pavement side of the ditch along highways. The least possible amount of ditch shall be left open when work is not in progress, and equipment shall be removed from the pavement and shoulders during shutdown periods. Shoulders of roadways shall be left in good acceptable condition, and all disturbed topsoil and grass shall be replaced.

F. The Contractor shall not begin work on any property of any railroad until the Town has secured necessary permits. The Contractor shall conform to all requirements of the railroad, or its authorized representatives, in the construction of this portion of the work.

1. The Contractor shall also pay the cost of flagmen, inspections, or other expenses of the railroad in protecting rail or vehicular traffic. The Contractor shall notify the railroad of the time that the work will be done and shall not begin work until authorized by railroad officials.

1.04 RESTORATION OF RIGHT-OF-WAY

A. During construction, the Contractor shall maintain the site and adjacent public and private property, including streets and highways, free from accumulations of waste debris, rubbish, and dirt caused by his operations. Dry materials and rubbish shall be wet down as necessary to prevent blowing dust.

B. Immediately after completion of the work, or any substantial unit or portion of it, the Contractor shall remove all unused material, refuse, and dirt placed by him in the vicinity of the work and shall leave the premises in a neat and orderly condition, satisfactory to the Engineer of Record.

C. The right-of-way shall be restored to original or better condition. Horizontal benches shall be provided to facilitate access to the site and shall be located where directed by the Engineer of Record and the Town. Fill material, where required, shall be free of grass, roots, rock, and other objectionable material and shall be spread evenly and properly compacted. The entire right-of-way shall be graded, dressed off, and cleaned up to the satisfaction of the Engineer of Record, Town, and property owner, where applicable.

1. Where work is along streets or highways and dirt has been placed on the pavement, the pavement shall be swept clean of all dirt after backfill has been completed.

2. Site: The Contractor shall clean up behind the work as much as is reasonably possible as the work progresses, but in no case shall the pipe-laying operation be more than 1,000 feet ahead of complete cleanup. Upon completion of the work and before acceptance of the Final Payment for the project by the Town, the Contractor shall remove all his surplus and discarded materials, excavated material, and rubbish from the roadways, sidewalks, parking areas, lawns, and all adjacent property; shall restore, in an acceptable manner, all property, both public and private, which has been disturbed or damaged during the prosecution of

the work; and shall leave the whole site in a neat and presentable condition.

3. Except where specifically directed otherwise by the property owner, the entire construction right-of-way shall be provided with a permanent grass cover within 30 days after backfilling. Topsoil shall be replaced and seed planted or sod placed, fertilized, and watered until a grass cover satisfactory to the Engineer and property owner is obtained. If necessary, a temporary grass cover shall be provided until a permanent cover can be established. Grassing shall be as specified in Section 7, Grassing and Sodding. If required by the property owner, shrubbery shall be replaced to the satisfaction of the Engineer of Record and the property owner.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 5
TEMPORARY AND PERMANENT EROSION AND SEDIMENTATION CONTROL

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section does not stand alone and is incorporated as part of Town Construction Specification Manual (CSM). The CSM shall be used for other requirements that may not be covered in this Section.

B. The Contractor shall take every reasonable precaution throughout construction to prevent the erosion of soil and the sedimentation of streams, bays, storm systems, or other water impoundments, ground surfaces, or other property as required by Federal, State, and Local regulations. Within this Section various best management practices (BMPs) are presented with instructions for their use, however implementation according to this Section is no guarantee of success, nor shall it be a constraint to prevent the use of other more efficient or cost effective measures. Additional resources for BMPs include: The Florida Stormwater, Erosion, and Sedimentation control Inspector's Manual, and Florida Department of Transportation (FDOT) Standard Specifications.

C. The work shown on the approved Drawings shall be considered a minimum requirement. What is shown shall not relieve the Contractor of the responsibility to actively take all steps necessary to control soil erosion and sedimentation. The erosion and sedimentation control work includes, but is not limited to the following basic principles:

1. Conduct the earthwork and excavation activities in such a manner to fit the topography, soil type, and condition.

2. Minimize the disturbed area and the duration of exposure to erosion elements.

3. Stabilize disturbed areas immediately.

4. Safely convey run-off from the site to an outlet such that erosion shall not be increased off site.

5. Retain sediment on site that was generated on site.

6. Minimize encroachment upon watercourses.

D. Temporary Erosion and Sedimentation Control: In general, temporary erosion and sedimentation control procedures shall be directed toward:

1. Preventing soil erosion at the source.

2. Preventing silt and sediment from entering any waterway if soil erosion cannot be prevented.

3. Preventing silt and sediment from migrating downstream in the event it cannot be prevented from entering the waterway.

E. Permanent Erosion Control: Permanent erosion control measures shall be implemented to prevent sedimentation to the waterways and to prevent erosion to the Project site.

F. The latest FDOT standards shall apply if not specifically addressed in the Town's CSM and Details.

1.02 QUALITY ASSURANCE

A. General: Perform all work under this Section in accordance with all pertinent Federal, State, and Local rules and regulations.

B. Conflicts: Where provisions of pertinent rules and regulations conflict with these Specifications, the more stringent provisions shall govern.

C. The Contractor shall submit a written plan to the Town or Engineer of Record for both temporary and permanent grassing. The plan shall include selection of species, dates, and rates of application for seeding, fertilizing, and mulching and shall be in accordance with Section 7, Grassing and Sodding.

D. The Contractor shall create a regular inspection and maintenance program for all the BMPs implemented.

PART 2 PRODUCTS

2.01 MATERIALS

A. Silt fence shall be FDOT Index #102 filter fabric in accordance with Section 985 of the FDOT standard specifications, manufactured in accordance with the Appendix A, Approved Manufacturer List of the Town CSM, and supported by wood posts as shown in the Town of Howey-in-the-Hills Standard Details.

B. Floating turbidity barriers shall be in accordance with the Town CSM Details.

C. Netting shall be 1/2 inch, galvanized steel, chicken wire mesh.

D. Grass shall be in accordance with Section 7, Grassing and Sodding.

E. Mulch shall be straw, consisting of oats, rye, or wheat straw, or a Pangola, Peanut, or Bermuda. Mulch shall be free from undesirable weed and other undesirable grasses.

F. Lime shall be Dolomitic Agricultural Ground limestone, in accordance with FDOT Section 982.

G. Filter Fabric shall meet the requirements of FDOT Section 985.

H. Rock bags shall be placed as shown in the Drawings, or as directed by the Town or Town's Representative. Use a fabric material with openings that are clearly visible to minimize clogging yet small enough to prevent rock loss. Use material of sufficient strength to allow removing and relocating bags without breakage. The bag size when filled with rocks shall be approximately 12 by 12 by 4 inches. Use No. 4 or No. 5 coarse aggregate rock.

I. Plywood shall be 3/4 inch thick exterior type.

PART 3 EXECUTION

3.01 INSTALLATION

A. General

1. Permanent erosion and sediment control measures shall be installed and maintained at the earliest practical time consistent with good constructions practices. One of the first construction activities should be the placement of permanent and temporary erosion and sediment control measures around the perimeter of the project or the initial work area to protect the project, adjacent properties, and water resources.

2. Temporary erosion and sediment control measures shall be coordinated with permanent measures to assure economical, effective, and continuous control through the construction phase. Temporary measures shall not be constructed for expediency in lieu of permanent measures. Temporary measures shall be regularly maintained by the Contractor. After rainfall events, the Contractor shall inspect and repair any damage caused during such rainfall event.

3. Construct any stormwater systems required before any building or road construction is started. Protect stormwater system from silting and debris. Protect swale bottom from sealing by excavating all silt deposits during construction and before seeding, mulching, and sodding is finished.

4. Avoid dumping soil or sediment into any stream bed, pond, ditch, or watercourse.

5. Maintain an undisturbed vegetative buffer where possible between a natural watercourse and trenching and grading operations.

6. Avoid equipment crossings of streams, creeks, and ditches where practicable.

7. Clearing: The Contractor shall schedule and perform clearing and grubbing in such a manner that subsequent grading operation and erosion control practices can follow immediately thereafter. Excavation, borrow, and embankment operations shall be conducted as a continuous operation. All construction areas not otherwise protected shall be planted with permanent vegetative cover within 30 working days after completion of active construction.

8. Stabilizing: The angle for graded slopes and fills shall be no greater than the angle that can be retained by vegetative cover or other adequate erosion-control devices or structures. All disturbed areas outside of embankment left exposed shall, within 30 working days of completion of any phase of grading, be planted or otherwise provided with either temporary or permanent ground cover, devices, or structures sufficient to restrain erosion.

9. If any earthwork is to be suspended for any reason for longer than 30 calendar days, the areas involved shall be seeded with vegetative cover or otherwise protected against excessive erosion during the suspension period. Suspension of work in any area of operation does not relieve the Contractor of the responsibility for the control of erosion in that area.

B. Temporary Erosion and Sedimentation Control

1. Temporary erosion and sedimentation control devices shall be installed and maintained from the initial land disturbance activity until the satisfactory completion and establishment of permanent erosion control measures. At that time, temporary devices shall be removed.

2. Temporary erosion and sedimentation control procedures should be initially directed toward preventing silt and sediment from entering waterbodies.

3. The Contractor shall maintain an undisturbed natural buffer, extending a minimal 5 feet from the top of the bank of a waterbody, to filter the runoff. Should this buffer prove infeasible due to construction activities being too close to the creek, or if the amount of sediment overwhelms the buffer, the Contractor shall place silt fences to filter the run-off and, if necessary, take additional measures to stabilize the waterbody banks. When excavation activities disturb the previously stated preventative measures, or if they are not maintained, or whenever the construction activities cross the waterbodies, check dams shall be installed downstream and within 200 feet of the affected area.

4. Filter fabric or other approved methods shall be placed and secured over the grates of each existing inlet, grating, or storm pipe opening near the area of excavation to prevent silt and debris from entering the storm systems.

5. The Contractor shall use silt fences and floating turbidity barriers as shown on the Drawings or as directed by the Town or Engineer of Record, or as required to restrict movement of sediment from the site.

6. The Contractor shall establish vegetative cover on all unpaved areas disturbed by the work in accordance to Section 7, Grassing and Sodding.

7. The Contractor shall use mulch for temporary stabilization of areas subject to excessive erosion and for protection of seed beds after planting where required.

C. Permanent Erosion Control: Permanent erosion control shall include:

1. Permanent erosion control measures shall be implemented as soon as practical after the completion of pipe installation or land disturbance for each segment of the Project. In no event shall implementation be postponed when no further activities related to pipe installation shall impact that portion or segment of the Project. Partial payment requests may be withheld for those portions of the Project not complying with this requirement.

2. Restoring the work site to its original contours, unless shown otherwise on the Drawings or directed by the Town or Engineer of Record.

3. Permanent vegetative cover shall be performed in accordance with Section 7, Grassing and Sodding.

3.02 MAINTENANCE AND REMOVAL

A. The Contractor shall maintain all temporary and permanent erosion-control measures in functioning order. Silt dams, silt fences, traps, barriers, check dams, appurtenances, and other temporary measures and devices shall be maintained until no longer needed, and shall then be removed. Dislodged filter stone shall be replaced with new materials. Detention ponds, if constructed, shall be maintained in a condition ensuring that unfiltered water shall not leave the pond. Grassed areas shall be maintained until completion of the project. Areas which fail to show a suitable stand of grass or which are damaged by erosion shall be immediately repaired. No additional payment shall be made to the Contractor for the re-establishment of erosion-control devices, which may become damaged, destroyed, or otherwise rendered unsuitable for their intended function during the construction of the project.

B. The Contractor shall remove all silt, sediment, and debris buildup regularly to maintain functioning storm systems and erosion-control devices.

C. All erosion and sedimentation control devices, including check dams, shall be inspected by the Contractor at least weekly and after each rainfall occurrence and cleaned out and repaired by the Contractor as necessary.

D. Material from sediment traps shall not be stockpiled or disposed of in a manner which makes them readily susceptible to being washed into any watercourse by runoff or high water.

E. Necessary repairs to erosion and sediment control devices or replacement of erosion and sediment control devices shall be accomplished promptly.

F. Near completion of the project, when directed by the Town or Engineer of Record, the Contractor shall dismantle and remove the temporary devices used for sediment control during construction. All erosion-control devices in seeded areas shall be left in place until the grass is established.

G. The Contractor shall clean up all areas at the completion of the project. Any sediment deposits remaining in place after the barriers are no longer required shall be dressed to conform to the existing grade, prepared and seeded in accordance with Section 7, Grassing and Sodding.

END OF SECTION

SECTION 6
UTILITY EXCAVATION, TRENCHING, AND BACKFILLING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section does not stand alone and is incorporated as part of the Town Construction Specification Manual (CSM). The CSM shall be used for other requirements that may not be covered in this Section.

B. The provisions set forth in this Section shall be applicable to all underground potable water, wastewater, reclaimed water, and stormwater piping installations, regardless of location, unless prior approval is received from the Town for special design consideration.

C. It shall be the Contractor's responsibility to acquaint himself/herself with all existing conditions and to locate all structures and utilities along the proposed utility alignment in order to avoid conflicts. The Contractor shall examine the site before submitting a bid, taking into consideration all conditions that may affect the work.

D. Where actual conflicts are unavoidable, work shall be coordinated with the Town and performed so as to cause as little interference as possible with the service rendered by the Town disturbed.

E. The Contractor is responsible for providing all materials, equipment, labor, and work necessary to construct the project in accordance with the Contract Documents. This work includes but is not limited to the following:

1. Excavating and removing unsatisfactory materials.
2. Preparing trench foundations.
3. Providing satisfactory material for all trenches as specified and as required.
4. Obtaining, storing, maintaining, and disposing of materials.
5. Dewatering, shoring, and sheeting.
6. Placing, compacting, testing, final grading, and subgrade demolition.
7. Performing all other work required by the Contract Documents.

F. The Contractor is responsible for performing all work so as not to damage existing roadways, facilities, utilities, structures, etc., and shall repair and replace such damage to equal or better than its original undamaged condition without cost to the Town.

G. The Contractor shall coordinate all additional subsurface investigations and testing included with this work with the Engineer of Record before performing the excavation and foundation preparation work. In general, if different and unsuitable/unsatisfactory soil conditions are found during the Contractor's work, the Engineer of Record and the Town shall be notified immediately.

H. Work site cleanup and property restoration shall follow behind construction operations without delay. Some of this cleanup will be done on a daily basis, as needed, usually at the end of the workday.

1.02 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply:

A. OSHA Excavation Safety Standards, 29 CFR 1926, Subpart P

B. Florida Trench Safety Act (Law of Florida 90-96)

C. American Association of State Highway and Transportation Officials (AASHTO)

1. AASHTO T-180—Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

D. American Society for Testing and Materials (ASTM)

1. ASTM A328/A328M—Standard Specification for Steel Sheet Piling.
2. ASTM D1556/D1556M—Standard Test Method for Density of Soil and Unit Weight of Soil in Place by the Sand-Cone Method.
3. ASTM D1557—Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
4. ASTM D2937—Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method.
5. ASTM D3282—Standard Practice for Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes.
6. ASTM D3740—Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.

7. ASTM D6938—Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
8. ASTM E329—Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.

1.03 GENERAL

A. Trench excavation shall be confined to the construction area as shown on the Drawings, and shall be done in an approved manner with proper equipment. Excavation and backfilling shall be suspended during rain and inclement weather, or when unsatisfactory field conditions are encountered, unless otherwise directed by the Engineer of Record. At all times during construction, the Contractor shall maintain proper drainage in the construction area, and shall take all measures necessary for erosion and sediment control.

B. Existing Utilities: The Contractor shall be solely responsible for locating and verifying the location of all existing utilities. The Contractor shall take every precaution to protect existing utilities from damage during construction operations. If damage occurs, the utility involved shall be promptly contacted and repairs made at their direction and at the Contractor's expense. The work shall meet the approval of the utility involved. If the respective utility desires to make repairs with its own forces, the Contractor shall bear all the expenses of the work.

C. When interruptions of existing utilities occur, temporary service shall be provided as directed and approved by the respective utility involved.

D. Notification of Intent to Excavate

1. Florida Underground Facility Damage Prevention and Safety Act (Florida Administrative Code [FAC] Chapter 556) requires persons to ascertain the location of underground public utility property before excavation or demolition in certain situations. The Act also requires such persons to give timely notice of intent to excavate or demolish before commencing such operations. Failure to comply could subject the violator to a civil penalty for each violation of the Act.
2. Notification of intent to excavate may be given by calling the Sunshine State One Call of Florida (SSOCOF) at this toll free number: (800) 432-4770 or 811, to call for location of underground facilities.

E. If existing utilities are found to conflict with the permanent facilities being constructed under this Section, immediately notify the Engineer of Record and secure his instructions.

F. Do not proceed with permanent relocation of utilities until written instructions are received from the Engineer of Record.

G. Protection and Restoration of Property: During the course of construction, the Contractor shall take special care and provide adequate protection in order to minimize damage to vegetation, surfaced areas, and structures within the construction right-of-way, easement or site, and take full responsibility for repair or replacement thereof.

H. Material Disposal: Excess, unsuitable, or cleared or grubbed material resulting from the utility installation shall be removed from the work site and disposed of at locations secured by the Contractor. Excess excavated material shall be spread on the disposal site and graded in a manner to drain properly and not disturb existing drainage conditions.

PART 2 PRODUCTS

2.01 CLASSIFICATION OF EXCAVATION

The Contractor shall provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations. All excavation shall be unclassified, except as otherwise specified below.

A. Materials used for trench construction shall be free of clumps of clay, rock or gravel, debris, waste, frozen materials, and other deleterious matter as determined by the Engineer of Record and shall be satisfactory soil materials as follows:

Area Classification	**Soil Materials**
In excavations and trenches	Excavated and borrow material that has been sampled, tested, and approved as "Satisfactory Soil Material."

B. Satisfactory Soil Materials

1. Soil Classification Groups:
   Satisfactory soil materials for each trench shall be as follows:

Satisfactory Soil Material (ASTM D3282, Soil Classification Groups)		
In-situ Foundation	Bedding, Haunching, and Initial Backfill	Final Backfill
A-1-a A-1-b A-3	A-1-a A-3	A-1-a A-1-b A-3

2. Maximum Particle Size Limitations for Satisfactory Soil Materials:
The maximum allowable particle size for satisfactory soil materials within each trench for each type of utility shall be as follows:

Conduit	Maximum Allowable Particle Size		
	In-situ Foundation	**Bedding, Haunching, and Initial Backfill**	**Final Backfill**
Plastic Pipe (PVC, CPVC, HDPE, etc.) less than 6-inch-diameter	See Note 1	½ inch	3 inches
Plastic Pipe (PVC, CPVC, HDPE, etc.) 6-inch-diameter and Larger	See Note 1	¾ inch	3 inches
Concrete Pipe			
Steel Pipe			
Ductile Iron Pipe			
Fiberglass Pipe	See Note 1	3/4 inch or 3 times the wall thickness, whichever is less	3 inches
Other Conduit Materials	See Note 2	See Note 2	See Note 2

(1) There is no requirement when satisfactory undisturbed native soil material is used. Disturbed portions of the foundation and/or unsatisfactory native soil material shall be replaced with satisfactory soil materials meeting all the requirements for Bedding.

(2) The maximum allowable particle size shall be in accordance with the manufacturer's written recommendation.

3. Additional Requirements of Satisfactory Materials:
Satisfactory soil materials shall be free of debris, waste, frozen materials, vegetation, or other deleterious matter. Soils within 4 inches of the exterior surface of the pipe shall be free of gravel, stones, or other materials that may abrade the pipe surface.

C. Unsatisfactory Materials

1. Unsatisfactory soil materials shall mean ASTM D3282, Soil Classification Groups A-2-4, A-2-5, A-2-6, A-2-7, A-4, A-5, A-6, A-7, peat, and other highly organic soils. Soil materials of any classification that have a moisture content at the time of compaction beyond the range of 1 percentage point below and 3 percentage points above the optimum moisture content of the soil material as determined by moisture-density relations test shall also be unsatisfactory.

2. Soil unsuitable for a proper foundation encountered at or below trench grade, such as muck or other deleterious material, shall be removed for the full width of the trench and to the depth required to reach suitable foundation material, unless special design considerations received prior approval from the Town. For rock or other non-crushing material, removal depth shall be 6 inches below the bottom of the utility. Backfilling below trench grade shall comply with the applicable provisions of this Section.

2.02 BEDDING OF PIPE

A. Select material for backfill shall be suitable material from the excavation free of large stones, hard lumps, debris, and other objectionable material. When rock or other non-crushing material is encountered at trench grade, excavation shall be extended to 6 inches below the outside of the bottom of the utility, and a cushion of sand to fully cover the pipe or fittings to a minimum depth of 12 inches shall be provided.

B. If select material is not available from the excavation, it shall be hauled to the site, placed, and compacted at the Contractor's expense. All trenches shall be excavated below the established subgrade as required to provide for preparation of trench bottoms in strict accordance with the improved ditch bedding details as shown.

C. Class B (Minimum Utility Bedding): The bottom of the trench shall be shaped to provide firm bedding for the pipe. The pipe shall be firmly bedded in undisturbed soil or hand shaped so that the pipe will be in continuous contact therewith for its full length.

D. Class A (Special Utility Bedding): Should special bedding be required due to depth of cover, impact loadings, or other conditions, "Class A" bedding methods shall receive prior approval by the Town.

PART 3 EXECUTION

3.01 TRENCH EXCAVATION

A. Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions. If excavated materials intended for fill and backfill include unsuitable soil materials, replace with satisfactory soil materials.

B. Trenches for pipe shall be excavated along the lines designated by the Engineer and to the depths necessary for laying pipe to the required grades.

1. Do not excavate trench more than 200 feet ahead of pipe laying, unless permitted by the Engineer of Record.

2. Where trenching takes place in existing concrete or asphalt pavement, the pavement shall be saw cut 5 feet wider on each side of the trench than the top width of the trench, unless otherwise noted on the Drawings. Ragged edges of pavement shall be recut as required before paving to form a straight and uniform alignment.

3. The minimum width of the trench shall not be less than the outside pipe diameter plus 1 foot, and the maximum width of trench, measured at the top of the pipe, shall not exceed the outside pipe diameter plus 2 feet, unless otherwise shown on the Drawing details, or approved by the Town.

4. Maximum trench width up to a level 24 inches above the top of the pipe shall be as shown on the Drawings.

5. Sides of trenches shall be kept as nearly vertical as possible. In order to prevent damage to property, injury to persons, erosion, cave-ins, or excessive trench widths, adequate sheeting and bracing shall be provided in accordance with standard practice and in accordance with all safety, protection of property, and other applicable laws and regulations, including the Florida Safe Trench Act.

6. Excavated material to be used for backfill shall be neatly deposited at the sides of the trenches where space is available. Where stockpiling of excavated material is required, the Contractor shall be responsible for obtaining the sites to be used.

7. Utilities shall be laid "in the dry" unless otherwise approved. Dewatering systems shall be used in accordance with good standard practice and must be efficient enough to lower the water level in advance of the excavation and maintain it continuously to keep the trench bottom and sides firm and dry. Any dewatering equipment to be used in a residential area shall be equipped with a sound attenuating enclosure and approved by the Town. All machinery required for pumping or bailing shall be furnished by the Contractor. Sump and pump type trenching may be used only on short shallow runs where well points would be impractical and excessively expensive, and only with the prior approval of the applicable Regulatory Agency. In all cases, density testing up to a point at least 1 foot above the water table shall be completed before removal of dewatering equipment.

On sewer lines installed using dewatering, service laterals shall be installed while the trench is dry. Disposal of water after removal shall be satisfactory to the Engineer of Record. There will be no disposal into existing sewer.

C. Before excavating the trench, the Contractor shall perform surface preparation including clearing and grubbing,

D. The Contractor shall be required to fully comply with all applicable OSHA Excavation Safety Standards and to abide by them as covered under the Florida Trench Safety Act (Laws of Florida 90-96), effective October 1, 1990.

E. The Contractor shall ensure that mechanical equipment used for trench excavation shall be of a type, design, and construction and shall be so operated that conduit/utility, when accurately laid to specified alignment, will be centered in the trench with adequate clearance between the conduit/utility and sidewalls of the trench. Undercutting the trench sidewall to obtain clearance will not be permitted.

F. The Contractor shall not use mechanical equipment in locations where its operation would cause damage to trees, buildings, culverts, other existing property, utilities, structures, etc. above or below ground. In all such locations, the Contractor shall use hand excavating methods.

G. The Contractor shall not use blasting.

H. The Contractor shall cut trenches sufficiently wide to enable proper installation of services and to allow for testing and inspection. The Contractor shall also trim and shape trench bottoms and leave them free of irregularities, lumps, and projections. Trench width shall be excavated as specified on the Contract Drawings.

I. The Contractor shall construct trench walls to avoid sidewall collapse or sloughing. Trenches shall be either braced or open construction in accordance with the Contract Documents. No separate payment will be made for any special procedure used in connection with the excavation.

J. Where sheeting and bracing are not required, the Contractor shall construct trench walls in the bottom of the excavation as vertical as possible to the maximum height allowable by OSHA. Trench walls above this height shall be sloped to guard against sidewall collapse or sloughing as specified on the Contract Drawings.

K. Where sheeting and bracing are required, the sheeting and bracing system shall meet the requirements specified in these Specifications and the Town CSM.

1. No wood sheeting shall be left in place.

2. Steel sheeting to be left in place shall be as specified in ASTM A328/A328M.

L. Excavations shall be to the design elevations shown on the Contract Drawings or as specified, unless unsatisfactory or unsuitable foundation materials are encountered in the bottom of the excavation. Where unsatisfactory or unsuitable foundation materials are encountered, this material shall be undercut and removed as indicated on the Contract Drawings and replaced with satisfactory soil material meeting all the requirements for bedding. The lift thicknesses and compaction requirements for the replacement soil shall also meet the requirements for bedding.

M. The Contractor shall be careful not to over excavate except where necessary to remove unsatisfactory or unsuitable materials, irregularities, lumps, rock, and projections. Unnecessary over excavation shall be replaced as specified in these Specifications at the Contractor's sole expense.

N. The Contractor shall accurately grade bedding soil materials at the bottoms of the trenches to provide uniform bearing and support for each section of conduit/utility at every point along its entire length except where it is necessary to excavate the bedding for conduit/utility bells (e.g., pipe bells), etc. or for proper sealing of conduit/utility joints. Abrupt changes in grade of the trench bottom shall be avoided.

O. The Contractor shall dig bell holes and depressions after the bedding has been graded to ensure that the conduit/utility rests on the prepared bedding for as much of its full length as practicable. Bell holes and depressions shall be only of such length, depth, and width as required to make the joint.

P. The Contractor shall do the following:

1. Pile all excavated material in a manner that will not endanger the work or erode the stormwater management facilities or water courses.

2. Avoid obstructing sidewalks, driveways, and plant facilities.

3. Leave hydrants, valve pit covers, valve boxes, or other utility controls unobstructed and accessible.

4. Keep gutters, drainage inlets, natural water courses, and miscellaneous drainage structures clear or make other satisfactory provisions for their proper operation.

Q. The Contractor shall keep all satisfactory materials that are suitable for use/reuse in the trench construction separated from unsatisfactory materials.

R. Except where otherwise authorized, indicated, or specified, the Contractor shall replace, at the Contractor's own expense, all materials excavated below the bottom of concrete walls, footings, slabs on grade, and foundations with concrete or flowable fill, as directed by the Engineer of Record.

S. The Contractor shall adhere to these Additional Excavation Requirements for Piping:

1. Excavate trenches so that the piping can be laid to the lines, grades, and elevations indicated on the Contract Drawings.

2. For piping designated to be laid to a minimum cover requirement, grade trenches to avoid high and low points to the extent practical. As-built Drawings of such pipes shall present top-of-pipe and grade elevations at all high and low points along each pipe segment, at the ends of each pipe segments, and at intervals not to exceed 100 feet along each pipe segment. If, in the opinion of the Engineer of Record, additional air release and/or vacuum relief valves are required, the Contractor shall install the additional items as directed by the Engineer of Record.

3. The cover over PVC pipe shall not be less than 3 feet. Where the cover is less than 3 feet, that section of pipe shall be ductile iron pipe.

4. Where trenching occurs in existing lawns, and seeding is not an option, replace area with sod in accordance with Section 7, Grassing and Sodding.

5. Where trenching takes place in existing concrete or asphalt pavement, the pavement shall be saw cut at the full trench width plus 5 feet on either side as shown on the Town of Howey-in-the-Hills Standard open cut and repair detail. Ragged edges of pavement shall be re-cut as required before paving to form a straight and uniform alignment.

6. Sides of trenches shall be kept as nearly vertical as possible. Maximum trench width up to a level 24 inches above the top of the pipe shall be as shown on the Drawings.

7. Water that is found in or accumulates in trenches shall be pumped, bailed, or otherwise removed. All machinery required for pumping or bailing shall be furnished by the Contractor. Trenches shall be kept free of water while pipe is being laid. Disposal of water after removal shall be satisfactory to the Engineer of Record. There will be no disposal into existing sewer.

8. Continue dewatering operations along each pipe segment until the required minimum cover is provided. During the dewatering operations, the ground water level in the trench shall remain at all times a minimum of 1 foot below bottom of trench excavations.

T. The Contractor shall adhere to this Additional Excavation Requirement for Appurtenances:

1. Ensure that excavations for valves and similar appurtenances shall be sufficient to leave at least 12 inches in the clear between the outer surfaces and the embankment or timber used to hold and protect the walls.

U. The Contractor shall adhere to these Additional Excavation Requirements for Roadway and Pavement Restoration:

1. Open cuts of Town streets are expressly prohibited. However, hardship waivers may be granted at the sole discretion of the Public Works Director, in accordance with the requirements of this Section. Restoration shall be as required by the Public Works Director, taking into account factors such as age of existing roadway, density of traffic, location, etc.

2. Pavement or roadway surfaces cut or damaged shall be replaced by the Contractor in equal or better condition than the original, including stabilization, base course, surface course, curb and gutter, or other appurtenances. The Contractor shall obtain the necessary permits and all applicable authorizations from the proper agencies before any roadway work. Additionally, the Contractor shall provide advance notice to the appropriate authority and local emergency services agencies, as required, before construction operations.

3. Restoration shall be in accordance with requirements set forth by the Town. The materials of construction and method of installation, along with the proposed restoration design for items not referred to or specified herein, shall receive prior approval from the Town.

4. Where existing pavement is removed, the surfacing shall be mechanical saw cut before trench excavation, leaving a uniform and straight edge,

with minimum disturbance to the remaining adjacent surfacing. The width of cut for this phase of existing pavement removal shall be minimal.

5. Immediately following the specified backfilling and compaction, a temporary sand seal coat surface shall be applied to the cut areas. This temporary surfacing shall provide a smooth traffic surface with the existing roadway and shall be maintained until final restoration.

6. Density tests shall be provided for trenches in pavement across roadways as specified in the Town CSM.

3.02 BACKFILLING OF TRENCHES

A. Backfilling of trenches shall progress as rapidly as pipe-laying will permit.

B. The Contractor shall not backfill trenches until required tests are performed.

C. Immediately after the pipe has been jointed and inspected, backfilling shall be placed to a minimum of 12 inches above the crown of the pipe to adequately protect the pipe from injury and movement, in accordance with ASTM D2321. Before and during the backfilling of any trench, precaution should be taken against flotation of pipelines therein due to entry of large quantities of water into the trench, which could cause uplift of the pipeline. The diameter deflection of polyvinyl chloride (PVC) pipe shall not exceed 5 percent after completion and approval of construction, and for a period of 1 year thereafter.

D. Backfill material shall be clean earth fill composed of sand or other Town approved fill.

E. Trenches improperly backfilled shall be reopened to the depth required for proper compaction, then refilled and compacted as specified, or the condition shall be otherwise corrected as directed.

F. The Contractor shall perform the following steps to ensure compaction at the bottom of the trench or excavation before bedding:

1. Remove disturbed native soil material and/or any soils not meeting the requirement of satisfactory soil material as indicated on the Contract Drawings.

2. When trenches are cut within the right-of-way and under all roadways, drives (including dirt drives), parking areas, and all other areas to be paved, compaction as determined by AASHTO T-180, shall be, for each 12-inch backfill lift, equal to 98 percent of maximum density, with

compaction in other areas, not less than 95 percent of maximum density from the bottom of trench to 12 inches above the top of pipe and not less than 90 percent of maximum density from the top of pipe to the top of backfill. Density tests shall be provided for trenches within pavement, across roads, and areas adjacent to proposed building structures. Backfilling of pipe trench or under and around structures shall be, for each 12-inch backfill lift, compacted to 98 percent of maximum density as determined by AASHTO T-180. One compaction test shall be carried out for each 300 linear feet of pipe and for every 100 square feet of backfill under and around structures and pavement as a minimum.

G. To backfill below and around pipe to the spring line of the pipe, the Contractor shall do the following:

1. Construct foundation and bedding as indicated on the Contract Drawings before placement of pipe.

2. Install each pipe at proper grade, alignment, and final position.

3. Deposit satisfactory soil material uniformly and simultaneously on each side of pipe in completed course layers to prevent lateral displacement.

4. As fast as the material is placed, it shall be cut under the haunches of the pipe with a shovel and thoroughly compacted with light tamps for the full width of the trench to provide support for the bottom and sides of the pipe, and to hold the pipe in the proper position during subsequent pipe backfilling and compaction operations. Backfilling shall be carried up evenly on both sides in 6-inch lifts to 12 inches above the pipe.

5. Construct haunching of the pipe as indicated on the Contract Drawings.

H. To trench backfill above pipe spring line to finished grade, the Contractor shall do the following:

1. Deposit satisfactory soil material around and above pipe in uniform layers as shown on the Contract Drawings.

2. Backfill and compact trenches from the spring line of the pipe to the top of the trench in completed course layers as shown in the Contract Drawings.

3. Use material previously defined in these Specifications as satisfactory soil material.

4. Compact by hand or mechanical tampers.

I. Protective concrete slabs shall be installed over the top of trenches, where required, to protect the installed pipe against excessive loads across roadways and river/swamp areas, as required by the Town.

J. Existing sidewalks and driveways removed, disturbed, or destroyed by construction, shall be replaced or repaired by the Contractor at his expense.

K. All pipes installed shall have associated tracer tape and wire installed in accordance with the respective piping specification section.

L. No pipe or piping shall be backfilled until inspected and approved by the Town.

M. All piping shall be properly identified in accordance with the respective piping specification section.

N. Backfill around manholes and other structures shall conform to the requirements for this Section, except that no backfill shall be placed around manholes or other structures until all mortar has properly set unless otherwise noted.

O. The Contractor shall be responsible for final subsidence of all trenches, and shall leave trenches flush with the original ground after all settlement has taken place. Any settlement of backfill below finish grade shall be promptly corrected. Trenches shall be protected against scour due to surface drainage.

3.03 COMPACTION TEST

A. All backfill will be subject to a compaction test by an independent laboratory selected by the Engineer of Record or Town. If compaction fails the test, the Contractor shall remove and replace backfill to the satisfaction of the Engineer of Record and the Town, and shall pay for the cost of the re-test.

END OF SECTION

SECTION 7
GRASSING AND SODDING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section does not stand alone and is incorporated as part of the Town Construction Specification Manual (CSM). The CSM shall be used for other requirements that may not be covered in this Section.

B. The work under this Section includes the furnishing of all labor, material, equipment, and supervision required to grade, install, and maintain grass and sod in all areas shown on the Construction Drawings or specified herein.

1.02 GENERAL

A. It is the intent of these specifications to provide a complete grassing and sodding procedure that shall be carefully followed, and, upon consultation with the Town or Engineer of Record, shall be adjusted to meet unforeseen weather and soil conditions to secure a successful planting of the areas to be grassed or sodded. All grassed areas that are disturbed or damaged by the construction operation shall be restored by re-sodding or seeding and mulching after fill has been graded to meet the existing contours. Sod shall be similar to the type of grass in place and shall be fresh, live, and well rooted. Areas to be seeded and mulched shall be agreed upon and approved by the Town or Engineer of Record before excavation. Unless approved otherwise by the Town or Engineer of Record, the sodded areas shall be uniform level and smooth without dips or holes.

PART 2 PRODUCTS

2.01 PLANTING

A. Materials: Materials shall be approved by the Town or Engineer of Record before use.

1. Topsoil: The Contractor shall provide topsoil from off-site or from on-site excavation as approved by the Town or Engineer of Record. Topsoil shall be friable and loamy (loam, sandy loam, silt loam, sandy clay loam, clay loam) and shall be free of debris, trash, stumps, rocks, roots, and noxious weeds.

2. Seed: During the period March 15 to October 15, the seed mixture shall be 100% Argentine Bahia. During the remainder of the year, the mixture shall be 1/3 each of Argentine Bahia, Bermuda, and Rye grass seed.

3. Sod: The Contractor shall provide strongly rooted sod, not less than 2 years old and free of weeds and undesirable native grasses. Provide only live, fresh, and uninjured sod capable of growth and development when planted (viable, not dormant) and in strips not more than 18 inches wide x 4 feet long. Provide sod composed principally of Argentine Bahia, St. Augustine, or Centipede to match existing grass type and adequate irrigation system is provided. No sod that has been cut for more than 72 hours shall be used unless specifically authorized by the Town or Engineer of Record after careful inspection thereof. Any sod that is not planted within 36 hours after cutting shall be stacked in an approved manner and maintained properly moistened.

4. Mulch: The mulch material shall be straw or hay, consisting of oats, rye, or wheat straw, or a Pangola, Peanut, Bermuda, or Bahia grass hay. Mulch shall be free from undesirable weed and other undesirable grasses.

5. Sprigs: Sprigs shall be of St. Augustine grass or other types, as directed by the Town or Engineer of Record. A sprig shall be a stolon, also known as a runner, approximately 4 inches long.

6. Erosion Control Fabric: The Contractor shall provide 70% agricultural straw with 30% coconut fiber matrix stitches with degradable nettings, designed to degrade within 18 months. Erosion control anchors shall be as recommended by the manufacturer

7. Lime: Lime shall be finely ground agricultural or dolomitic limestone.

8. Fertilizer for Grassing, Sodding, and Sprigging: For temporary seeding, fertilizer shall be 10-20-20. For permanent seeding, fertilizer shall be 5-20-10. For sodding and sprigging, fertilizer shall be 10-10-10 in fall and 5-10-10 in spring. Equivalent nutrients may be applied with other fertilizer formulations.

PART 3 EXECUTION

3.01 PREPARATION

A. All preparation and planting shall be done in an acceptable manner and by competent personnel.

1. The Contractor shall coordinate all work activities to provide for establishing grass or sod cover at the earliest possible time in the construction schedule to minimize erosion of topsoil.

2. If grading is completed and ready for grassing or sodding at a time inappropriate for establishing the permanent grass cover, temporary coverage shall be provided for protection of graded surfaces until such time that permanent cover can be established. Temporary cover shall be provided as specified below. The Contractor shall return to the site and provide the permanent cover, in the manner specified in the Contract Drawings, and at such time as may be suitable.

    a. Surface area to be temporarily grassed shall be prepared as for permanent cover.
    b. Area to be grassed shall be planted with Rye or Sudan grass for temporary protection. Seed shall be applied at such rates as to provide for adequate and acceptable temporary cover.
    c. After temporary planting is completed, the planted areas shall be watered as specified in the maintenance section below.

3. Grassing and sodding shall not be performed when weather and soil conditions are, in the Town's or Town Representative's opinion, unsuitable for proper results.

4. Seed, sod, and sprigs shall be placed only when the soil is moist and in proper condition to induce growth. Moisten areas prepared for grassing before planting if the soil is dry. Water thoroughly and allow the surface to dry off before planting. Do not create a muddy soil condition.

5. Dispose of any existing sod, growth, rocks, or other obstructions that might interfere with tilling, seeding, sodding, or later maintenance operations. Remove stones over 1-1/2 inches in any dimensions and sticks, roots, rubbish, and other extraneous matter. Remove from site: do not stockpile.

6. Till to a depth of not less than 300 mm (12 inches). Thoroughly loosen and pulverize topsoil.

7. Spread planting soil mixture to depth required to meet thickness, grades, and elevations indicated after light rolling and natural settlement. Do not spread if material is frozen or if subgrade is frozen. Top soil shall be maintained at a minimum compacted depth of 2 inches on 3:1 or steeper slopes and 4 inches on flatter slopes, the Contractor shall add top soil as required to meet these depths. Where soils are known to be highly acid (pH 6.0 and lower), lime should be applied at the rate of 2 tons of pulverized agricultural limestone per acre. Grade grassed areas to a smooth, even surface with loose, uniformly firm texture. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit fine grading to areas that can be planted within the immediate future. Restore prepared areas to specified condition if eroded or otherwise disturbed after the fine grading and before planting.

8. Before seeding, sodding, or sprigging, fertilizer shall be applied uniformly. For temporary seeding, the rate shall be 10 pounds per 1,000 square feet. For permanent seeding, sodding, and sprigging the rate shall be 25 pounds per 1,000 square feet. Fertilizer shall be applied after smooth raking of topsoil and before roller compaction. Do not apply fertilizer at same time or with same machine as will be used to apply seed. Lightly water to aid the dissipation of fertilizer.

3.02 SODDING

A. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod strips; do not overlap. Stagger to offset joints in adjacent courses. Work from boards to avoid damage to subgrade or sod. Tamp or roll lightly to ensure contact with subgrade. Work sifted soil into minor cracks between pieces of sod; remove excess to avoid smothering of adjacent grass.

B. Where sodding is used in drainage ditches, the setting of the pieces shall be staggered, such as to avoid a continuous seam along the line of flow. Along the edges of such staggered areas, the offsets of individual strips shall not exceed 6 inches. In order to prevent erosion caused by vertical edges at the outer limits, the outer pieces shall be tamped to produce a featheredge effect.

C. Anchor sod on slopes 3:1 or greater with wood pegs as required to prevent slippage. Sod shall be installed with the length perpendicular to the slope. Begin laying sod at the bottom of the slope and work uphill.

D. Any pieces of sod that, after placing, shows an appearance of extreme dryness shall be removed from the work.

E. When sodding adjacent to paving, the top of the sod shall be a minimum of 1 inch and a maximum of 2 inches below the top of the edge of pavement as shown in the Town of Howey-in-the-Hills Standard Details.

F. After planting is completed, the planted areas shall be sufficiently watered to maintain a moist soil depth of at least 4 inches for the first week.

3.03 SEEDING

A. Seed shall be applied evenly at a rate of 60 pounds per acre in two intersecting directions, raked into the ground, and lightly covered. All grass seed shall be mixed with soil before sowing in a manner insuring an even distribution and retainage of the seed on the site.

B. Upon completion of seeding, apply mulch at a rate of 4,000 pounds per acre. Tack mulch by crimping with crimping attachment. Do not seed areas in excess of that which can be mulched on the same day.

C. After the seed is covered, the area shall be compacted and dressed smooth by a roller not exceeding 112 pounds. Mulch material shall be held in place by covering with light poultry netting staked in place or by a coat of suitable asphaltic material.

D. After planting, apply water with a fine spray immediately after each area has been mulched. Saturate to 4 inches of soil.

E. Cover seeded slopes where grade is 4 inches per foot or greater with erosion fabric. Roll fabric onto slopes without stretching or pulling. Lay fabric smoothly on surface, bury top end of each section in 6-inch-deep excavated topsoil trench. Provide a 2- to 4-inch overlap of adjacent rolls. Backfill trench and fine grade by raking smooth and level with adjacent soil. Secure outside edges and overlaps in accordance with the manufacturer's recommendations. Lightly dress slopes with topsoil to ensure close contact between fabric and soil. At the sides of ditches, lay fabric laps in direction of water flow. Lap ends and edges a minimum of 6 inches.

3.04 HYDRO-SEEDING

A. Apply seeded slurry with a hydraulic seeder at the rate designated on schedule evenly in two intersecting directions.

B. Do not hydro-seed area in excess of that which can be mulched on same day.

C. Apply water with a fine spray immediately after each area has been mulched. Saturate to 4 inches of soil.

3.05 SPRIGGING

A. Where sprigging is specified in the Contract Drawings, the entire area shall grassed by planting sprigs endwise in a 2-inch-deep trench. The trenches shall be 8 inches apart and sprigs planted 6 inches apart in the trenches. Other methods of planting sprigs that will provide an equal stand of grass may be approved.

3.06 MAINTENANCE

A. The Contractor shall be responsible to see that all planted areas, including seeded, sprigged, and sodded areas, receive sufficient water and maintenance during the life of this Contract or until a satisfactory growth of grass is established acceptable to the Town or Engineer of Record.

B. To maintain the grassing and sodding, the Contractor shall do the following:

1. The Contractor shall erect barricades, warning signs, and fencing to protect newly planted areas from traffic. Maintain barricade fencing and warning signs throughout the maintenance period.

2. Mow sod to a height of 2 inches as soon as there is enough top growth to cut with mower. Remove no more than 40% of grass leaf growth in initial or subsequent mowing. Do not delay mowing until grass blades bend over and become matted.

3. Maintain lawns by watering, fertilizing, weeding, mowing, trimming, and other operations such as rolling, filling, re-grading, replanting as required to establish a smooth, acceptable lawn, free from eroded or bare areas.

4. Remove weeds by pulling or chemical treatment.

5. Apply the second fertilizer application after the first mowing and when grass is dry.

6. Replant bare areas using same materials specified for lawns.

7. Arrange watering schedule to avoid walking over muddy areas. Use equipment and water to prevent puddling and water erosion and displacement of seed or mulch (if any).

C. Apply water in sufficient quantities and as often as seasonal conditions require to keep the grassed areas moist. It is the Contractor's responsibility to determine the quantities of water required and when to irrigate.

END OF SECTION

SECTION 8
SURFACE RESTORATION

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section does not stand alone and is incorporated as part of the Town Construction Specification Manual (CSM). The CSM shall be used for other requirements that may not be covered in this Section.

B. This Section covers the work necessary to provide for the restoration of all asphalt and concrete pavement and concrete sidewalks removed during construction.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 1, General Provisions:

A. Limerock material submittal is to be made to include liquid limit, plastic index, gradation, certification regarding deleterious material, limerock bearing ratio (LBR), Florida Department of Transportation (FDOT) pit number, and other information as required to indicate performance in accordance with the specifications.

B. Information regarding asphaltic and Portland cement concrete materials and mix shall be submitted as required by the referenced FDOT specifications.

1.03 REFERENCE STANDARDS

A. Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

B. The latest edition of the FDOT Standard Specifications for Road and Bridge Construction (Standard Specifications) and Roadway and Traffic Design Standards shall be referred to for construction, workmanship, and quality control as specified with exceptions as noted in this Section.

1. Where the referenced FDOT Specifications cite "the Department," this shall be modified to “the Owner and/or Public Services Director or his Designee” by this Contract.

2. The Contractor shall retain an independent testing agency, as approved by the Public Services Director, to perform all tests, including tests referenced to be performed by the Public Services Director.

C. American Association of State and Highway Transportation Officials (AASHTO)

1. AASHTO T 99—Standard Method of Test for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-inch) Drop.

D. American Society of Testing and Materials (ASTM)

1. ASTM D1556/D1556M—Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
2. ASTM D1557—Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN- m/m3)).
3. ASTM D2167—Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
4. ASTM D6938—Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.04 QUALITY ASSURANCE

A. The Contractor shall perform field-density tests along the centerline of construction or as directed by the Public Services Director or his Designee and in accordance with the FDOT's *Standard Specifications for Road and Bridge Construction,* latest edition.

B. The Contractor shall field check the depth of stabilization and/or limerock at each road crossing with a pipeline.

C. The Town may require additional testing as deemed necessary. The Public Services Director or his Designee shall interpret test results and the Contractor shall perform remedial work as directed by the Town.

D. Laboratory maximum dry density of soil mixtures at optimum moisture shall be determined by ASTM D1557 for subgrade, stabilized subgrade, and limerock base course.

E. Field density of stabilized subgrade and soils or soil mixtures in fill or backfill shall be determined by ASTM D2167, D1556/D1556M, or Nuclear Method D2922 or ASTM D1556/D1556M or D2922 for limerock base course.

F. Bearing value of stabilized subgrade shall be determined by the methods required for determining LBR according to the FDOT, Standard Specification FM 5-515.

G. Field density of stabilized subbase shall be 98% or greater of the Modified Proctor maximum dry density, ASTM D1557.

H. The Public Services Director or his Designee shall have sole responsibility for interpreting all test results. The Contractor shall bear the cost of all retests due to failure to achieve specified requirements.

1.05 WARRANTIES

A. Warranties shall be in accordance with Section 1, General Provisions.

PART 2 PRODUCTS

2.01 ROCK BASE

A. The following sections of FDOT Standard Specifications shall apply:

1. Section 200-1, Description.
2. Section 200-2, Materials.

2.02 STABILIZING

A. The following sections of FDOT Standard Specifications shall apply:

1. Section 160-1, Description.
2. Section 160-2, Stabilized Subgrade, Type B.
3. Section 160-4, Materials.

2.03 PRIME AND TACK COATS FOR BASE COURSES

A. The following sections of FDOT Standard Specifications shall apply:

1. Section 300-1, Description.
2. Section 300-2, Materials.
3. Section 300-3, Equipment.

2.04 SUPERPAVE ASPHALT

A. The following sections of FDOT Standard Specifications shall apply:

1. Section 334-1, Description.
2. Section 334-2, Materials.
3. Section 334-3, General Composition of Mixture.
4. Section 334-4, Acceptance of the Mixture at the Plant.
5. Section 334-5, Acceptance of the Mixture on the Roadway.

2.05 CEMENT CONCRETE PAVEMENT

A. The following sections of FDOT Standard Specifications shall apply:

1. Section 350-1, Description.
2. Section 350-2, Materials.

2.06 TRAFFIC STRIPES AND MARKINGS

A. The following sections of FDOT Standard Specifications shall apply:

1. Section 711-1, Description.
2. Section 711-2, Materials.

2.07 CONCRETE SIDEWALK PRODUCTS

A. Materials

1. The following sections of FDOT Standard Specifications shall apply:

a. Section 347, Concrete.
b. Section 415, Reinforcement.
c. Section 932, Joint Materials.

B. Forms

1. The following sections of FDOT Standard Specifications shall apply:

a. Section 520-3, Form Materials.

C. Excavation and Compaction

1. The following sections of FDOT Standard Specifications shall apply:

a. Section 520-4, Excavation.
b. Section 120-9, Compaction.

D. Joints

1. The following sections of FDOT Standard Specifications shall apply:

a. Section 520—6.1, Contraction Joints.
b. Section 520-6.2, Expansion Joints.

E. Finishing

1. The following sections of FDOT Standard Specifications shall apply:

a. Section 520-7, Finishing.

F. Curing

1. The following sections of FDOT Standard Specifications shall apply:

a. Section 520-8, Curing.

PART 3 EXECUTION

3.01 EXCAVATION AND EMBANKMENT

A. The following sections of FDOT Standard Specifications shall apply:

1. Section 120-1, Description.
2. Section 120-2, Classifications of Excavation.
3. Section 120-3, Preliminary Soils Investigation.
4. Section 120-4, Removal of Unsuitable Materials and Existing Roads.
5. Section 120-5, Disposal of Surplus and Unsuitable Material.
6. Section 120-6.1, Materials for Borrow.
7. Section 120-7, Materials for Embankment.
8. Section 120-8, Embankment Construction.
9. Section 120-9, Compaction Requirements.
10. Section 120-10, Acceptance Program.
11. Section 120- 11, Maintenance and Protection of Work.
12. Section 120-12, Construction.

B. Exceptions

1. Section 120-4.1, Subsoil Excavation: Unsuitable soils shall be those in Classifications A-6, A-7, or A-8 in the American Association of State Highway and Transportation Officials (AASHTO) System.

2. Section 120-4.2, Removal of Existing Old Road: Where removal of existing pavement is called for, it shall be removed to the full depth as indicated in the cross-sections and replaced with new limerock and paving.

3. Section 120-5.3, Disposal of Paving Materials: Disposing of muck on side slopes shall not apply.

4. Section 120-9.2.1, General: Laboratory maximum dry density shall be determined by Modified Proctor, ASTM D1557. Field densities shall be determined by ASTM D2167, D1556/D1556M, or Nuclear Method D2922. All embankments shall be compacted to not less than 95% of the maximum dry density, as determined by modified Proctor, ASTM D1557.

5. Section 120-12.1, Construction Tolerances: No tolerance greater than 0.1 foot above or below the cross-section will be allowed.

3.02 ROADWAY STABILIZING

A. The following sections of FDOT Standard Specifications shall apply:

1. Section 160-1, Description.
2. Section 160-2, Stabilized Subgrade.
3. Section 160-3, Stabilized Subbase.
4. Section 160-4, Materials.
5. Section 160-5, Construction Methods.
6. Section 160-6, Stabilized Subbase (Additional Strengthening of Upper Portion).
7. Section 160-7, Acceptance Program.
8. Section 160-8, Density Requirements.

B. Exceptions:

1. The Contractor shall stabilize the roadbed to a minimum depth of 12 inches as shown on the Drawings.

2. Section 160-7.2.1.2, Undertolerance in Bearing Value Requirements: no undertolerance will be acceptable.

3.03 LIMEROCK BEARING RATIO AND DENSITIES

A. Stabilized finish grade and stabilized shoulders shall have a minimum LBR value of 40.

B. Field density of stabilized finished grade shall be a minimum of 98% of the Modified Proctor maximum dry density as specified in ASTM D1557 to a minimum depth of 12 inches as shown on the Drawings.

3.04 PRIME AND TACK COATS

A. The following sections of FDOT Standard Specifications shall apply:

1. Section 300-3, Equipment.
2. Section 300-5, Cleaning Base and Protection of Adjacent Work.
3. Section 300-6, Weather Limitations.
4. Section 300-7, Application of Prime Coat.
5. Section 300-8, Application of Tack Coat.

3.05 LIMEROCK BASE

A. The following sections of FDOT Standard Specifications shall apply:

1. Section 200-3, Equipment.
2. Section 200-4, Transporting Limerock.
3. Section 200-5, Spreading Limerock.
4. Section 200-6, Compacting and Finishing Base.
5. Section 200-7, Acceptance Program.
6. Section 200-8, Priming and Maintaining.

B. Exceptions:

1. Section 200-7.2.1, Density: The minimum density which will be acceptable for paved areas will be 98% of the maximum dry density as determined by Modified Proctor, ASTM D1557.

2. Section 200-7.3.1.2, Depth and Surface Testing Requirements: Thickness of base shall be measured at intervals not to exceed 200 feet.

3.06 SUPERPAVE ASPHALT

A. The following sections of FDOT Standard Specifications shall apply:

1. Section 320-5, Paving Equipment.
2. Section 330-1, Description.
3. Section 330-2, Quality Control by Contractor.
4. Section 330-3, Limitations of Operations.
5. Section 330-4, Preparation of Asphalt Cement.
6. Section 330-5, Preparation of Aggregates.
7. Section 330-6, Preparation of the Mixture.
8. Section 330-7, Transportation of the Mixture.
9. Section 330-8, Preparation of the Application Surfaces.
10. Section 330-9, Placing Mixture.
11. Section 330-10, Compacting Mixture.
12. Section 330-11, Joints.
13. Section 330-12, Surface Requirements.
14. Section 330-13, Protection of Finished Surface.
15. Section 334-3, General Composition of Mixture.
16. Section 334-4, Acceptance of Mixture.

3.07 CEMENT CONCRETE PAVEMENTS

A. The following sections of FDOT Standard Specifications shall apply:

1. Section 350-1, Description.
2. Section 350-2, Materials.
3. Section 350-3, Equipment.
4. Section 350-4, Subgrade Preparation.
5. Section 350-5, Setting Forms.
6. Section 350-6, Protection from Weather.
7. Section 350-7, Placement of Reinforcement.
8. Section 350-8, Placing Concrete.
9. Section 350-12, Final Finish.
10. Section 350-13, Curing.
11. Section 350-14, Surface Requirements.
12. Section 350-15, Joints.
13. Section 350-16, Thickness Determinations.

3.08 PAVEMENT REPAIR

A. At his own expense, the Contractor shall repair all damage to pavement because of work under any Contract in a manner satisfactory to the Public Services Director. Pavement shall be saw cut and repaired to match the original surface

material and original grade. However, the asphalt concrete thickness shall not be less than 2 inches. The repair shall include preparing the subgrade, placing and compacting the applicable base, priming the limerock base, and placing and maintaining the surface treatment as specified in this Section.

B. The width of all repairs shall extend at least 12 inches beyond the limit of the damage. The edge of the pavement to be left in place shall be cut to a true edge with a saw or other approved method to provide a clean edge to abut the repair. The line of the repair shall be reasonably uniform with no unnecessary irregularities.

3.09 JOINTS

A. General pavement joints within asphalt or concrete driveways and roadways and where specified or directed by the Public Services Director, shall be mechanically sawed butt joints. The edges of asphalt pavement shall be trimmed to straight lines that a roller can follow or form.

3.10 TRAFFIC STRIPES AND MARKINGS

A. The following sections of FDOT Standard Specifications shall apply:

1. Section 711-1, Description.
2. Section 711-2, Material.
3. Section 711-3, Equipment.
4. Section 711-4, Application.
5. Section 711-5, Contractor's Responsibility for Notification.
6. Section 711-6, Protection of Newly Applied Traffic Stripes and Markings.
7. Section 711-7, Method of Measurement.
8. Section 711-8, Basis of Payment.

3.11 CONCRETE SIDEWALK

A. The following sections of FDOT Standard Specifications shall apply:

1. Section 522-1, Description.
2. Section 522-2, Material.
3. Section 522-3, Forms.
4. Section 522-4, Foundation.
5. Section 522-5, Joints.
6. Section 522-6, Placing Concrete.
7. Section 522-7, Finishing.
8. Section 522-8, Curing.

9. Section 522-9, Method of Measurement.
10. Section 522-10, Basis of Payment.

3.12 CONCRETE SIDEWALK REPAIR

A. At his own expense, the Contractor shall repair all damage to concrete sidewalks as result of his work in a manner satisfactory to the Public Services Director . Sidewalks shall be saw cut and repaired to match the original width, thickness and original grade. However, the concrete thickness shall not be less than 4 inches. The repair shall include preparing the subgrade, placing of forms, placing concrete, finishing and curing as specified in this Section.

B. The width of all concrete sidewalk repairs shall extend at least 12 inches beyond the limit of the damage. The edge of the sidewalk to be left in place shall be cut to a true edge with a saw or other approved method to provide a clean edge to abut the repair. The line of the repair shall be reasonably uniform with no unnecessary irregularities.

3.13 FOUNDATION

A. Compact fill areas, including cut areas under sidewalk that have been excavated more than 6 inches below the bottom of the sidewalk, to a minimum of 95% of AASHTO T 99 density. The area to be compacted is defined as that area directly under the sidewalk and 1 foot beyond each side of the sidewalk when right-of-way allows.

3.14 JOINTS

A. Form 1/2 inch expansion joints between the sidewalk and the curb or driveway or at fixed objects and sidewalk intersections with a preformed joint filler meeting the requirements specified in FDOT Section 932-1.1.

B. The Contractor may use open type or sawed contraction joints. Form open type contraction joints by staking a metal bulkhead in place and depositing the concrete on both sides. After the concrete has set sufficiently to preserve the width and shape of the joint, remove the bulkhead. After finishing the sidewalk over the joint, edge the slot with a tool having a 1/2 inch radius.

C. If electing to saw the contraction joints, cut a slot approximately 3/16 inch wide and not less than 1-1/2 inches deep with a concrete saw after the concrete has set, and within the following periods of time:

1. Joints at not more than 30 foot intervals: Within 12 hours after finishing.
2. Remaining joints: Within 96 hours after finishing.

3.15 FINISHING

A. Screeding: Strike off the concrete by means of a wood or metal screed, used perpendicular to the forms, to obtain the required grade and remove surplus water and laitance.

B. Surface Requirements: Provide the concrete with a broom finish. Ensure that the surface variations are not more than 1/4 inch under a 10-foot straightedge, or more than 1/8 inch on a 5-foot transverse section. Finish the edge of the sidewalk with an edging tool having a radius of 1/2 inch.

END OF SECTION

SECTION 9
BORING, JACKING, AND TUNNELING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section does not stand alone and is incorporated as part of the Town Construction Specification Manual (CSM). The CSM shall be used for other requirements that may not be covered in this Section.

B. Bored and jacked or tunneled crossings under roadways and railways shall be provided as shown on the Drawings and as specified herein. The provisions of this Section shall be the minimum standards for the installation of casing pipe by the boring and jacking method for placement of potable water, wastewater, reclaimed water, and stormwater pipelines. In general, all underground pipelines crossing exiting major Town roadways, Florida State highways, Lake County highways, and railroads shall be installed under these traffic-ways within bored and jacked steel casing pipe. All aspects of crossing construction shall conform to the requirements of the Florida Department of Transportation (FDOT), Lake County, or the Railroad, as applicable. It shall be the responsibility of the Contractor to submit the necessary permit documents and data to the appropriate authority and receive approval thereof.

1.02 GENERAL REQUIREMENTS

A. Authorities: All aspects of crossing construction shall conform to the requirements of FDOT, Lake County Highway Department, or the railroad, as applicable.

B. Insurance: It shall be the responsibility of the Contractor and/or his subcontractor to comply with all insurance requirements of the highway or railroad for work within their right-of-way.

C. Inspection: Crossing construction operations shall be subject to inspection by the Town's representative and by the highway or railroad representative, who shall have full authority to stop work if, in the authority’s opinion, it would cause damage to the roadway or railway section, or endanger traffic.

D. Additional Requirements:

1. The Contractor shall comply with all requirements of the highway or railroad relating to design, specifications, construction, and temporary

work including: inspection, watchmen, flagmen, protection of personnel and property, work restrictions, work scheduling, insurance, and such other requirements. Where laws or orders of public authority prescribe a higher degree of protection than specified herein, then the higher degree so prescribed shall be deemed a part to this specification. The Contractor shall pay for all costs associated with meeting these requirements, except as otherwise specified.

2. The steel casing pipe within the limits of the highway or railway right-of-way shall be installed to the proper line and grade. The steel casing shall be furnished and installed in accordance with additional requirements specified herein.

3. All work shall be completed to the full satisfaction of the highway or railroad engineer, or the respective authorized representative.

4. For all work on railroad right-of-way, the Contractor shall notify the Railroad Division Superintendent at least 72 hours before entering railroad right-of-way to begin construction.

5. Before installing the casing pipe, retain at the Contractor's own expense the services of a competent civil and/or geotechnical engineer with 5 years demonstrated experience in the design and installation of boring pits, casing pipe, carrier pipe and appurtenances, grouting, and dewatering. The aforementioned engineer shall approve and affix his/her stamp to the Contractor's drawings and design concept for the jackings. The drawings and design concept shall include but not be limited to the dewatering, soil stabilization, boring pits, reaction blocks, and installation schedule. The Contractor's engineer shall avail himself of all the available information contained on the Contract Drawings and herein and shall be responsible for making whatever additional investigations of the site and the conditions thereon that he/she may deem necessary.

6. Continuously keep the auger pits' subgrade free from ground and surface waters during the operation and dewater using well points along the length of each jacking alignment. Observed water levels before construction are to be below the invert elevation of the auger pits and casing pipe. Groundwater control along and at the face of the casing pipe shall include chemical grout stabilization as required.

7. The Contractor shall be fully responsible for inspecting the location where the pipes are to be installed and shall familiarize himself/herself with the conditions under which the work will be performed and with all necessary details as to the orderly prosecution of the work. The omission of any

details for the satisfactory installation of the work in its entirety that may not appear herein shall not relieve the Contractor of full responsibility.

8. Prepare to work at night and on Saturday and Sunday, if required to complete the work and approved by the Town, highway department, or railroad. After the operation has begun, work continuously (24 hours a day) until the complete length of pipe has been installed.

9. If any movement or settlement occurs which causes or might cause damage to existing structure over, along, or adjacent to the work, immediately stop any or all work except that which assists in making the work secure and in preventing further movement, settlement, or damage. Resume auger boring only after all necessary precautions have been taken to prevent further movement, settlement, or damage, and repair the damage, at the Contractor's own cost and to the satisfaction of the Engineer of Record.

E. Damage

1. Highway: Repair costs of settlement or other damage to the roadway within a period of 2 years after completion of boring or tunneling operations shall be the responsibility of the Contractor, at no expense to the Town or highway department.

2. Railroad: Existing construction features, structures, and facilities damaged or disturbed because of the Contractor's operations shall be repaired by the Contractor in a manner satisfactory to the Engineer of Record and the railroad, at no additional expense to the Town or railroad, within 1 year after completion of boring or tunneling operations.

F. Blasting

1. Highway: No blasting will be done without prior written approval of the responsible Highway Engineer. If requested, the Contractor shall furnish the Highway Department with details of the proposed blasting method. Blasting shall comply with all Federal, State, and Local regulations pertaining to the use of explosives. If rock is encountered before approaching the shoulder or pavement, the first four series of charges shall be used in determining the amount of controlled blasting to be used before beginning any blasting beneath the shoulders or pavement or the highway; however, if rock is encountered after proceeding beneath the pavement, only small charges shall be used until the proper amount of charge is determined.

2. Railroad: No explosives or blasting will be permitted in connection with boring or tunneling operations without prior written approval of the railroad. When requesting approval to blast on railroad right-of-way, the Contractor shall provide the following at no additional cost to the Town and as necessary to comply with railroad requirements.

   a. Certificate of insurance (in the amount required by the railroad) with proof that explosion, collapse, and underground coverage is provided. The certificate shall show that insurance coverage is provided for the contractual liability assumed by the Town in his encroachment agreement with the railroad.
   b. Blasting procedure (including load, drill, and shooting pattern) shall be submitted. If the railroad engages the services of an independent blasting expert to monitor blasting, the cost of this expert will be paid by the Town. All other costs associated with meeting railroad encroachment requirements shall be paid by the Contractor.

G. Submittals: The Contractor shall submit the following to the Engineer of Record at least 8 weeks before the scheduled start of any work associated with the construction of auger pits or auger operations, as evidence of compliance with the requirements of this Section. Acceptance of the submitted material by Engineer of Record does not indicate acceptance of responsibility for the means and methods of construction. The Contractor shall be responsible for the entire auger jacking operation.

1. Work Plan detailing the equipment, materials, sequence, and procedures for boring, jacking, and tunneling operations and installation and grouting of the pipe within the casing, including provisions for standby and backup equipment.

2. Qualifications of the Subcontractor.

3. Shop drawings showing size, location, and design calculations for reaction blocks and auger pits, including carrier pipes, pumps, and temporary bulkheads.

4. Number and capacities of jacks.

5. Size, arrangement, and installation of chemical grout soil stabilization and dewatering equipment.

6. Revisions to shop drawings as necessary to accommodate field conditions and/or comply with the requirements specified herein.

PART 2 PRODUCTS

2.01 MATERIALS

A. Carrier Pipe shall be Pressure Class 350 ductile iron pipe and shall additionally meet the piping material requirements specified in the specification section(s) applicable for the type of flow to be conveyed. The carrier pipes shall be supported by casing spacers within the casing pipe.

1. Casing Spacers: Casing spacers shall be a two-piece prefabricated unit by a single manufacturer. All casing spacers in a single casing pipe crossing shall be by the same manufacturer. Casing spacers shall have a shell made from either 304 stainless steel, 14-gauge mild steel which has been heat fusion coated with PVC plastic, (PVC coating shall be .01 inch thick over the entire band including the runner studs) or high density polyethylene. Casing spacers on 16-inch and smaller carrier pipe shall have 8-inch-wide steel bands, and casing spacers on 18-inch and larger carrier pipe shall have 12-inch-wide steel bands, except high-density polyethylene spacers shall have high density polyethylene bands. All casing spacers for 14-inch and smaller pipe size shall have four 10- gauge or 14-gauge steel risers with runners, and casing spacers for 16-inch and larger pipe shall have six 10-gauge or 14-gauge steel risers with runners (two top and four bottom), except high density polyethylene spacers shall have one riser for every diameter inch of carrier pipe. The runners (risers) shall be either glass reinforced plastic, ultra-high-molecular-weight (UHMW) polymer or high density polyethylene. All nuts, bolts, and washers shall be 304 stainless steel. All risers over 2 inches in height shall be reinforced. Wooden skids are not an acceptable alternate.

B. Jack and Bore Casing Pipe shall be new prime steel pipe conforming to the requirements of ASTM A139/A139M, Grade B and shall be the sizes shown on the Drawings. Casing pipe sections shall have beveled ends with a single v-groove and shall be full penetration butt welded on the outside of the casing pipe for the field welded water pipe joints. All joints of the steel casing pipe shall be butt welded before being subject to the jacking operation. The welded joints shall be wire brushed and painted with bitumastic enamel coating in accordance with AWWA C203. Steel casing pipe shall have a minimum yield strength of 35,000 psi, be equipped with grout holes as specified herein, be designed to withstand Cooper's E-80 railroad loading where the steel casing pipe crosses under railroad tracks and conform to AWWA C200 and ASTM A53/A53M. Steel

casing pipe shall be painted inside and outside with two coats bitumastic enamel coating paint in accordance with AWWA C203.

1. The inside diameter of the casing pipe shall be such as to allow the carrier pipe to be removed subsequently without disturbing the casing or the roadbed. For steel pipe casing, the inside diameter of the casing pipe shall be at least 2 inches greater than the largest outside diameter of the carrier pipe joints or couplings, for carrier pipe less than 6 inches in diameter; and at least 4 inches greater for carrier pipe 6 inches and over in diameter. The minimum casing pipe size and wall thickness shall be as shown in the following table for the carrier pipe size indicated.

Carrier Pipe Nominal Inside Diameter (inch)	Casing Pipe Nominal Inside Diameter	Coated or Catholically Protected Casing Pipe Nominal Wall Thickness (Inch)	Uncoated or Unprotected Casing Pipe Nominal Wall Thickness (Inch)
4	10	0.188	0.188
6	14	0.188	0.250
8	16	0.219	0.281
10	18	0.250	0.312
12	20	0.281	0.344
14	22	0.281	0.344
16	26	0.312	0.406
18	28	0.375	0.438
20	30	0.406	0.469
24	34	0.469	0.532
30	40	0.531	0.594
36	46	0.594	0.657

2. For casing pipe crossings under roadways, railroads, or other installations not within the jurisdiction of the Town: The Contractor shall comply with the regulations of said authority concerning design, specifications, and construction. However, in no case shall the minimum casing pipe diameter and wall thickness for a specific carrier pipe size be less than that specified in the above table.

C. Steel Liner Plate for Tunnels: For sizes greater than 48-inch diameter, steel liner plate shall be used. Steel liner plate for tunnels shall be fabricated from structural, hot rolled, carbon-steel plates conforming to ASTM A1011/A1011M and of the four-flange Type 10 gauge, or the two-flange Type 12 gauge, with lap seam longitudinal joint, with ultimate tensile strength of 42,000 psi and yield strength of 28,000 psi. Liner plates shall be galvanized in accordance with

AASHTO M 167 and bituminous coated in accordance with AASHO M 190. Thickness of liner plate shall be not less than 0.105 inch (12-gauge).

1. Bolts, nuts, washers, and other accessory hardware shall be hot-dipped galvanized in accordance with ASTM A153/A153M.

2. Grout holes shall be provided in the liner plate at not more than 4-foot-6-inch centers along the tunnel and staggered around the circumference of the liner. Grout holes shall be threaded with cast iron plugs.

D. Cement grout shall consist of a mixture of about 1 part cement to 2 parts sand which shall be subject to increase or decrease in the amount of cement necessary or as permitted, to provide good flowing characteristics.

E. Sand fill shall be of such sizes that when dry 100 percent by weight shall pass a No. 20 sieve and not over 5 percent by weight shall pass a No. 100 sieve.

F. Mortar shall consist of 1 part cement, 1/4 part lime, and 2 parts sand. Sand shall comply with ASTM C9; lime shall comply with ASTM C207, Type 5; cement shall comply with ASTM C150/C150M. Type II.

PART 3 EXECUTION

3.01 INSTALLATION

A. Casing pipes crossing under Town roadways shall be located at suitable approved alignments in order to eliminate possible conflict with existing or future utilities and structures, with a minimum of 36-inch depth of cover between the top of the casing pipe and surface of the roadway where practicable.

B. For casing pipe crossings under roadways, railroads, or other installations not within the jurisdiction of the Town: The Contractor shall comply with the regulations of said authority regarding design, specifications, and construction. However, in no case shall the minimum casing pipe diameter and wall thickness for a specific carrier pipe size be less than that specified in this specification.

C. Bored, jacked, or tunneled installations shall have a bore hole essentially the same as the outside diameter of the pipe plus the thickness of the protective coating.

D. Carrier pipe shall be installed in a manner to provide proper line and grade. Carrier pipe shall be adequately anchored to prevent movement, including flotation. Contractor shall submit his proposed method of installation and details of anchorage for the Engineer of Record's approval before installation.

E. Casing up to and including 48-inch-diameter shall be bored unless conditions require tunneling. The decision to tunnel for casing of this size will be made by the Town based upon available information and following discussions with the Engineer and Contractor. In some cases, casing may be bored initially, with the remaining portion tunneled where conditions encountered require tunneling.

F. Boring and Jacking Pits:

1. Required boring and jacking pits or shafts shall be excavated and maintained to the minimum dimension. Said excavations shall be adequately barricaded, sheeted, braced, and dewatered as required. The distance between the edges of the jacking pit and the pavement is 6 feet minimum.

2. Furnish, install, and remove, to the extent required, thrust restraints or other provisions which may be required in driving the casing and carrier pipes forward.

3. Steel rails or beams embedded in the concrete shall be used in the pit for placement and alignment of each piece of steel casing pipe or ductile iron carrier pipe during installation operations.

4. The Contractor shall be fully responsible for the removal of the pits including the breaking up, removing, and disposing of concrete, if so required or cutting off sheeting and furnishing and placing approved fill to the normal subgrade as may be required following the installation operations.

G. Dewatering:

1. Provide sumps, wells, or well points around or within the auger pit to maintain the groundwater at least 2 feet below the bottom of the pit.

2. Provide well points along the alignment of the jacked casing pipe to maintain the groundwater at least 2 feet below the bottom of the jacked casing pipe.

3. Provide each dewatering system with adequate protection against pumping fines from the subgrade soils. Should soil particles be observed in the discharge water, modify dewatering operations.

4. Maintain dewatering operations throughout auger/jacking operations.

H. Boring:

1. The boring and jacking operations shall be done simultaneously with continuous installation, until the casing pipe is in final position. Correct line and grade shall be carefully maintained. Add-on sections of casing pipe shall be full-ring butt welded to the preceding length, developing watertight total pipe strength joints. The casing installation shall produce no upheaval, settlement, cracking, movement, or distortion of the existing roadbed or other facilities.

2. Casing pipe holes shall be mechanically bored through the soil by a cutting head on a continuous auger mounted inside the pipe. The auger and cutting head arrangement shall be removable from within the pipe in the event an obstruction is encountered. The Contractor shall bear all cost of the bore as well as any corrective action required to meet line and grade requirements shown on the Drawings.

3. The distance to which excavation is carried ahead of the pipe shall be not more than is absolutely necessary for installation purposes, so that ground settlement adjacent to and within the limits of the pipeline crossing is eliminated. In order to minimize the amounts of voids produced during excavation in the forward end of the casing pipe, a positive stop shall be provided at the end of the casing pipe, which prevents the auger from extending beyond the end of the casing pipe. If voids occur or are encountered outside the pipe, grout holes shall be drilled at 10-foot centers in the top of the casing pipe the voids filled with cement grout at sufficient pressure to fill voids and prevent embankment settlement.

4. If it becomes necessary to abandon an incomplete or unacceptable bore, the abandoned casing shall be capped and filled completely with grout. The abandonment procedure shall be also approved by the highway department or railroad before starting abandonment procedure. Abandonment procedures shall be completed before moving to another boring location. All costs in connection with an abandoned bore, including the construction cost and capping and filling costs shall be at the Contractor's expense.

5. The casing pipe shall be adequately protected to prevent crushing or other damage under jacking pressure.

6. Use a steel or concrete jacking ring that allows the jacking pressure to be distributed evenly around the wall of the jacking pipe.

7. The use of a jacking frame shall be required. It shall be fabricated from structural steel members and shall be designed to distribute the stresses from the jacks evenly to the jacking ring.

8. Casing pipe shall be so constructed as to prevent leakage of a substance from the casing throughout its length, except at ends of casing. Casing shall be installed so as to prevent the formation of a waterway under the roadway or railroad, and with an even bearing throughout its length, and shall slope to one end (except for longitudinal occupancy).

9. After the casing pipe has been completely installed, thoroughly clean the interior. Place the carrier pipe within the casing pipe using casing spacers.

10. If a pipe is laid within a 2 horizontal to 1 vertical slope from a point 5.5 feet off the traffic way centerline, take precaution to keep the soil from running by either sheeting or other approvable methods to the Engineer of Design of the railroad or roadway being crossed.

11. After inspection, the ends of the casing shall be filled with 2,500 psi concrete not less than 8 inches thick.

I. Tunneling:

1. The completed tunnel liner shall consist of steel liner plates with bolted connections, installed to the required lines and grades, and in accordance with the manufacturer's instructions. Excavation shall be controlled so that the space outside the liner plate is held to a minimum.

2. The tunneling shall be conducted continuously, on a 24-hour basis until complete. At any interruption of the tunneling operation, the heading shall be completely bulkheaded.

3. Care shall be taken to insure that all parts of the system are maintained free from dirt.

4. All voids between the liner plate and the tunnel wall shall be filled with grout, containing no more water than necessary, placed under pressure through the grout holes provided in the tunnel liner plates. The grouting operations shall be done with the installation of the liner plates so that at no time will the grouting operations be further than 25 feet from the front end or head of the tunnel construction. Grouting shall be started in the lowest end and proceed continuously to the upper end. At the end of each day's operations, the voids outside installed liner plates shall be grouted whether 25 feet or less.

5. Grout shall be forced, under pressure, into each grout hole. If the grout from one hole flows along the liner plates so as to plug the next hole, the plug shall be opened by punching through the grout so that each hole may be used for grouting. The grouting operation shall be continued at each hole until all spaces outside the liner plates are filled and no grout will flow.

6. Apparatus for mixing and placing grout shall be capable of mixing effectively and stirring the grout and then forcing it into the annular space in a continuous uninterrupted flow.

7. Carrier pipe to be installed within the tunnel liner plates must be braced to sides and top of casing pipe with casing spacers as specified to prevent flotation or motion during the placing of grout.

8. After the carrier pipe is installed within the casing pipe or tunnel, conduct a leakage test on pipe as designated by the Engineer. Any leaks that are discovered during the testing phase shall be repaired to the satisfaction of the Engineer. Once the Engineer is satisfied with the leakage testing results, each end of the casing or tunnel shall be closed with 4-inch masonry or concrete bulkheads, with a drainage opening provided in the lower end to prevent the entrance of foreign material, but to allow leakage to pass in the event of a carrier break.

J. Gate Valves:

1. Gate valves in accordance with Section 11, Pipe, Fittings, Valves, and Appurtenances, shall be installed on each side of the casing as directed by the Utility Department.

END OF SECTION

SECTION 10
HORIZONTAL DIRECTIONAL DRILLING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section does not stand alone and is incorporated as part of the City Construction Specification Manual (CSM). The CSM shall be used for other requirements that may not be covered in this Section.

B. This Section includes furnishing all labor, materials, equipment, and incidentals necessary to complete each directional drill (or Horizontal Directional Drilling [HDD]) installation shown on the Drawings.

C. Directional drilling at additional locations must receive prior approval from the Public Services Director or his Designee.

D. Directional drilling must meet all of the Town of Howey-in-the-Hills, Florida Department of Transportation (FDOT), and other applicable agency requirements.

1.02 SUBMITTALS

A. The following general data is for information only.

1. A statement of qualifications on HDD jobs in the last 3 years. See Article 1.05 of this Section.

2. Include at a minimum the owner's name, address, telephone number, contact person, date and duration of work, location, pipe information, and contents handled by pipeline.

3. Supervisory field personnel and historical information of HDD experience.

B. Submit shop drawings and written procedures in accordance with the below Town of Howey-in-the-Hills requirements.

1. Size, capacity, and arrangement of equipment.
2. Location and size of drilling and receiving pits.
3. Dewatering and methods of removing spoils material.
4. Method of installing detection wire and pipe.

5. Type, location, and method of installing locator station.
6. Manufacturer's Catalog Data of the pipe.
7. Method of fusing pipe segment and type of equipment.
8. Type of cutting head.
9. Method of monitoring and controlling line and grade.
10. Method of detecting surface movement.

C. Maintain and submit complete drilling logs of guided directional drill operations upon completion of work.

D. A statement that the Contractor has inspected the drill rod and determined that the drill rod is in satisfactory condition for its intended use.

E. Submit all drilling fluids, additives, and mixtures for information only.

1. Products information, material specifications, and handling procedures.
2. Material safety data sheet and special precautions required.
3. Method of mixing and application.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Society for Testing and Materials (ASTM)

1. ASTM A48/A48M—Standard Specification for Gray Iron Castings.
2. ASTM A307—Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength.
3. ASTM D3261—Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
4. ASTM D3350—Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
5. ASTM D4976—Standard Specification for Polyethylene Plastics Molding and Extrusion Materials
6. ASTM F714—Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter.
7. ASTM F1804—Standard Practice for Determining Allowable Tensile Load for Polyethylene (PE) Gas Pipe During Pull-In Installation.

B. American Water Works Association (AWWA)

1. AWWA C207—Steel Pipe Flanges for Waterworks Service – Sizes 4 Inch Through 144 Inch (100 mm Through 3,600 mm).
2. AWWA C906—Polyethylene (PE) Pressure Pipe and Fittings, 4 Inch Through 65 Inch (100 mm Through 1,650 mm), for Waterworks.

C. NSF International (NSF)

1. NSF/ANSI 61—Drinking Water System Components – Health Effects.

1.04 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall inspect materials delivered to the site for damage. All materials found during inspection or during the progress of work to have cracks, flaws, surface abrasions, or other defects shall be rejected and removed from the job site.

B. The Contractor is responsible for disposing of fluids. Disposal of fluids shall be done in a manner that complies with all permits and applicable Federal, State, and Local regulations.

1.05 QUALIFICATIONS

A. The Contractor and his field supervisor assigned to this project must be experienced in work of this nature and must have successfully completed a minimum of 10 similar projects of similar length, pipe type, pipe size, and soil type using directional drilling in the last 3 years. As part of the bid submission, the Contractor shall submit a description of such project(s) that shall include, at a minimum, a listing of the location(s), date of project(s), owner, pipe type and size installed, length of installation, type and manufacturer of equipment used, and other information relevant to the successful completion of the project.

PART 2 PRODUCTS

2.01 DRILL ROD

A. The Contractor shall select the appropriate drill rod to be used. The Contractor shall inspect and approve the drill rod before the drill rod arrives at the work site.

2.02 PRODUCT PIPE

Each product pipe to be installed shall be High Density Polyethylene (HDPE) as per AWWA C906.

A. Carrier: HDPE pipe shall be DR 11, working pressure rating of 160 psi. Pipe shall be manufactured in accordance with the Appendix A, Approved Manufacturer List of the City CSM.

1. Material for pipes to be used for potable water application shall be approved by the National Sanitation Foundation (NSF). All fittings, sizes 4-inch and larger shall meet the requirements of AWWA C906. All fittings shall be ductile iron pipe size. All fittings shall meet the requirements of ANSI/NSF 61. All fittings shall be made of materials conforming to polyethylene code designation PE 3408. Standard dimension ration shall be DR11. Pressure Class shall be 160 psi.

2. Color Coding: The piping shall be permanently coded to provide service identification. Stripes along the entire outside length of the pipe, 120 degrees apart, shall be made by coextrusion or impregnation in accordance with the following schedule. Fully colored pipe co-extruded from permanently pigmented HDPE is also acceptable.

Service	Striped Pipe	Solid Colored Pipe
Potable Water	Blue Stripes	Blue
Reclaimed Water	Pantone Purple Stripes	Pantone Purple
Wastewater	Green Stripes	Green

3. Marking on the pipe shall include the following:

a. Nominal size and outside diameter (OD) base.
b. Standard material code designation.
c. Dimension ratio.
d. Pressure class.
e. AWWA designation (AWWA C906).
f. Material test category of pipe.

2.03 TRACER WIRE

A. All piping shall be installed with two, continuous, insulated, 10-gauge high-strength, copper-clad carbon steel wire with 45-mil minimum insulation for location purposes by means of an electronic line tracer. The wire shall have a breaking strength of 1,150 pounds minimum.

B. The wire insulation shall be solid color in accordance with the coding described below.

1. Potable Water – Blue.
2. Sanitary Sewer and Force Mains – Green.
3. Reclaimed Water – Pantone Purple.
4. Raw Water – Black.

C. Tracer wire must be taped onto the pipe every 20 feet. Splicing of wires is not allowed for pipe installed by directional drilling.

D. Tracer wires shall begin and terminate in the locate station boxes or valve boxes on either end of the directional drill. Locate station boxes shall not be installed in streets or driveways. The length of each tracer wire in each box shall be long enough to extend between 1 foot and 2 feet above ground level.

E. After construction is complete, but before final inspection, the City inspector will test the tracer wire with standard City locating equipment. If the inspector determines that the tracer wire is not operating properly, the Contractor shall locate and correct the problem at his expense. The main will not be accepted and placed into operation until the tracer system is acceptable to the City.

2.04 FITTINGS AND RESTRAINERS

A. Pipe flange joints shall be made using a flange adapter, which is butt fused to the HDPE pipe. A back-up ring shall be fitted behind the flange adapter sealing surface flange for bolting to the mating flange. Standard back-up rings shall be AWWA C207 Class D for 160 psi and lower pressure ratings. One edge of the back-up ring must be chamfered to fit up against the back of the sealing surface flange. Mechanical joints to polyethylene pipe shall be fully constrained by compressing the pipe OD against a rigid tube or stiffener in the pipe bore. The stiffener shall be stainless steel. Approved joint restraining devices shall be manufactured in accordance with Appendix A, Approved Manufacturer List of the City CSM.

2.05 DRILLING FLUIDS

A. A high-quality bentonite drilling fluid shall be used to ensure hole stability, cuttings transport, bit and electronics cooling, and hole lubrication to reduce drag on the drill pipe and the product pipe. Composition of the fluid must comply with all Federal, State, and Local environmental regulations.

B. The bentonite drilling fluid shall be mixed with potable water (of proper pH) to ensure that no contamination is introduced into the soil during the drilling, reaming, or pipe installation. The Contractor is responsible for any required pH adjustments.

PART 3 EXECUTION

3.01 PREPARATION

A. The Contractor may use the road right-of-way as necessary for the directional drill operations. The Contractor shall comply with all Town of Howey-in-the-Hills, FDOT, Lake County, and local traffic and permit requirements, including providing proper traffic maintenance plans and following the required maintenance plan procedures. The Contractor shall also follow FDOT rules concerning drilling under Town of Howey-in-the-Hills and FDOT rights-of-way concerning minimum depth and other depth requirements based on water table elevation, confining layer location, soils data, and existing utility conflicts.

B. Directional drilling equipment machine safety requirements shall include a common grounding system to prevent electrical shock in the event of underground electrical cable strike. The grounding system shall connect all pieces of interconnecting machinery; the drill, mud mixing system, drill power unit, drill rod trailer, operator's booth, worker grounding mats, and any other interconnected equipment to a common ground. The drill shall be equipped with an "electrical strike" audible and visual warning system that will notifythe system operators of an electrical strike.

C. The Contractor shall provide equipment to guard against electrocution and an alarm system on drilling equipment capable of detecting electrical current as it approaches electric lines.

D. Test pit underground utilities crossing before HDD operation.

3.02 DRILL ENTRANCE AND EXIT PITS

A. The Contractor shall be responsible for designing and constructing the drill entrance and exit pits. If the Contractor requires additional area to perform the directional drilling operation outside of the City, FDOT, and County rights-of-way, the Contractor shall include in his bid the cost to acquire all necessary temporary construction easements to construct the required work.

B. Drill entrance and exit pits are required and shall be maintained at minimum size to allow only the minimum amount of drilling fluid storage before transfer to mud recycling or processing system or removal from the site.

C. Drilling mud shall not be allowed to flow freely on the site or around the entrance or exit pits. Mud spilled shall be removed as soon as possible and the ground restored to its original condition. Pits shall be shored to OSHA standards.

D. When drilling near wetlands or watercourses, the Contractor shall provide secondary containment to prevent drilling fluids from entering the wetlands area or watercourse by using sandbags or other acceptable means as approved by the Public Services Director.

3.03 DRILL ENTRANCE AND EXIT ANGLE

A. Entrance and exit angles shall be at the Contractor's discretion so that the elevation profile maintains adequate cover to reduce the risk of drilling fluid breakouts and to ensure that ground exit occurs as specified in this Section. The Contractor shall be responsible for ensuring that entrance and exit angles ensure that pullback forces do not exceed a 5% strain on the polyethylene pipe.

B. The entry angle typically should be 12º to 14º (not to exceed 15º) and the exit angle should be 6º to 12º to facilitate the pullback operation.

3.04 DRILLING FLUIDS

A. The Contractor shall maintain drilling fluid in borehole to increase stability of the surrounding soil and reduce drag on pulled pipe.

B. The Contractor shall be responsible for disposing of the drilling fluids in compliance with all relative environmental regulations, right-of-way and workspace agreements, and permit requirements.

C. Drilling fluid returns can be collected in the entrance pit, exit pit, or spoils recovery pit. The Contractor shall immediately clean up any drilling fluid spills or overflows from these pits.

D. The Contractor shall provide drilling fluid relief holes as required to prevent heaving of earth, pavement, or roads. The Contractor shall properly seal the relief holes in a timely manner to prevent any damage or injury.

E. The Contractor shall minimize drilling fluid at locations other than entry and exit points. Immediately clean up any drilling fluids that inadvertently surface.

3.05 PILOT HOLE

A. The pipe shall have a minimum cover of 36 inches.

B. The type and size of the pilot string cutting head and the diameter of the drill pipe shall be at the Contractor's discretion.

C. Determine drilling length and equipment pull strength for type of soil encountered.

D. The pilot hole shall be drilled along the path shown on the Drawings. Pilot hole tolerances are as follows:

1. Vertical tolerance: Provide a minimum of 10 times the bore hole diameter of cover below ditch bottoms and roads with a tolerance of plus or minus 1 foot. The Contractor may go deeper if necessary to prevent breakout.

2. Horizontal tolerance: 2 feet from the centerline of the product pipe.

3. Curve Radius: No curve will be accepted with a radius less than the pipe manufacturer's recommendations.

4. Entry Point Location: The Contractor shall establish the pilot hole entry point.

5. Exit Point Location: The Contractor shall establish the exit point location.

E. The installed pipeline cover requirements as shown on the Drawings and as specified in this Section shall not be violated.

F. At completion of pilot hole drilling, furnish Public Services Director with tabulations of horizontal and vertical alignment.

3.06 REAMING

A. Reaming operations shall be conducted at the Contractor's discretion. The type of back reamer to be used shall be determined by the type of subsurface soil conditions encountered during the pilot hole drilling operation. The reamer type shall be at the Contractor's discretion.

3.07 PULL BACK

A. The entire pipeline to be installed via direction drilling shall be fully assembled before pull back operations begin.

B. The pipeline shall be supported during pullback operations to allow freedom of movement and prevent damage. The pipeline shall be installed in one continuous pull.

C. Torsional stress shall be minimized by using a swivel to connect the pull section to the reaming assembly.

D. Maximum allowable tensile force imposed on the pull section shall not exceed 90% of the pipe manufacturer's safe pull (or tensile) strength. If the pull section is made up of multiple pipe sizes or materials, the lowest safe pull strength value shall govern and the maximum allowable tensile force shall not exceed 90% of this value.

E. Minimize external pressure when installing the pullback section in the reamed hole. The Contractor shall replace damaged pipe resulting from external pressure at no cost to the Owner. Buoyancy modification shall be at the discretion of the Contractor.

F. Pull detection wire along with HDPE pipe. Extend wire into locator station at each end of HDPE pipe.

3.08 GUIDANCE SYSTEMS

A. A magnetic survey tool located behind the pilot string cutting head shall be used.

3.09 GATE VALVES

A. Gate valves in accordance with Section 11, Pipe, Fittings, Valves, and Appurtenances, shall be installed on each side of the HDD-installed pipe as directed by the Public Services Department.

3.10 RECORD DRAWINGS AND DOCUMENTATION

A. Record Drawings shall include a plan, profile, and all information recorded during the work. The Record Drawings shall be tied to the project's survey control and shall be provided in the version of AutoCAD in use by the Town of Howey-in-the-Hills.

B. The Contractor shall maintain drilling logs that accurately provide drill bit location (both horizontally and vertically) at least every 15 feet along the drill path. In addition, the Contractor shall keep logs that record, at a minimum, the following every 15 minutes throughout each drill pass, back ream pass, or pipe installation pass:

1. Drilling fluid pressure.
2. Drilling fluid flow rate.
3. Drill thrust force.
4. Drill pullback force.
5. Drill head torque.

C. The Public Services Director and his Designee shall have access to instrumentation, readings, and logs at all times during operation.

3.11 UTILITY LOCATES

A. The Contractor shall locate all utilities before excavating or drilling. The Contractor shall be responsible for damage to utilities and shall repair damaged utilities at no cost to the City.

3.12 CLEANUP

A. Immediately upon completion of work of this Section, the Contractor shall remove all rubbish and debris from the job site. All construction equipment and implements of service shall be removed and the entire area involved shall be left in a neat condition acceptable to the Public Services Director.

B. "Blow holes" or "breakouts" of drilling fluid to the surface shall be cleaned up immediately and the surface area returned to its original condition. All drilling fluids, spoils, and separated materials shall be disposed of in compliance with Federal, State, and Local environmental regulations.

C. The Contractor shall repair any damage caused by the Contractor to City, FDOT, or Lake County roads or property to the satisfaction of the respective agency.

APPENDIX A
DIRECTIONAL BORE DESIGN FACTORS

Calculations for computing the maximum safe pull back force should be submitted with the project design package. The following equations from the PLEXCO Polyethylene Industrial Piping Systems; "Technical Information; Technical Note: HDD (Guided Bore) with PLEXCO Pipe," are presented for estimating **some** of the factors to be considered in designing a successful directional bore. They are based upon approximations and are for "ideal" conditions. They are by no means all of the considerations to be used in designing a directional bore. The designer is responsible for the design of the directional bore and use of the following shall not transfer any of that responsibility to the City. The City makes no claim to the accuracy or completeness of the equations.

(a) **PULLBACK FORCE**: The pullback force is calculated at the leading end of the pipe behind the pulling head. For pipe pulled in straight level bores, the frictional resistance or required pulling force, *P F*, is approximated by: Where is the coefficient of friction between pipe and ground; is the net downward or upward force on the pipe (lb/ft); and L is the length (ft).

(b) **FRICTIONAL RESISTANCE OF DRILLING MUD**: The frictional resistance is highest just before movement and decreases with movement. When pullback ceases, frictional forces and drag forces increase due to the thyrotrophic nature of drilling mud. The mud starts to gel when it is undisturbed. Therefore, pullback should never be stopped, except for drilling rod removal, until the pipe is completely pulled into its permanent position.

(c) **BUOYANT FORCE**: The pullback force will depend on whether the pipe is full or deliberately weighted to reduce buoyancy. Buoyant force pushes the pipe up against the top of the borehole, creating a frictional drag between the pipe and the borehole. The buoyant weight of the pipe is: Where: D = pipe outside diameter, = specific weight of the mud slurry (lb/ft), and = weight of empty pipe.

(d) **MINIMUM RADIUS OF CURVATURE**: Drill path curvature, at the entry and exit pits, is limited by the steering capabilities of the boring equipment. Drilling rod typically has a bending radius is around 150 or less, the safe pulling strength of PE pipe may be significantly reduced by the additional tensile stresses due to curvature.

(e) **CAPSTAN EFFECT**: For pipe pulled around a curve (vertical or horizontal) creating an angle, (in radians), the capstan effect, Where: = coefficient of friction between pipe and slurry or pipe and ground, = net downward (or upward) force on pipe (lb/ft), e = natural logarithm base (e = 2.71828) and L = length (ft).

(f) **SAFE PULL FORCE**: The safe pull stress may be calculated by subtracting the bending stress due to curvature from the allowable tensile stress: The "safe

pull force" can be found by multiplying the safe pull stress by the cross-sectional area of the pipe. Where: = allowable tensile stress (psi), D = outer diameter of pipe (in), DR= Dimension Ratio and E = time-dependent modulus of elasticity (psi) from tables.

(g) **NET SAFE PULL FORCE**: All bending stresses due to various curvatures in the boring path are additive and should be subtracted from the safe pull force.

(h) **TIME DEPENDENCE**: The "safe" pull-load is time dependent. See ASTM F1804 for safe pullback values for PE pipe, less bending stresses. For additional sources of information, the designer is referred to the following reference sources: Mini-Horizontal Directional Drilling Manual (1995), North American Society of Trenchless Technology (NASTT), Chicago, IL PPI Handbook of Polyethylene Piping (1998), Plastics Pipe Institute, and Washington, D.C.

APPENDIX B
DIRECTIONAL BORE GUIDELINES

Pipe Size (inches)	Safe Pull Strength (lbs)	Minimum Bend Radius (inches)	Wall Thickness	Maximum Defect Depth
4	7,600	96	.36	1/16
6	15,800	138	.55	1/11
8	27,200	181	.73	5/32
10	41,000	222	.91	3/16
12	57,900	264	1.10	1/4

1. Schedule the bore with the Town of Howey-in-the-Hills Public Services Department 48 hours (2 working days) before boring.
2. If bore is over 100 linear feet, the Contractor needs to fuse pipe together the day before.
3. The Contractor needs to physically locate existing utilities, following the 48-hour Sunshine One-Call Guidelines.
4. Material Inspection: To be done before the bore is scheduled.
5. Surface cuts or scratches greater than or equal to maximum defect depth are not acceptable.
6. Blue stripe for Water; Green stripe for sanitary force main; Purple stripe for reclaimed water.
7. Two tracing wires attached to pipe.
8. Performing the bore: Set up the bore log. Calibrate the Contractor's locator with actual depth measurement – check the depth of the first rod. Ream the borehole.
9. Check the flow of bentonite – must be continuous.
10. Check the pulling pressure.
11. Do not allow operator to exceed safe pull strength.
12. Mark up drawing with "As-Built" data.
13. Record pullback pressure.
14. Fuse DR11 together – minimum 440º F to maximum 460º F.
15. Cool down time equals: Diameter ÷ 2.

TOWN OF HOWEY-IN-THE-HILLS

DIRECTIONAL BORE STANDARDS
Directional Bore Log

Project Name: _____

Project Number: _____ **Date:** _____

Contractor/Site Representative: _____

Bore Location/Number: _____ **Size/Material:** _____

Starting Location: _____ **Bore Rod Length:** _____

No.	Total Length	Distance from Start Point	Depth	Pull Back Pressure	Comments
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

***Lengths to be measured in rod Length increments**

Inspector/City Representative:_____ Contractor:_____

END OF SECTION

SECTION 11
PIPE, FITTINGS, VALVES, AND APPURTENANCES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section does not stand alone and is incorporated as part of Town Construction Specification Manual (CSM). The CSM shall be used for other requirements that may not be covered in this Section.

B. This Section includes the material standards for pipe, fittings, valves, and appurtenances, as applicable to potable water, wastewater, and reclaimed water installations, unless noted or specified elsewhere in the Town CSM.

C. Required specialty items not included under this Section shall be high quality and consistent with approved standards of the industry for the applicable service installation, and shall be approved by the Public Services Director or his Designee before installation.

D. All material is to be furnished by the Contractor or Developer, with the exception of meters and meter couplings.

E. The Contractor shall furnish and install all supplementary or miscellaneous items, appurtenances, and devices incidental to or necessary for a sound, secure, and complete installation, although such work is not specifically indicated.

F. The Contractor is responsible for the coordination of work with other trades. All references to Industry Standards (ASTM, ANSI, AWWA, etc.) shall be to the latest revision unless otherwise stated. Only those materials included in the Town of Howey-in-the-Hills CSM shall be installed.

G. The minimum pipe inside diameter for all potable water mains shall be 8 inches.

H. All piping and equipment of the same type shall be from one manufacturer, unless authorized in writing by the Town or the Town's representative.

I. It is the Contractor's responsibility to field verify and restrain all existing connection points.

1.02 SUBMITTALS

A. All submittals shall be submitted in accordance with the shop drawing submittal requirements as specified in Section 1, General Provisions.

1. Shop Drawings: The Contractor shall submit catalog cut sheets, manufacturer's descriptive literature, and other necessary information to the Public Services Director for approval before installation.

2. Certifications: The Contractor shall submit a certification from the pipe and valve manufacturer that the pipe, fittings, and valves supplied are new, have been manufactured for this project, and have been inspected at the plant.

1.03 GENERAL REQUIREMENTS

A. All pipe and fittings shall be clearly marked with the name or trademark of the manufacturer. All pipe and fittings shall be suitable for 150 psi working pressure and shall meet all applicable AWWA specifications. All pipe installations shall have indicator tape run with pipe to indicate the purpose of piping (potable water, wastewater, and reclaimed water) and copper tracing wire for location purposes. No 3-inch pipe shall be allowed for use in the Town's utility systems.

B. Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

1.04 DUCTILE IRON PIPE, VALVES, AND FITTINGS

Ductile iron pipe and fittings shall conform to the latest revision of the following standards:

A. The American Society of Mechanical Engineers (ASME)

1. ASME B1.1—Unified Inch Screw Threads, (UN and UNR Thread Form).
2. ASME B16.1—Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
3. ASME B16.21—Nonmetallic Flat Gaskets for Pipe Flanges.

B. American Society for Testing and Materials (ASTM)

1. ASTM A48/A48M—Standard Specification for Gray Iron Castings.

2. ASTM A193/A193M—Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.
3. ASTM A194/A194M—Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
4. ASTM A307—Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 psi Tensile Strength.
5. ASTM A536—Standard Specification for Ductile Iron Castings.
6. ASTM A563—Standard Specification for Carbon and Alloy Steel Nuts.
7. ASTM B117—Standard Practice for Operating Salt Spray (Fog) Apparatus.
8. ASTM C150/C150M—Standard Specification for Portland Cement.
9. ASTM C283—Standard Test Methods for Resistance of Porcelain Enameled Utensils to Boiling Acid.
10. ASTM D714—Standard Test Method for Evaluating Degree of Blistering of Paints.
11. ASTM D792—Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
12. ASTM D1238—Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer.
13. ASTM E96/E96M—Standard Test Methods for Water Vapor Transmission of Materials.
14. ASTM G95—Standard Test Method for Cathodic Disbondment Test of Pipeline Coatings (Attached Cell Method).

C. American Water Works Association (AWWA)

1. AWWA C104—Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
2. AWWA C110—Ductile-Iron and Gray-Iron Fittings.
3. AWWA C111/A21.11—Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
4. AWWA C115—Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
5. AWWA C150—Thickness Design of Ductile-Iron Pipe.
6. AWWA C151/A21.51—Ductile-Iron Pipe, Centrifugally Cast.
7. AWWA C153—Ductile-Iron Compact Fittings.
8. AWWA C207 – Steel Pipe Flanges for Waterworks Service – Sizes 4-Inch through 144-Inch (100 mm through 3,600 mm).
9. AWWA C600—Installation of Ductile-Iron Water Mains and Their Appurtenances.
10. AWWA C651—Disinfecting Water Mains.

11. AWWA C700—Cold-Water Meters – Displacement Type, Metal Alloy Main Case.
12. AWWA C800—Underground Service Line Valves and Fittings.

D. International Organization for Standardization (ISO)

1. ISO 9002—Quality Systems – Model for Quality Assurance in Production, Installation, and Servicing.

E. NSF International (NSF)

1. NSF/ANSI 61—Drinking Water System Components – Health Effects.

F. University of Southern California (USC)

1. The USC Foundation for Cross-Connection Control.

1.05 POLYVINYL CHLORIDE (PVC) PRESSURE PIPING AND FITTINGS

PVC pressure pipe and fittings shall conform to the latest revision of the following standards:

A. American Society of Testing Materials (ASTM)

1. ASTM A242/A242M—Standard Specification for High-Strength Low-Alloy Structural Steel.
2. ASTM A536—Standard Specification for Ductile Iron Castings.
3. ASTM D2241—Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
4. ASTM F477—Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

B. American Water Works Association (AWWA)

1. AWWA C900—Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4-Inch to 60-Inch (100 mm to 1,500 mm).

1.06 HIGH-DENSITY POLYETHYLENE (HDPE) PIPE

HDPE pipe shall conform to the latest revision of the following standards:

A. American Society for Testing and Materials (ASTM)

1. ASTM A307—Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 psi Tensile Strength.

2. ASTM D3261—Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
3. ASTM D3350—Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
4. ASTM D4976—Standard Specification for Polyethylene Plastics Molding and Extrusion Materials.
5. ASTM F714—Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter.

B. American Water Works Association (AWWA)

1. AWWA C151/A21.51—Ductile-Iron Pipe, Centrifugally Cast.
2. AWWA C901—Polyethylene (PE) Pressure Pipe and Tubing, 1/2-Inch (13 mm) through 3-Inch (76 mm), for Water Service.

C. International Organization for Standardization (ISO)

1. ISO 9001—Quality Management Systems – Requirements.

1.07 SMALL DIAMETER PIPE

Small diameter pipe (3-inch and smaller) shall only be used when directed by Public Services Director or his Designee and shall conform to the latest revision of the following standards:

A. American Society for Testing and Materials (ASTM)

1. ASTM A53/A53M—Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. ASTM A90/A90M—Standard Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
3. ASTM A105/A105M—Standard Specification for Carbon Steel Forgings for Piping Applications.
4. ASTM A182/A182M—Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
5. ASTM A193/A193M—Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.
6. ASTM A194/A194M—Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
7. ASTM A312/A312M—Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenistic Stainless Steel Pipes.

8. ASTM A320/A320M—Standard Specification for Alloy-Steel and Stainless Steel Bolting for Low-Temperature Service.
9. ASTM D1784—Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
10. ASTM D1785—Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
11. ASTM D2464—Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
12. ASTM D2466—Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
13. ASTM D2467—Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
14. ASTM D2564—Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
15. ASTM D2657—Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings.
16. ASTM D2665 – Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
17. ASTM D2855—Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly(Vinyl Chloride) (PVC) or Chlorinated Poly(Vinyl Chloride) (CPVC) Pipe and Piping components with Tapered Sockets.
18. ASTM D3261—Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
19. ASTM D3311—Standard Specification for Drain, Waste, and Vent (DWV) Plastic Fittings Patterns.
20. ASTM F437—Standard Specification for Threaded Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
21. ASTM F438—Standard Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40.
22. ASTM F439—Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
23. ASTM F441/F441M—Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
24. ASTM F493—Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
25. ASTM F593—Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
26. ASTM F594—Standard Specification for Stainless Steel Nuts.

B. Plastic Pipe Institute (PPI)

1. PPI TR-31—Underground Installation of Polyolefin Piping.

C. American Society of Mechanical Engineers (ASME)

1. ASME B1.20.1—Pipe Threads, General Purpose (Inch).
2. ASME B16.5—Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard.
3. ASME B16.11—Forge Fittings, Socket-Welding and Threaded.
4. ASME B18.2.1—Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series).
5. ASME B36.10M—Welded and Seamless Wrought Steel Pipe.
6. ASME B36.19M—Stainless Steel Pipe.

D. National Sanitation Foundation (NSF)

1. NSF/ANSI 61—Drinking Water System Components – Health Effects.

1.08 METER CONNECTION

The meter connection shall conform to the latest revision of the following standard:

A. American Water Works Association (AWWA)

1. AWWA C701—Cold-Water Meters – Turbine Type, For Customer Service.
2. AWWA C702—Cold-Water Meters – Compound Type.
3. AWWA C703—Cold-Water Meters – Fire Service Type.
4. AWWA C706—Standard for Direct-Reading, Remote-Registration Systems for Cold-Water Meters.
5. AWWA C707—Encoder-Type Remote-Registration Systems for Cold-Water Meters.

PART 2 PRODUCTS

2.01 PIPE AND FITTINGS

A. Design Criteria – General

1. Pipe for sizes 4 inches and larger supplied under this specification shall have a nominal iron pipe size (IPS) outside diameter (OD) and shall be rated for a minimum working pressure of 150 psi.

2. The minimum pipe inside diameter for all potable water mains shall be 8 inches.

3. A piping schedule listing the piping identification abbreviations and materials of construction shall be provided on the Contract Drawings.

4. All potable water piping systems including pipe, valves, fittings, weld-solvents, linings, gaskets, lubricants, grout disinfection agents, etc., and surfaces in contact with potable water shall meet all local and State of Florida regulations and requirements including NSF/ANSI 61. The Contractor shall coordinate color of potable water system piping color with Owner's color standard and shall provide color as approved by the Owner.

5. Nonmetallic Marking Tape: Marking tape shall be "Extra-Stretch" marking tape. Extra-Stretch marking tape shall consist of 6-ply copolymer film bonded together without the use of adhesives, specifically formulated for prolonged use underground. It shall be highly resistant to alkalis, acids, and other destructive agents found in the soil. Extra Stretch tape shall have a minimum thickness of 6 mils, minimum tensile strength of 80 pounds per 3-inch-wide strip, and a minimum elongation of 600%. Tape shall bear a continuous printed message repeated every 16 to 36 inches warning of the installation buried below. Installation instructions for the tape shall be printed with each message along the entire length. Manufacturer shall be in accordance with Appendix A, Approved Manufacturer List of the Town CSM.

6. Locator Wire for Non-metallic Pipe: For location purposes all open-cut nonmetallic piping shall have a type THW insulated PVC copper conductor, #10 solid strand wire strapped to the pipe at 10-foot intervals. Wire shall meet National Electric Codes and Underwriter Laboratories, Inc. requirements. See Section 10, Horizontal Directional Drilling, for requirements of HDD installed pipe.

7. Piping Supports: The Contractor shall furnish and install all supports necessary to hold the piping and appurtenances in a firm, substantial manner at the lines and grades indicated on the Drawings or as specified. Piping within pumping stations shall be adequately supported from floors, walls, ceilings, or beams. Supports from the floor shall be by approved saddle stands or suitable concrete piers as indicated or approved. The Developer shall submit to the Public Services Director calculations, signed and sealed by a Registered Florida Professional Engineer to demonstrate that the proposed pipe supports are sufficient to support the loads they are intended to support.

2.02 DUCTILE IRON PIPE

A. Design Criteria

1. Ductile iron pipe shall be in accordance with AWWA C151/A21.51. Pipe shall be laid in accordance with AWWA C150. Thickness class shall be governed by design conditions; minimum pressure class shall be 350.

2. The minimum pipe inside diameter for water mains shall be 8 inches.

3. Cast and ductile iron pipefittings shall conform to AWWA C110 and AWWA C153. All underground fittings shall be mechanical joint, unless otherwise specified.

4. Ductile iron pipe needs to be marked with stripe or polywrap with appropriate color code.

5. Joints:

   a. "Push-On" and mechanical type joints shall be in accordance with AWWA C111/A21.11.
   b. Restrained joint assemblies with mechanical joint pipe shall be Mechanical Joint Retainer Glands, "locked-type" joints and joint restraints by a manufacturer in accordance with Appendix A, Approved Manufacturer List of the Town CSM.
   c. Flanged connections shall be in accordance with AWWA C115, 125-pound standard.
   d. No leaded joints or connection of any kind will be permitted.
   e. PVC fittings for pressure mains are prohibited above 2 inches in diameter.
   f. Manufacturer shall be in accordance with Appendix A, Approved Manufacturer List of the Town CSM.

6. Coatings and Linings:

   a. Ductile iron pipe and fittings for water service shall be cement mortar lined in accordance with AWWA C104.
   b. Ductile iron pipe and fittings for water service shall receive an exterior asphaltic coating approximately 1 mil thick. The coating shall be applied to the exterior of all pipe and fittings unless otherwise specified.
   c. Coatings shall be applied in accordance with AWWA C110 and AWWA C153-fittings, AWWA C115-flanged pipe, and AWWA C151/A21.51-ductile iron pipe.

7. Bolts and Nuts for Flanges for Ductile Iron Pipe:

    a. Bolts and nuts for Class 150 flanges (including AWWA C207, Class D) located indoors, outdoors above and below ground, and in vaults and structures shall be carbon steel, ASTM A307, Grade B.
    b. Bolts and nuts for submerged Class 150 flanges shall be Type 304 stainless steel conforming to ASTM A193/A193M (Grade B8) for bolts and ASTM A194/A194M (Grade 8) for nuts. Fit shall be Classes 2A conforming to ASME B1.1 when connecting to cast-iron valves having body bolt holes.

8. Gaskets for Flanges for Steel, Ductile Iron, and Stainless Steel Pipe:

    a. Flange gaskets shall be in accordance with AWWA C207, except as modified herein. Gaskets shall be ring type. All gasket material shall be suitable for the fluid being conveyed and shall be resistant to free chlorine concentrations up to 10 mg/L. All gasket material shall be rated to the surge pressures listed in the pipe schedule. Gaskets shall be ethylene propylene diene monomer (EPDM), or Viton, unless otherwise noted by the Town.

2.03 PVC PIPE (8-INCH AND ABOVE)

A. Design Criteria

1. Pipe shall be manufactured from clean virgin Type I, Grade I rigid, unplasticized polyvinyl chloride resin (Class 12454-A or Class 12454-B) conforming to ASTM D1784. The PVC compound shall have an established hydrostatic design basis (HDB) of 4,000 psi as described in ASTM D2837. The pipe shall bear the NSF seal for potable water pipe.

2. The minimum pipe inside diameter for water mains shall be 8 inches.

3. Pipe with diameters of 8 to 12 inches for water mains shall have a minimum dimension ratio (DR) of 18, Class 150, and shall be manufactured in accordance with AWWA C900 latest revision.

4. Pipe with diameters of 14 inches and larger for water mains shall have a minimum DR of 25, Class 165, and shall be manufactured in accordance with AWWA C900 latest revision or Pressure Class 350 ductile iron pipe may be used.

5. Pipe buried at depths of 10 feet or greater to top of pipe shall have a minimum DR of 26 for all pipe diameters.

6. PVC pipe restrainers shall be manufactured in accordance with Appendix A, Approved Manufacturer List of the Town CSM.

7. PVC Pipe Colors:

   a. WATER – Blue.
   b. WASTEWATER – Green.
   c. REUSE RECLAIM WATER – Pantone Purple.

8. Bolts and Nuts for Flanges for PVC Pipe:

   a. Bolts and nuts for buried and submerged flanges and flanges located outdoors above ground or in vaults and structures shall be Type 304 stainless steel conforming to ASTM A193/A193M, Grade B8, for bolts and ASTM A194/A194M, Grade 8, for nuts.

   b. The Contractor shall provide a washer under each nut and under each bolthead. Washers shall be of the same material as the nuts.

9. Gaskets for Flanges for PVC Pipe:

   a. Gaskets for flanged joints shall be full faced, 1/8 inch thick, having a Brinell Hardness of 50 to 70 durometer A. Gasket material for other than sodium hypochlorite service shall be ethylene-propylene rubber (EPR). Gasket material for sodium hypochlorite service shall be Viton ETP. Gaskets shall be compatible with the chemicals being conveyed.

2.04 HIGH DENSITY POLYETHYLENE (HDPE) PIPE

A. Design Criteria

1. All HDPE shall be by manufacturer provided in Appendix A, Approved Manufacturer List of the Town CSM.

2. All HDPE pipe 4 inches in diameter or greater shall have a ductile iron pipe outside diameter, and HDPE pipe 3 inches in diameter and smaller shall be CTS.

3. All HDPE piping system components shall be the products of one manufacturer.

4. Pipe and fittings shall be manufactured by an ISO 9001-certified manufacturer.

5. HDPE pipe 4 inches in diameter and larger shall conform to material standard ASTM D3350 345434 E cell classification rated as PE 3408 by the Plastics Pipe Institute. Minimum pressure rating shall be in accordance with Piping Schedule Drawing or as specified in this Section. Minimum pressure rating shall be 150 psi Standard Dimension Ratio (SDR) 11 for pipe sizes greater than 4 inches in diameter. For pipe sizes 3 inches and smaller in diameter, the minimum pressure rating shall be 200 psi SDR 9.

6. The polyethylene compound shall be suitably protected against degradation by ultraviolet light.

7. The maximum allowable hoop stress shall be 800 psi at 73.4º F.

8. The pipe manufacturer shall be listed with the Plastic Pipe Institute as meeting the requirements of the resin manufacturer to manufacture pipe from the resin used.

B. Fittings

1. The pipe manufacturer shall mold or fabricate the polyethylene fittings. Butt fusion outlets shall be made to the same outside diameter, wall thickness, and tolerances as the mating pipe. All fittings and custom fabrications shall be fully rated for the same internal pressure as the mating pipe.

   a. Molded Fittings: Molded fittings shall be manufactured in accordance with ASTM D3261 and shall be so marked. Each production lot of molded fittings shall be subjected to the test required under ASTM D3261. The manufacturer shall submit samples from each molded fitting production lot to x-ray inspection for voids and shall certify that voids were not found.

   b. Polyethylene Flange Adapters: Flange adapter shall be made with sufficient throughbore length to be clamped in a butt fusion joining machine without the use of a subend holder. The sealing surface of the flange adapter shall be machined with a series of small v-shaped grooves to restrain the gasket against blow-out. Flange adaptors shall be fitted with ductile-iron backup rings pressure rated equal to or greater than the mating pipe. The Contractor shall provide flat ring-type EPDM gaskets with gasket thickness and

hardness as recommended by the pipe manufacturer for use with HDPE flanged joints. Provide carbon steel hardware (bolts, nuts, washers, etc.) conforming to ASTM A307, Grade B for use with the flange adapters assemblies in accordance with the pipe manufacturer's recommendations. Gaskets shall be made from material suitable for exposure to the liquid within the pipe.

c. Fabricated Fittings: Fabricated fittings shall be made by heat fusion joining specially machined shapes cut from pipe, polyethylene sheet stock, or molded fittings. Fabricated fittings shall be rated for internal pressure service equivalent to the full-service pressure rating of the mating pipe. Pressure de-rated fittings are not acceptable. Directional fittings 16 inches IPS and larger, such as elbows, tees, crosses, etc., shall have a plain end inlet for butt fusion and flanged directional outlets.

2. Ductile Iron/HDPE Mechanical Joint Adaptors:

a. The manufacturer of the HDPE pipe shall supply all ductile iron/HDPE mechanical joint adaptors and accessories required to connect plain-end HDPE piping to mechanical joint fittings, valves, and appurtenances.

b. The ductile iron/HDPE mechanical joint adaptor shall consist of:

(1) A molded or fabricated HDPE mechanical joint transition fitting.
(2) A Buna-N gasket for a ductile iron mechanical joint.
(3) A ductile iron mechanical joint backup drive ring.
(4) Cor-Ten mechanical joint tee bolts.
(5) A stainless-steel sleeve stiffener molded or fabricated within the mechanical joint (MJ) end of the HDPE mechanical joint adaptor fitting.

c. The ductile iron/HDPE mechanical joint adaptor shall be connected to the HDPE pipe by a heat-fused joint on one end and connected to a ductile iron pipe valve, fitting, or appurtenance with the internally stiffened mechanical joint end.

d. The tee bolts and backup drive ring shall act as a joint restraint for connections to mechanical joints.

e. The HDPE mechanical joint adaptor fitting shall be molded or fabricated by the manufacturer of the HDPE pipe. All molded

fittings shall be fully pressure rated to match the SDR pipe pressure rating. Fabricated fittings shall be rated for internal pressure service equivalent to the full pressure rating of the mated IPS pipe.

f. If rework compounds are required, only those generated in the manufacturer's own plant from resin compounds of the same class and type from the same raw material supplier shall be used.

g. Solvent epoxy cementing and mechanical joining with bolt on wrap-around clamps shall not be used.

3. HDPE Pipe Jointing Method:

a. HDPE pipe shall be jointed by butt fusion in accordance with the pipe manufacturer's directions and only for pipe within one SDR ratio of each other.

b. For SDR ratios that are two or more apart (i.e., SDR 21 to an SDR 11), the joint shall be made using a restrained joints. Same-diameter pipe may be joined by using HDPE flange adapters and backup rings bolted to each other.

c. All HDPE pipe joined by butt fusion shall be made from the same class and type of raw material made by the same raw material supplier.

d. Butt fusion means the butt joining of the pipe by heat fusion aligned faces of the pipe ends (butts) in a suitable apparatus and joining under controlled pressure and alignment.

e. The external bead resulting from the butt-fusion process shall be visible and examined for complete butt-fusion 360° around the pipe exterior.

f. Short spools of pipe between valves and fittings shall be ductile iron pipe, with all joints restrained for sizes 4 inches and larger. For 2-inch, the spool shall be Schedule 40 Type 304 stainless steel piping or Schedule 80 PVC piping with IP threads stainless steel or PVC fittings and all joints restrained.

g. Where approved by the Public Services Director or his Designee, the HDPE pipe and fittings may be fused with Electrofusion Couplings. Technical information must be provided to demonstrate

that the fused coupling will not compromise the structural integrity of the HDPE pipe.

C. Polyethylene Tubing and Fittings – 2 Inches and Less: Tubing shall comply with AWWA C800 and AWWA C901, be approved for potable water service by the NSF and bear the NSF seal. Tubing shall be by manufacturer provided in Appendix A, Approved Manufacturer List of the Town CSM. The product shall be rated for a minimum working pressure of 200 psi with a minimum SDR of 9. Fittings shall be brass, equipped with compression type connections.

2.05 VALVES

A. General: The valve type, size, rating, flow direction arrow if applicable, and manufacturer shall be clearly marked on each unit. Valves shall open left (counterclockwise) with an arrow cast in the metal of operation hand wheels and nuts indicating the direction of opening. Valves shall be located on each leg of every tee and cross.

B. Gate Valves

1. Valves for Underground Service: Valves from 2 through 12 inches for underground service shall be iron body gate valves, non-rising stem type and shall be equipped with a 2-inch square cast-iron operating nut with corrosion protection coating inside and out. Resilient seated valve, which meets all requirements of AWWA C515 (water). Valves shall be by manufacturer provided in Appendix A, Approved Manufacturer List of the Town CSM. All dead end lines will have valves at the end equal to the size of main line with blow off attached. End line valves shall be adequately restrained to the pipeline such that they may be excavated and the line extended without shutting off line pressure.

2. Valves for Aboveground Service for Water Systems: Valves shall be flanged iron body, bronze mounted resilient seat gate valves, conforming to AWWA C515, with the exception that valves shall be outside screw and yoke (OS&Y) rising stem type. Valves shall have cast iron hand wheels or chain operators with galvanized steel chains, as required. Valves for fire suppression system shall be approved by Town fire officials and a detector valve may be required.

3. Valves Smaller than 2 Inches: Valves smaller than 2 inches shall be bronze body gate valve conforming to Federal Specifications 150 psi minimum working pressure with threaded joints by manufacturer provided in Appendix A, Approved Manufacturer List of the Town CSM.

C. Backflow Devices

1. All services are to be protected by a backflow prevention device suited to the highest degree of hazard encountered at the connection. Maintenance of the device is to remain the responsibility of the Utility customer, including proper certifications. All backflow assemblies need to be tested and reports sent to the Town of Howey-in-the-Hills before they can be put into service.

2. Double check valve assembly shall be designed to specification of the USC Foundation for Cross-Connection Control Laboratory, and ASSE #1015. Double check valves for 2-1/2 through 10 inches. Double check valve assembly from 2-1/2 inches and up shall be furnished with OS&Y gate valve shut-offs. Manufacturer shall be in accordance with Appendix A, Approved Manufacturer List of the Town CSM.

3. All commercial services shall be equipped with a reduced pressure zone backflow prevention device(s). Reduced pressure zone valve shall be designed to specification of the USC Foundation for Cross-Connection Control Laboratory, and ASSE #1013. Reduced pressure zone valve assemblies 2 inches and up shall be furnished with OS&Y gate valve shut-offs. Manufacturer shall be in accordance with Appendix A, Approved Manufacturer List of the Town CSM.

4. The pressure vacuum breaker on 3/4- to 2-inch lines shall be ASSE 1020 approved, and supplied with full port ball valves. The main body and bonnet shall be bronze (ASTM B584), the loaded-air inlet shall use a silicone elastomer spring and seat disc. The entire assembly shall be accessible for maintenance and testing without removing the device from the line. The pressure vacuum breaker shall be furnished with shut-off valves and ball type test cocks. Manufacturer shall be in accordance with Appendix A, Approved Manufacturer List of the Town CSM.

5. Shut-off valves on backflow assembly for sizes 3/4 through 2 inches shall be provided with ball valves, assemblies above 2 inches shall be provided with resilient seat full flow gate valves.

6. Where reclaimed water is available, all potable water connections shall be equipped with a reduced pressure zone backflow prevention device.

7. All backflow prevention devices including but not limited to reduce pressure and double detector check assemblies (DDCAs) shall be set within 12 inches of the meter and shall be set a minimum of 12 inches

above the 100-year flood plain. Pressure vacuum breakers shall be 12 inches above the highest point of use, not to exceed 5 feet.

8. Fire sprinkler systems to have a DDC valve assembly with bypass meter and device equipped with a 3/4-inch register mounted meter on the bypass meter for theft prevention. Equipment manufacturer shall be in accordance with Appendix A, Approved Manufacturer List of the Town CSM.

9. All Backflow devices criteria will adhere to the Town Backflow Ordinance 2007-04, or latest ordinance.

D. Butterfly Valves: Valves 14 inches and larger shall be cast-iron body, self-lubricated, resilient seated, one-piece stainless steel shaft, and capable of drip-tight shut-off at the rated pressure and meet AWWA C504. Valve operators shall conform to AWWA C504. Valve operator for buried or submerged installations shall be furnished with sealed enclosures. Valves shall be equipped with actuating nuts, cast iron hand wheels, or chain operator as appropriate for the installation and type of operator. Valves shall be installed in a vertical position. All valves shall be accompanied by a 3-inch diameter bronze valve marker anchored in the concrete pad that indicates size of valve, type of valve, service (potable water), and direction and number of turns to open. Manufacturer shall be in accordance with Appendix A, Approved Manufacturer List of the Town CSM.

E. Fire Hydrants

1. Fire hydrants shall be by manufacturer in accordance with Appendix A, Approved Manufacturer List of the Town CSM. Note: See Town details for painting.

2. A blue roadway reflector shall be required to be installed with each fire hydrant.

3. Valve shall have the text, “FIRE” and painted red.

4. Fire hydrants must be red with bonnet color corresponding to the flow as determined by the Town of Howey-in-the-Hills Fire Department.

F. Air Release Valves

1. Air release valves shall be automatic float operated valves designed to release accumulated air from a potable water piping system while the system is in operation and under pressure. Manufacturer shall be in accordance with Appendix A, Approved Manufacturer List of the Town CSM.

2. Valves shall conform to the following standards:

    a. AWWA C512.
    b. NSF/ANSI 61 Drinking Water System Components – Health Effects.
    c. Manufacturer shall meet requirements of ISO 9001.

3. The valve body shall be threaded with national pipe thread (NPT) inlets and outlets. The body inlet connection shall be hexagonal for a wrench connection. The valve shall also have two additional NPT connections for the addition of gauges, testing, and draining.

4. Design:

    a. The cover shall be bolted to the valve body and sealed with a flat gasket. Resilient seals shall be replaceable and provide drop tight shut off to the full valve pressure rating.

    b. Floats shall be unconditionally guaranteed against failure including pressure surges. Mechanical linkage shall provide sufficient mechanical advantage so that the valve will open under full operating pressure. Simple lever designs shall consist of a single pivot arm and a resilient orifice button. Compound lever designs shall consist of two levers and an adjustable threaded resilient orifice button.

5. Materials:

    a. The valve body and cover shall be constructed of ASTM A48/A48M Class 30 cast iron for working pressures up to 300 psi.
    b. The orifice, float and linkage mechanism shall be constructed of Type 316 stainless steel. Non-metallic floats or linkage mechanisms are not acceptable. The orifice button shall be Viton for simple lever valves and Buna-N for compound lever designs.

6. Options: The valve body and cover shall be constructed of ASTM A129 Grade Class B cast iron for working pressures up to 300 psi. Where reclaimed water is available, all potable water connections shall be equipped with a reduced pressure zone backflow prevention device.

7. Air valve assemblies shall be in accordance with Section 16, Wastewater Force Main System, for wastewater service and Section 22, Reclaimed Water System, for reclaimed water service.

G. Automatic Flushing System

1. The automatic flushing system consists of a base and cover, built in piping, programmable electronic timer, battery, solenoid, and control valve.

2. The base shall be UV resistant and vented to reduce erosion and dissipate the force of the discharging water. The cover shall be blue and be UV and impact resistant. The cover shall be lockable to the base and lock/unlock with a special key.

3. The glass reinforced nylon control valve shall be 2 inches in diameter and shall open and close via an electric solenoid.

4. A multi-event programming module shall control the opening and closing of the solenoid. A lithium battery shall provide the power to the unit. The programming unit shall be located above the discharge of the flushing water.

5. Flushing system shall have dechlorination capability. Manufacturer shall be in accordance with Appendix A, Approved Manufacturer List of the Town CSM. If a system other than an approved manufacturer's is provided, the programming controller and security locking key shall be provided by the Contractor.

H. Insertion Valves:

1. Insertion valve shall be used upon approval by the Town of Howey-in-the-Hills on a case-by-case basis.

2. The insertion valve shall be a resilient seat gate valve type designed for potable water, raw water, reclaimed water, or wastewater.

3. Insertion valves must meet ANSI/AWWA 515

4. Insertion valve must be ductile iron body type.

2.06 MISCELLANEOUS ITEMS

A. Valve Boxes: Units shall be two-piece, screw type, adjustable, cast iron, minimum interior diameter of 5 inches. Potable valve box covers shall be round and painted blue cast with the "WATER" inscription in legible writing on the top. Wastewater valve box covers shall be round and painted green cast with the, or "SEWER" inscription in legible lettering on the top. Reclaim valve box covers shall be square and painted purple, cast with the "RECLAIM" inscription in legible lettering on the top. Fire service valve box covers shall be round and painted red cast with the "FIRE" inscription in legible writing on the top. Boxes shall be suitable for the applicable surface loading and valve size. Valve boxes not in the pavement shall have concrete pads installed with minimum dimensions of 24 x 24 x 4 inches. All valves shall be accompanied by a 3-inch diameter bronze valve marker anchored in the concrete pad that indicates size of valve, type of valve, service (water), and direction and number of turns to open. Manufacturer shall be in accordance with Appendix A, Approved Manufacturer List of the Town CSM.

B. Meter Boxes: Single and double plastic meter boxes shall be by manufacturer provided in Appendix A, Approved Manufacturer List of the Town CSM.

C. Water Service Lines: Service lines shall be 1 inch for single and 2 inches with 1-inch branch off for double service. All fittings and corporation stops shall be in accordance with Appendix A, Approved Manufacturer List of the Town CSM. Curb Stops (lock wing), "Y" Branch, etc., shall be in accordance with the table below: **Note:** All materials shall meet the Town specifications approval.

Size (Inch)	Type	Ford	McDonald	Mueller
1	FIP x FIP	B11-444W	6101W	B20200 R
1	Comp. X FIP	B41-444W	6102W-22	B25170 R
1	FIP x SPUD	B13-444W	6101MW	B24351 R
1	Comp. X SPUD	B43-4344W	6100MW-22	B24350 R

Note: The Town must approve Service layout Submittals.

D. Fire Service Meters

1. General: All meters furnished shall be manufactured by a registered ISO 9001 quality standard facility. Acceptable meters shall have a minimum of 10 years of successful field use. All specifications meet or exceed the latest revision of AWWA C703. The use of Fire Service Meters shall be as directed by the Public Services Director or his Designee.

2. Type: Meters shall consist of a combination of an AWWA Class II in-line horizontal axis turbine for measuring high rates of flow and a positive displacement bypass meter conforming to AWWA C700 for measuring low rates of flow. An automatic valve shall direct the flow from the bypass meter to the mainline meter as flow rates increase and back to the bypass meter as flow rates decrease. All components of the meter assembly shall be both UL (Underwriter's Laboratory) Listed and FM (Factory Mutual) approved for fire service use. Meters shall be certified to NSF/ANSI 61, Annex G requirements.

3. Capacity: The capacity of the meters in terms of normal operating range, maximum rate for continuous use, maximum loss of head, and extended low flow capability is as follows:

Size (Inch)	Normal Operating	Maximum Rate for Continuous Use	Maximum Loss of Head @ Max Rate (psi)	Extended Low Flow
4	3/4 – 1,200	1,200	9	3/8
6	1 1/2 – 2,500	2,500	10.5	3/4
8	2 – 4,000	4,000	10.5	1
10	2 – 6,500	6,500	9	1

4. Size: The size of meters shall be determined by the nominal size (in inches) of the opening in the inlet and outlet flanges. Overall lengths of the meters shall be as follows:

Laying Length (Inches)
4 – 33
6 – 45
8 – 53
10 – 68

5. Cover and Body: The meter cover shall be cast of an NSF/ANSI 61, Annex, G, no-lead high copper alloy containing a minimum of 85% copper. An arrow indicating direction of flow shall be cast in raised characters on the cover. The cover shall have a rated working pressure of 175 psi. The cover shall contain a calibration vane for calibrating the turbine measuring element while in-line and under pressure. The calibration vane shall be mounted under the register that is attached in a tamper-resistant manner. The meter body, strainer body, and valve body shall be 300 series stainless steel. The meter body shall be welded to the valve body effecting a uni-body construction with the valve. The strainer outlet and meter inlet shall be connected by a flexible grooved coupling. The meter assembly shall have a rated working pressure of 175 psi. Meters shall be supplied with a strainer designed and approved for the fire service

use by UL and FM, and shall have a rated working pressure of 175 psig. Manufacturer shall be in accordance with Appendix A, Approved Manufacturer List of the Town CSM.

6. External Bolts: Meter, strainer, and valve cover bolts shall be made of AISI Type 316 stainless steel. All other bolts shall be zinc-plated steel or stainless steel.

7. Connections: Inlet and outlet flanges shall be 300 series stainless steel and round flanged conforming to AWWA C207, Class D.

8. Registers: Registers shall be permanently roll-sealed, straight reading in gallons, cubic feet, or cubic meters. Registers shall include a center-sweep test hand and low flow indicator. Registers shall be removable for replacement without interruption of the service line.

9. Register Boxes: Register boxes and covers shall be of bronze composition. The name of the manufacturer and the meter serial number shall be clearly identifiable and located on the register box covers.

10. Register Box Sealing: The register box shall be affixed to the top cover by means of a plastic tamperproof seal pin that must be destroyed in order to remove the register.

11. Meter Serial Number: The meter serial number shall be on the meter flange or cover and on register box covers.

12. Unitized Measuring Element (UME): A UME is a complete assembly, factory calibrated to AWWA Standards that includes the cover, registers, and a turbine measuring element. It shall be easily field removable from the meter body without the requirement of unbolting flanges.

13. Intermediate Gear Train: The intermediate gear train shall be directly coupled to the turbine rotor and magnetically coupled to the register through the meter cover. The gear train shall be housed within the turbine measuring chamber. All moving parts of the gear train shall be made of a self-lubricating polymer or AISI Type 316 stainless steel for operation in water.

14. Bypass Meter: The bypass meter shall be of a positive displacement, nutating disc type. The bypass meter may be piped on the left or right side of the assembly. The bypass meter shall conform to AWWA C700 standards in the following sizes:

Mainline Size	Meter Size
4-inch Mainline	1-inch Bypass Meter
6-inch Mainline	1-1⁄2-inch Bypass Meter
8- and 10-inch Mainline	2-inch Bypass Meter

15. Automatic Valve: The automatic valve shall be of the spring-loaded, knuckle-joint type. All internal linkage parts shall be stainless steel. A vulcanized rubber disc on a stainless steel clapper plate shall seal against a bronze seat. The springs shall be AISI Type 18-8 stainless steel. The disc meter shall include a self- actuated valve that directs flow through the disc meter at low flow rates, and through the turbine meter at high flow rates. At high flow rates, the self-actuated throttle valve shall restrict the flow through the disc meter to minimize wear.

16. Strainer: A strainer shall be provided for the disc meter. It shall be easily removable and have an effective straining area of double the disc meter inlet.

17. Registration Accuracy: Registration accuracy over the normal operating range shall be 98.5% to 101.5%.

18. Remote Capability Options: All meters shall be equipped with encoder remote registers conforming to AWWA C707 and meet all AWWA C703 performance standards.

19. Manufacturer shall be in accordance with Appendix A, Approved Manufacturer List of the Town CSM.

E. Compound Meters

1. General: All meters furnished shall be manufactured by a registered ISO 9001 quality standard facility. Acceptable meters shall have a minimum of 10 years of successful field use. All specifications meet or exceed the latest revision of AWWA C702. The use of compound meters shall be as directed by the Public Services Director or his Designee.

2. Type: Compound meters shall consist of a combination of an AWWA Class II turbine meter for measuring low rates of flow enclosed in a single maincase. An automatic valve shall direct the flows through the disc meter at low flow rates and through the turbine meter at high flow rates. At high flow rates, the automatic valve shall also serve to restrict the flow through the disc meter to minimize wear.

3. Capacity: The capacity of the meters in terms of normal operating range, maximum rate for continuous use, maximum loss of head, and extended low flow capability is as follows:

Size (Inch)	Normal Operating Range (gpm)	Maximum Continuous Flow (gpm)	Maximum Loss of Head @ Max Rate (psi)	Maximum Intermittent Flow (gpm)	Low Flow (gpm)
2	1/2 - 200	160	8	200	1/8
3	1/2 - 450	350	8	450	1/8
4	1 – 1,000	700	8	1,000	1/2
6	1-1/2 – 2,000	1,400	8.5	2,000	3/4
6 x 8	1-1/2 – 2,000	2,000	10.5	2,000	3/4

4. Size: The size of meters shall be determined by the nominal size (in inches) of the opening in the inlet and outlet flanges. Overall lengths of the meters shall be as follows:

Meter Size	Laying Length
2-inch	15 1/4-inch
3-inch	17-inch
4-inch	20-inch
6-inch	24-inch
6-inch x 8-inch	55 3/8-inch

5. Case and Cover: The maincase and cover shall be cast from an ANSI/NSF 61 certified no lead high copper alloy containing 85% copper. The size, model, and arrows indicating direction of flow shall be cast in raised characters on the maincase and cover. The covers all contain a stainless steel calibration vane for calibrating the turbine measuring element while the meter is in-line and under pressure. A test plug shall be located in the maincase or the cover for field testing of the meter.

6. External Bolts: Casing bolts shall be made of AISI Type 316 stainless steel.

7. Connections: Maincases shall be flanged. The 2-inch meters shall be oval flanged and 3- through 6-inch sizes shall be round flanged per Table 4, AWWA C702.

8. Registers: Separate magnetic drive registers shall record the flow of the turbine and disc meters and their total will be the registration of the compound meter. The registers shall be permanently roll-sealed, straight reading in gallons, cubic feet, or cubic meters. Registers shall include a

center-sweep test hand, a low flow indicator, and a glass lens. Registers shall be serviceable without interruption of the meter's operation.

9. Register Boxes: Register boxes and covers shall be of bronze composition. The name of the manufacturer shall be clearly identifiable and located on the register box covers.

10. Register Box Sealing: Registers shall be affixed to the cover by means of a plastic tamperproof seal pin that must be destroyed in order to remove the register.

11. Meter Serial Number: The meter serial number shall be imprinted on the meter flange or cover as well as on the register box covers.

12. Measuring Chamber:

    a. The turbine measuring chamber shall be a self- contained unit, attached to the cover for easy removal. The turbine shaft shall be tungsten carbide with tungsten carbide inserts and shall rotate in removable graphite bushings. Thrust bearings shall be tungsten carbide.

    b. The nutating disc chamber shall be a self-contained unit mounted on the cover and easily removable from the cover. It shall conform to AWWA C700 for the following sizes: a 5/8-inch disc shall be used for 2-inch and 3-inch items; a 3/4-inch disc shall be used for 4-inch items; and a 1-inch disc shall be used for 6-inch items. The inlet to the disc chamber shall be a "single" opening of adequate size not to be susceptible to plugging and water restriction by water-borne debris.

13. UME: A UME is a complete assembly, factory calibrated to AWWA Standards that includes the cover, registers, and both a turbine measuring element and a nutating disc chamber assembly. It shall be easily field removable from the meter body without the requirement of unbolting flanges.

14. Intermediate Gear Train: The intermediate gear train shall be directly coupled from the turbine rotor and magnetically coupled to the register through the meter cover. The gear train shall be housed within the turbine measuring chamber. All moving parts of the gear train shall be made of a self-lubricating polymer or AISI Type 316 stainless steel for operation in water.

15. Automatic Valve:

    a. The automatic valve shall be of the spring-loaded, poppet type. All valve parts shall be made of no-lead high copper alloy containing a minimum of 85% copper, stainless steel, or a suitable polymer with a replaceable semi-hard EPDM rubber seat.

    b. Only the cover must be removed to gain access to the valve for inspection or service.

    c. The disc meter shall include a self-actuated valve that directs flow through the disc meter at low flow rates and through the turbine at high flow rates. At high flow rates, the self-actuated throttle valve shall restrict the flow through the disc meter to minimize wear.

16. Strainer: A strainer shall be provided for the disc meter. It shall be easily removable and have an effective straining area of double the disc meter inlet.

17. Registration Accuracy: Registration accuracy over the normal operating range shall be 98.5% to 101.5%. Registration at the crossover shall not be less than 95% with direct reading registers. Registration at the crossover shall not be less than 90% with absolute encoder or generator remote registers. Registration at the extended low flow rate shall not be less than 95%.

18. Remote Capability Options:

    a. Type A – All meters shall be equipped with encoder remote registers conforming to AWWA C707 and shall meet all AWWA C702 performance standards.

       All meters shall be equipped with encoder remote registers conforming to AWWA C707 and meet all AWWA C703 performance standards.

    b. Type B – All meters shall be equipped with generator remotes conforming to AWWA C706, and shall meet all AWWA C702 performance standards and shall include all hardware. Two-wire cable shall not be included in quoted meter prices.

    c. Manufacturer shall be in accordance with Appendix A, Approved Manufacturer List of the Town CSM.

F. Strainers

1. General: All strainers furnished shall be manufactured by a registered ISO 9001 quality standard facility. This specification covers 150 psi working pressure plate-type strainers for use with water meters of 2- through 20-inch pipe size. The strainer is to be mounted upstream of the meter to prevent debris such as stones or pebbles greater than 3/16 inch in diameter from entering or damaging the meter.

2. General Requirements: The strainer shall be designed for minimum weight and pressure loss and shall be in conformance with the data shown below:

Pipe Size (Inches)	**Laying Length (Inches)**	**Maximum Height Base to Center of Flange (Inches)**
2	7	2 1/8
3	6	3 3/4
4	7 1/2	4 1/2
6	9	5 1/2
8	10	6 3/4
10	15	8
12	16 7/8	9 1/2
16”	24 1/4	11 3/4
20”	18 5/8	13 3/4

3. The strainer screen shall be made of perforated AISI Type 18-8 stainless steel plate and be shaped for maximum rigidity against forces exerted by the flow stream.

4. The effective straining area shall be at least double that of the meter maincase inlet area.

5. The 2-inch strainer shall be furnished with oval two-bolt flanged connections. Strainers 3 inches and larger shall be furnished with round flanged connections. Bolt circle, bolt hole diameters, and flange dimensions shall be in compliance with meter connection specifications contained in AWWA C701.

6. The strainer bodies and covers in sizes 2- through 10-inch shall be made from an NSF/ANSI 61 certified no-lead high copper alloy containing a minimum of 85% copper. The manufacturer’s name, strainer pipe size, and direction of flow (if required) shall be cast in raised letters and shall be clearly visible.

7. Bodies and covers for 12-, 16-, and 20-inch strainers shall be epoxy-coated steel. The manufacturer's name, strainer pipe size, and direction of flow (if required) shall be clearly marked on the strainer. Strainers of this size shall be equipped with flush ports.

8. Cover bolts for the 2- through 10-inch sizes shall be made of AISI Type 316 stainless steel. Cover bolts for the 12- through 20-inch sizes shall be made of AISI Type 316 stainless steel.

9. Strainer cover shall be equipped with a vent screw to remove trapped air at installation.

10. Strainers manufacturer shall be in accordance with Appendix A, Approved Manufacturer List of the Town CSM..

G. Water Meters: All meters shall be supplied by the Town at the expense of the utility customer, up to 2 inches. All meters larger than 2 inches shall be purchased by the Contractor/customer and installed in accordance with the Town specifications.

H. Tapping Saddles, Sleeves, and Valves

1. Any tap or valve installation into the existing Town system shall be made by the Town or approved agent at the expense of the Developer. The cost for taps shall be set by the Town of Howey-in-the-Hills Public Services Department, at current prices at the time of the tap.

2. Tapping sleeves for taps 4 inches or greater shall be designed for a minimum water working pressure of 150 psi. Tapping sleeve shall be fabricated from 304 stainless steel and shall be fully passivated. The design shall allow for the insertion of bolts from either side and the internal seal is to be the "O-ring" type. In the interior of the tapping sleeve, a full circumferential gasket shall be molded of virgin styrene-butadiene rubber (SBR) compatible with potable water, reclaimed water, and raw sewage. The outlet flange shall be ANSI drilled to match the tapping valve. The sleeve shall be NSF/ANSI 61 Annex G certified. The tapping sleeve shall be furnished complete with bolts, nuts, and gaskets.

3. Tapping valves shall conform to AWWA C515 with the exception of the valve ends and other modifications necessary for tapping service with a minimum water working pressure of 150 psi. Each tapping valve shall be provided with a flanged inlet end designed, faced, and drilled for attachment to the outlet flange of the tapping sleeve; an outlet end provided with a tapping flange for attachment of a standard drilling

machine; and a mechanical-joint-type bell end for connection of the branch main. Manufacturer shall be in accordance with Appendix A, Approved Manufacturer List of the Town CSM.

4. Before making the tap, the Contractor, in the presence of a Town inspector, shall hydrostatically pressure test the tapping saddle/sleeve and valve installation at a test pressure of 150 psi, or 50 psi over the existing system pressure, whichever is greater. Pneumatic, or air-pressure testing is prohibited.

5. Backtaps shall not be permitted unless specifically authorized by the Public Services Director or his Designee before the tap to be installed and/or during the plan approval process. Any said authorized backtaps shall be constructed using ductile iron pipe, MJ fittings, and retainer glands or restraints. Threaded rod shall only be permitted from the steel casing to the first fitting, and shall be welded for minimum of 8 inches on each rod alongside the casting. Welding of eyebolts directly to the casing for installing treaded rod is not permitted.

I. Full Circle Repair Clamps

1. Repair clamps shall be full circle type and shall meet the below specifications for Type F or Type FS. The use and type of full circle repair clamps shall be approved by the Public Services Director or his Designee before installation.

   a. Type F - repair clamps with 18-8 Type 304 SS bands, nuts, bolts, and side bars

   b. Type FS - Bands shall be 18-8 Type 304SS. Bolts and heavy hex nuts shall be low alloy in accordance with ASTM A242/A242M and AWWA C111/A21.11. Lugs shall be ductile iron in accordance with ASTM A536. Gaskets shall be gridded virgin SBR compounded for water service and meeting ASTM D2000. Finish shall be shop coat. Repair clamps shall be single, double, or triple section as required for the size of the water main. Clamps manufacturer shall be in accordance with Appendix A, Approved Manufacturer List of the Town CSM.

J. Snap Clamps

1. Snap clamps shall be used to repair pinholes and other small leaks that do not require a full gasket seal. Clamps shall be used for pipe sizes 1/2 inch to 8 inches in diameter and shall meet the below specifications for

Type FSC or FLSC. The use and type of snap clamps shall be approved by the Public Services Director or his Designee before installation.

a. Type FSC - Clamp shells shall be 18-8 Type 304SS with ductile iron lugs meeting ASTM A536 (electrodeposited zinc finish). Gaskets shall be Buna-N with heavy grid design extending form lug to lug. Bolts shall be AISI C1018 steel, 3/8- or 7/16-inch electrodeposited zinc with dichromate seal. Snap clamps manufacturer shall be in accordance with Appendix A, Approved Manufacturer List of the Town CSM.

b. Type FLSC - Clamp shells, lugs, and bolts shall be 18-8 Type 304SS. Gaskets shall be Buna-N with heavy grid design extending from lug to lug. Snap clamps manufacturer shall be in accordance with Appendix A, Approved Manufacturer List of the Town CSM.

K. Wrap Clamps

1. Wrap Clamps shall be used to repair pinholes and other small leaks that require a full gasket seal. Clamps shall be used for pipe sizes 1/2 to 2 inches in diameter and shall meet the below specifications for Type FSC or FLSC. The use and type of wrap clamp shall be approved by the Public Services Director or his Designee before installation.

a. Type FSC - Wrap clamp shells shall be 18-8 Type 304SS with ductile iron lugs meeting ASTM A536 (electrodeposited zinc finish). Gaskets shall be Buna-N with heavy gridded armor for 360-degree coverage. Bolts shall be AISI C1018 steel, 3/8 or 7/16 inch electrodeposited zinc with dichromate seal. Wrap clamps manufacturer shall be in accordance with Appendix A, Approved Manufacturer List of the Town CSM..

b. Type FLSC – Wrap clamp shells, lugs, and bolts shall be 18-8 Type 304SS. Gaskets shall be Buna-N with heavy gridded armor for 360-degree coverage. Wrap clamps manufacturer shall be in accordance with Appendix A, Approved Manufacturer List of the Town CSM.

L. PVC Coupling Leak Clamps

1. PVC coupling leak clamps shall be used to repair leaking solvent welds on PVC water mains without shutting down the water main to install a new piece of pipe. Clamps shall be used for pipe sizes 2 through 8 inches in

diameter and shall meet the below specifications for Type FCC or FIBC. The use and type of PVC coupling leak clamp shall be approved by the Public Services Director or his Designee before installation.

a. Type FCC – Shall be used for pipe joined with Schedule 40 solvent weld couplings. Clamps shall have a 5-inch-wide band and shall be 18-8 Type 304 SS. Lugs shall be ductile iron in accordance with ASTM A536. Gaskets shall be SBR in accordance with ASTM D2000. Bolts and heavy hex nuts shall be low alloy in accordance with ASTM A242/A242M. PVC coupling leak clamps manufacturer shall be in accordance with Appendix A, Approved Manufacturer List of the Town CSM.

b. Type FIBC – Shall be used for Class 160 and 200 integral bell pipe joined by solvent weld. Clamps shall have a 7.5-inch-wide 18-8 Type 304 SS. Lugs shall be ductile iron in accordance with ASTM A536. Gaskets shall be SBR in accordance with ASTM D2000. Bolts and heavy hex nuts shall be low alloy in accordance with ASTM A242/A242M. PVC coupling leak clamps manufacturer shall be in accordance with Appendix A, Approved Manufacturer List of the Town CSM.

M. Bell Joint Leak Clamps

1. Bell joint leak clamps shall be used to repair leaking bell joints on PVC or ductile iron pipe. Solvent welds on PVC water mains without shutting down the water main to install a new piece of pipe. Clamps shall be used for pipe sizes 2 through 8 inches in diameter and shall meet the below specifications for Type FCC or FIBC. The use and type of PVC coupling leak clamp shall be approved by the Public Services Director or his Designee.

PART 3 EXECUTION

3.01 INSTALLATION

A. General Requirements

1. Piping, fittings, valves, and appurtenances shall be installed in accordance with these Standards and/or approved by the Town of Howey-in-the-Hills Public Services Director or his Designee.

2. Piping shall be installed along straight line and grade between fittings or other defined points, unless definite lines of alignment, deflection, or

grade change have been established. Modification to approved alignment or grade during construction shall receive prior approval from the Public Services Director or his Designee and all resulting design considerations shall be resolved by the Contractor.

3. Materials shall be cleaned and maintained clean, with all coatings protected from damage. The interior of the pipe shall be free of dirt and debris; when work is not in progress all open ends shall be plugged.

4. Pipe, valves, fittings, or other items shall be inspected before installation, and any items showing a fracture or other defect shall be rejected. However, ductile iron pipe showing an end crack, with no fracture indicated beyond that visible, may be salvaged by cutting off the damaged section 12 inches past the crack, providing the remaining pipe is sound. This procedure must be witnessed by the Public Services Director or his Designee.

5. Underground piping shall not be driven to grade by striking it with an unyielding object. When the pipe has been properly bedded, enough compacted backfill shall be placed to hold the pipe in correct alignment. If necessary, precaution should be taken to prevent flotation.

6. Jointing shall be by an approved method and shall not require undue force to accomplish full satisfactory seating and assembly. Connections at structures shall be cut accurately and worked into place without forcing and shall align with the connecting point.

7. Restrained joints shall be provided at all bends, wyes, tees, caps, valves, hydrants, and reducers. If any joints are within the required restrained length, they shall be restrained with a restraining harness as required. The restraints will be sized and placed according to the Drawings or according to the pipe manufacturer's recommendations when not shown on the Drawings, and approved by the Town.

8. Subaqueous pipe laying may be permitted where conditions make it impractical to lay pipe in the "dry" provided the Contractor submits his plan for laying pipe under water to the Public Services Director or his Designee and obtains advance approval thereof.

9. Ductile iron pipe is required at all street crossings, ditch crossings, culvert crossings, bore and jack crossings, wastewater, reclaimed, or stormwater crossings.

10. Disinfecting of all potable water pipes shall be accomplished by the Contractor following approved pressure testing. Unless alternate procedures are set forth under the applicable service Standard, said disinfecting procedures shall be in accordance with AWWA C651.

11. Ductile Iron Pipe installation shall be performed in accordance with the applicable provisions of the latest AWWA Specifications.

12. PVC pipe-lubrication and/or solvent for pipe and fitting joints shall be non-Toxic (NSF-approved for potable water). Following making, solvent type joints shall not be disturbed for 5 minutes and shall not have internal pressure applied for 24 hours, or as recommended by the pipe manufacturer.

END OF SECTION

SECTION 12
POTABLE WATER DISTRIBUTION SYSTEM

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section does not stand alone and is incorporated as part of the Town Construction Specification Manual (CSM). The CSM shall be used for other requirements that may not be covered in this Section.

B. This Section includes general technical criteria for the design and installation of water distribution systems for potable water service. The relevant provisions of other sections of this specification shall be applicable to this Section unless otherwise indicated herein or approved by the Public Services Director or his designee.

C. The Contractor shall provide all work necessary for the construction and testing of a complete potable water piping system. This work shall include the installation of all potable water lines, services, fittings, valves, fire hydrants, and appurtenances as may be required to complete the work as indicated in the Drawings and as specified herein.

D. The work shall also include such connections, reconnections, temporary services, and all other provisions concerning existing water systems as is required to perform the new work. Only those materials included in the Town CSM shall be installed. All materials shall be new unless specifically called for otherwise and approved by the Public Services Director or his designee.

E. The minimum pipe inside diameter for all water mains shall be 8 inches.

F. All piping and equipment of the same type shall be from one manufacturer, unless authorized in writing by the Town or the Town's representative.

1.02 SUBMITTALS

A. All submittals shall be submitted in accordance with the shop drawing submittal requirements as specified in Section 1, General Provisions.

1. Shop Drawings: The Contractor shall submit catalog cut sheets, manufacturer's descriptive literature, and other necessary information to the Public Services Director for approval before installation.

2. Certifications: The Contractor shall submit a certification from the pipe and valve manufacturer that the pipe, fittings, and valves supplied are new, have been manufactured for this project, and have been inspected at the plant.

1.03 DESIGN STANDARDS

A. General

1. The Developer shall comply with the applicable criteria set forth in Water Environment Federation (WEF) Manual of Practice No. 9, Latest Edition, and Recommended Standards for Water Works, Latest Edition, and the Florida Department of Environmental Protection (FDEP) requirements. Additionally, American Society of Civil Engineers (ASCE) publication Pipeline Design for Water and Wastewater may be used as a design guide, when not in conflict with other requirements.

2. Before installation of any water distribution system, a hydraulic model of the water distribution system shall be performed and submitted to the Town for approval in accordance with Section 1, General Provisions.

3. The minimum design for water distribution systems shall provide for at least 100% of the combined maximum day-demand rate and required fire flow for said rate, with special provisions for peak flows in excess thereof. The allowable minimum service pressure under said design condition shall not be less than 20 pounds per square inch (psi).

B. Design Criteria

1. Normal flow demands for design shall be calculated based on full ultimate development as known, or projected. The average daily flow for domestic use shall be calculated at the minimum rate of 300 gallons per day per equivalent residential unit, with 3.5 persons per single family residence, and 2.5 persons per multi-family or mobile home dwelling unit.

2. Maximum day instantaneous demand to be used for design shall be 1.0 gallons per minute (GPM) per single family residence and 0.7 GPM per dwelling unit for each multi-family or mobile home unit.

3. Flow demands for commercial, industrial, or other special developments shall be established from existing records or by estimated projections, using the best available data. It shall be stated in the Developers Agreement that the Developer shall bear sole responsibility for sizing the water system improvements to meet the projected demand for the

Development. Any future onsite upsizing of utilities required due to more intensive uses of the land shall be the responsibility of the Developer.

4. Water distribution systems and/or water main extensions shall be designed and constructed in accordance with the fire protection requirements of the Insurance Services Office (National Board of Fire Underwriters), as stated in the latest edition of their publication "Guide for the Determination of Required Fire Flows", if not in conflict with the following:

   a. Fire flows in single-family residential areas shall provide a minimum of 1,000 GPM at a 20-psi residual pressure.

   b. Fire flows in commercial, institutional, industrial areas, and apartment or multi-unit complexes shall provide a minimum of 1,500 GPM at a 20-psi residual pressure. Larger commercial/ industrial, major shopping centers, schools, and similar uses shall have a fire flow capacity of 2,500 to 3,500 GPM or as determined necessary by the Fire Department.

   c. Fire Hydrant Spacing: Distance from or spacing of fire hydrants for residential and commercial shall be a maximum of 500 feet from the furthermost point of any structure, as the Fire Department would lay hose or as otherwise specified by the Fire Department to meet determined water flow requirements for fire protection and/or increase fire protection effectiveness. Fire hydrants shall be connected to water mains of 8-inch minimum size, which are of satisfactory loop design in low-density residential subdivisions, and a minimum of 8-inch mains in all other areas. Connections to dead end stubs are acceptable, if said stubbed water main is not less than 8 inches and will provide acceptable flow.

   d. Valve Locations: Valves shall be provided for all branch connections, loop ends, fire hydrant stubs, or other locations as required to provide an operable, easily maintained, and repaired water distribution system. A valve shall be required on each leg of every tee and cross. Valves are to be placed so that the maximum allowable length of water main required to be shut down for repair work shall be 500 feet, for water mains of 12-inch-diameter or less. Valves are to be placed so that the maximum allowable length of water main required to be shut down for repair work shall be 250 feet, for water mains larger than 12 inches in diameter. Adjusted spacing shall be subject to review and approval by the Public Services Director or his designee. Valve boxes falling in

asphalt areas shall have compaction in 12-inch lifts, with the top 12 inches consisting of limerock.

C. Pipe Separation Requirements: All water mains shall be installed in accordance with Chapter 62-555.314, Florida Administrative Code (FAC), and any updates to the FAC, and in conformance with all separation requirements.

D. Joint Restraining: Restrained joints shall be provided at all points where the line bends greater than 10 degrees and at all wyes, tees, caps, valves, hydrants, and reducers. If any joints are within the required restrained length, they shall be restrained with a restraining harness as required. The restraints will be sized and placed according to the Drawings or according to the pipe manufacturer's recommendations when not shown on the Drawings.

E. Pipe Depth and Protection: The standard minimum cover for water distribution systems shall be 3 feet from the top of the finish grade. However, should this design not be feasible, protective concrete slabs shall be provided over the pipe within the limits of the lesser cover. Where waterways, canals, ditches, or other cuts are crossed, ductile iron pipe shall be installed across and to 10 feet each side of the bottom. Additionally, approved utility crossing signs shall be placed on the pipe alignment at each side of the canal, etc. Subaqueous crossings shall be subject to approval by the Public Services Director or his designee.

F. Looping and Dead Ends

1. All water distribution systems shall be designed to incorporate looping of the water mains to optimize flows and pressures in the system. Where it is impractical to construct a looped system, installation of a dead end line must be approved by the Public Services Director or his Designee. The use of "lollipop" designs at the end of cul-de-sacs or in other locations is strictly prohibited.

2. Dead ends shall be minimized by making appropriate tie-ins whenever practical, in order to provide increased reliability of service and reduce head loss.

3. Dead end mains shall be equipped with a means to provide adequate flushing. Flushing devices should be sized to provide flows that will give a velocity of at least 2.5 feet per second in the water main being flushed. They may be provided with a fire hydrant if flow and pressure are sufficient. No flushing device shall be directly connected to any sewer.

G. Connections at Structure: Where pipes are to extend into or through structures, flexible joints are to be provided at the wall face.

H. Special Exterior Protection for Corrosion: Extra protection shall be provided for underground ductile iron pipe and fittings within areas of severe corrosive conditions. This shall be accomplished by the installation of polyethylene encasement, through the area of concern. The soil test evaluation to determine the necessity for extra protection in suspect areas shall be set forth in AWWA C105. Additionally, where other existing utilities are known to be cathodically protected, ductile iron pipe crossing said utility shall be installed parallel to and within 10 feet of, protection shall be provided. Steel pipe shall not be installed in severe corrosion areas.

I. Air Venting and Blow Offs: Where the water main profile is such that an air pocket or entrapment could occur, resulting in flow blockage, methods for air release shall be provided. Air venting capabilities shall be provided for distribution mains by appropriately placing fire hydrants, blow-offs, or other manual devices. At critical points on major mains, automatic air release assemblies shall be installed. Special care shall be taken to preclude any cross-connection possibility in the design of automatic air release valve application. All dead-end water mains, temporary or permanent, shall be equipped with a lockable, manually operated blow-off at the terminus.

J. Service Connections: Connections to water mains 4 inches and larger shall be made by drilling the appropriate size hole and installation of service saddles, with services to smaller sizes accomplished by in-line fittings. A fitting with the service line extended to the property line or easement line, perpendicular to said line, and terminating with a plugged curb stop and meter box, pending meter installation. On curbed streets, the exact location for each installed service shall be marked by etching or cutting a "W" in the concrete curb and painted blue. Where no curb exists or is planned, locations shall be adequately marked by a method approved by the Town. Method: 1/2-inch steel rebar, 3 inches below final grade.

K. Design Calculations: The Engineer/Developer shall submit signed, dated, and sealed calculations by and Professional Engineer licensed in the State of Florida with the final Construction Drawings for all water distribution projects. Calculations shall show that the water mains will have sufficient hydraulic capacity to transport the maximum flow as described in Part 1.03.A.3 of this Section while meeting the requirements of this Section and FDEP. Minor head losses shall be incorporated in calculations including losses through meters, detector checks, and backflow prevention assemblies.

PART 2 PRODUCTS

2.01 GENERAL

A. The materials of construction shall comply with the specific applicable standards set forth under Section 6, Utility Excavation, Trenching, and Backfilling, Section 9, Boring, Jacking, and Tunneling, Section 11, Pipe, Fittings, Valves, and Appurtenances, and as indicated in this specification.

B. All material shall be free from defects impairing strength and durability, shall be of the best commercial quality for the purpose specified, and shall have structural properties sufficient to safely sustain or withstand strains and stresses to which it is normally subjected and be true to detail.

2.02 PIPING

A. Pipe material for Water Mains shall be specified on the Construction Drawings and shall be in accordance with the design requirements in this Section and material specifications indicated in Section 11, Pipe, Fittings, Valves, and Appurtenances, unless otherwise shown on the Construction Drawings. Pipe, fittings, valves, restrainers, and other appurtenances shall be as specified in Section 11, Pipe, Fittings, Valves, and Appurtenances. All installed underground nonmetallic potable water mains shall be blue or ductile iron pipe marked with a continuous blue stripe located within the top 90 degrees of the pipe.

2.03 IDENTIFICATION

A. Nonmetallic Marking Tape: Marking tape shall be “Extra-Stretch” marking tape for potable water, colored blue. Extra-Stretch marking tape shall consist of 6-ply copolymer film bonded together without the use of adhesives, specifically formulated for prolonged use underground. It shall be highly resistant to alkalis, acids, and other destructive agents found in the soil. Extra Stretch tape shall have a minimum thickness of 6 mils, minimum tensile strength of 80 pounds per 3-inch-wide strip, and a minimum elongation of 600%. Tape shall bear a continuous printed message repeated every 16 to 36 inches warning of the installation buried below. Installation instructions for the tape shall be printed with each message along the entire length. Manufacturer shall be in accordance with Appendix A, Approved Manufacturers List.

B. Tracer wire shall have a blue, type TWH insulated polyvinyl chloride (PVC) copper conductor, #10 solid strand copper wire that is strapped to the pipe at 10- foot intervals installed. Wire shall meet National Electric Codes and Underwriter Laboratories, Inc. requirements.

2.04 AIR VALVES

A. Air release valves shall have with 316 stainless steel service saddle, 316 stainless steel piping, and 316 stainless steel ball valve. Air release valves manufacturers to be used shall be in accordance with the Appendix A, Approved Manufacturer List of the Town CSM.

B. Combination air valves shall have a 316 stainless steel service saddle, 316 stainless steel piping, and 316 stainless steel ball valve. Combination air valves manufacturers to be used shall be in accordance with the Appendix A, Approved Manufacturer List of the Town CSM.

PART 3 EXECUTION

3.01 INSTALLATION

A. General: The Contractor shall install all pipework meeting the requirements of AWWA for installation of various types and classes of pipe. It is the Contractor's responsibility to, coordinate utility locates with Sunshine State One-Call of Florida, Inc. (800-432-4770 or web site www.sunshine811.com) and individual utilities as may be required, make exploratory excavations, and/or use other methods available to locate existing utilities before construction of any water mains. If necessary, the Contractor shall adjust the new water mains, subject to approval of the Public Services Director or his Designee, to avoid conflicts with existing piping. If a conflict is found between an existing utility and proposed grade, the Contractor is to furnish the Public Services Director all pertinent information and the proposed remedial design. All remedial designs must be approved in advance by the Public Services Director or his Designee.

B. Reference Points and Layout: The Contractor shall be responsible for setting all grade lines, centerline of construction, and locating property lines. Any reference points, points of intersection, property corners, or benchmarks, which are disturbed during construction, shall be restored by a Land Surveyor registered to practice in the State of Florida, and all costs thereof shall be borne by the Contractor. The Contractor shall assume all responsibility for the correctness of the grade and alignment stakes.

C. Pipe Handling: Every care shall be taken in handling and laying pipe and fittings to avoid damaging the pipe, scratching or marring machined surfaces, and abrasion of the pipe coating. The lined pipe and fittings must be handled only from the outside of the pipe and fittings. No forks, chains, straps, hooks, etc. shall be placed inside the pipe and fittings for lifting, positioning, or laying. Carry pipe into position, do not drag. Do not dump or drop any of the materials of this Section into the trench. Lower pipe and accessories into trench by means of ropes,

belt slings, or other equipment approved by the Public Services Director or his Designee.

D. Pipe Cleaning: Thoroughly clean interior of pipe and accessories before lowering pipe into trench. Keep pipe clean during laying operations by plugging or other methods approved by the Public Services Director. Before installation, inspect each piece of pipe and fitting for defects. Material found to be defective before or after laying shall be replaced with sound material meeting the specified requirements, without additional cost to the Town. If damaged, the material shall be repaired in accordance with the liner manufacturer's recommendations. Any fitting showing a crack and any fitting or pipe which has received a severe blow that may have caused an incipient fracture, even though no such fracture can be seen, shall be marked as rejected and removed at once from the work site. In any pipe showing a distinct crack in which it is believed there is no incipient fracture beyond the limits of the visible crack, the cracked portion, if so approved by the Public Services Director or his Designee, may be cut off before the pipe is laid so that the pipe used may be perfectly sound. The cut shall be made in the sound barrel at a point at least 12 inches from the visible limits of the crack. Except as otherwise approved, all cutting shall be done with a power driven cut off saw. All cut ends shall be examined for possible cracks caused by cutting. Keep gaskets away from oil, grease, excessive heat, and direct rays of the sun. Keep PVC pipe covered during storage to prevent damage by sunlight.

E. Pipe Installation: Pipe shall be installed in accordance with AWWA C600, latest revision, for ductile iron water main; AWWA C605, latest revision, for PVC water main; manufacturer's instruction and Engineer direction. Underground pipe shall be furnished in nominal 18- or 20-foot laying lengths unless indicated otherwise on the Drawings. Pipe shall be cut to length as required to fit installation conditions.

1. Rest the full length of each section of pipe solidly on the pipe bed, with recesses excavated to accommodate bells, couplings, and joints.

2. Take up and relay pipe that has the grade or joint disturbed after laying.

3. Special Construction Requirements for 24 Inch and Larger PVC Pipe: For PVC pipe 24 inches and larger, unless approved otherwise by the Town, a foundation bed of granular material (57 stone) shall be placed under and around all ductile iron fittings and valves for additional support of heavy system components. A foundation bed of granular material shall be provided for all valves 20 inches size and larger. For granular materials, the minimum vertical limit is 12 inches under the fitting or valve, up to one-third the overall height of the fitting or valve. The minimum horizontal limits of the granular material shall be 12 inches in all directions beyond

the outer edges of the fitting or valve. The compaction of soils below the granular material shall be at 98% of the maximum density. All spool pieces between 24 inches and larger ductile fittings and valves shall be at least 5 feet long. Where possible, a full joint of pipe (no short pipe lengths) shall be connected to all fittings and valves. No joint deflection shall be allowed at the fittings or valves.

4. Pipe Depth: The standard minimum cover for water main systems shall be 36 inches from the top of the pipe to finish grade. Where these conditions cannot be met, special consideration will be given and must be approved by the Public Services Director or his Designee. Additional depth may be required where future surface improvements are planned or expected.

5. Pipe Separation Horizontal and Vertical Separation: See Article 1.03.C of this Section.

   a. The horizontal separation between sanitary force mains and existing or proposed water mains shall not be less than 10 feet, or as specified by FDEP. The elevation of the top of the sewer pipe shall be at least 18 inches below the invert of the water main.

   b. Wherever new sanitary force mains must cross under water mains, the sewer shall be laid at such an elevation that the top of the sewer pipe is at least 18 inches below the bottom of the water main. When the elevation of the sanitary force main cannot be buried to meet the above requirements, special protection shall be provided or the water main shall be relocated to provide this separation. Adjusted pipe shall be reconstructed with ductile iron pipe for a distance of 10 feet on each side of the sewer with one full length of water main pipe centered over the sewer so that both joints are as far from the sewer as possible. Said protection shall consist of completely encasing, 6 inches minimum, the sewer pipe in concrete for a minimum distance of 10 feet each side of the water main, or installation of pressure-tight joint cast or ductile iron pipe for the same dimension.

6. Joints: The Contractor shall submit the specific type of joint to be used on all pipes, including complete data on all material to be used, to the Engineer for approval before beginning any pipework. Make all joints conform to the requirements of the manufacturer's printed instructions as approved for the type of joint installed.

   a. Underground pipe shall be installed using push on joints or mechanical joints as shown on the Drawings. All adapters

necessary for the proper jointing of pipe shall be provided. Connections to other types of pipe shall be made with a watertight coupling suitable for application. Manufacture shall be in accordance with Appendix A, Approved Manufacturer List.

b. PVC Joints shall form a watertight and airtight seal.

F. Tracer Wire and Warning Tape Installation

1. General: Wherever nonmetallic pipe is installed by open cut, blue type TWH insulated PVC copper conductor, #10 solid strand copper wire that is strapped to the pipe at 10-foot intervals shall be installed. Wire shall meet National Electric Codes and Underwriter Laboratories, Inc. requirements.

2. Tracer wires shall begin and terminate in the test boxes. Wire shall run continuously through test stations for the entire length of the pipe line and shall be strapped to the pipe at 10-foot intervals. Test boxes shall be installed at each location as shown on the Drawings, spaced at intervals not exceeding 500 feet. Test boxes shall not be installed in streets or driveways. Tracer wire between boxes shall be continuous, unbroken lengths. The tracer wire shall not be installed in tension, but neither shall there be "coils" in the wire. The ends of the tracer wires shall be installed in the test boxes. The length of each tracer wire in each box shall be long enough to extend no less than 1 foot and no greater than 2 feet above ground level. Breaks shall be repaired by splicing with a connector. Manufacture shall be in accordance with Appendix A, Approved Manufacturer List. Repairs by "twisting" the two ends together will not be accepted.

3. Warning tape shall be buried in the backfill approximately 18 inches over the top of the water main. Tape shall be laid in continuous lengths. Warning tape should be above all direct buried potable water mains. Any breaks or tears shall be repaired before proceeding with the backfilling operations.

4. For pipe installed via Horizontal Directional Drill, see Section 10, Horizontal Directional Drilling, for tracer wire requirements.

G. Thrust Restraint: All non-flanged fittings and valves shall be restrained. In addition, restraint joints shall be provided at all changes in alignment. Restrained joints shall be of the type specified in Section 11, Pipe, Fittings, Valves, and Appurtenances, and Appendix A, Approved Manufacturer List of the Town CSM.

H. System Connections: All connections and ties to the Town's Water Distribution System and transfer of services will be performed by the Contractor under supervision of a Town representative.

I. Tapping Sleeve and Valve Connections: Unless approved otherwise by the Town, tapped connections in the barrel of a pipe shall be less than the diameter of pipe being tapped except 4-inch pipe, which may be tapped with a 4-inch tapping sleeve and valve. No taps shall be made within 5 feet of a joint.

J. Identification: All installed underground nonmetallic water mains shall be blue or ductile iron.

K. 3-Inch or Larger Flow Meter and Backflow Preventer Assemblies: Unless approved otherwise by the Town, all potable water flow meter and backflow assemblies of 3-inch-diameter or larger shall be installed on an above-ground concrete pad. No underground vaults are allowed.

3.02 TESTING

A. General: The Contractor shall submit the plan for testing to the Public Services Director or his designee for review at least 10 days before starting the test. Upon approval of the Public Services Director, the Contractor shall perform hydrostatic and leakage testing of all water distribution systems, as set forth in the following and shall conduct said tests in the presence of representatives from the Public Services Director and other authorized agencies, with 48 hours' advance notice provided, in writing or phone call. Note: The first test will be no cost the Contractor. All re-test will cost the Contractor $25.00 per re-test thereafter.

B. Test Pressures: At a minimum, the Contractor shall perform pressure and leakage test at 150 psi (based on the elevation or the lowest point of the section under test and corrected for gauge location).

C. Testing Records: The Contractor shall provide records of each piping installation during the testing. These records shall include the following information:

1. Date and times of test.
2. Identification of pipeline section tested or retested.
3. Identification of pipeline material.
4. Identification of pipe specification.
5. Test fluid.
6. Test duration.
7. Test pressure at low point in pipeline section.
8. Remarks: Leaks identified (type and location), types of repairs, or corrections made.

9. Certification by the Contractor that the leakage rate measured conformed to the Specifications.

D. Testing Fluid

1. The Town will provide a source of supply from the existing treated water distribution system for the Contractor's use in filling the lines. At no cost to the Town, the Contractor shall be responsible to provide necessary piping, fittings, valves, and appurtenances necessary to connection to the Town's water main at a location specified by the Public Services Director or his Designee.

2. An air break shall be maintained at all times between the Town's distribution system and the Contractor's equipment to prevent cross-connection. The line shall be slowly filled with water and the specified test pressure shall be maintained in the pipe for the entire test period by means of a pump furnished by the Contractor. Provide accurate means for measuring the quantity of water required to maintain this pressure. The amount of water required is a measure of the leakage. Testing fluid shall be potable water. The Contractor shall submit a request for use of water from waterlines to the Public Services Director or his designee a minimum of 48 hours in advance.

E. The Contractor shall provide back flow prevention control for temporary connections to existing water mains.

F. Testing Equipment: The Contractor shall provide calibrated oil-filled pressure gauges, pipes, and pumps to perform the hydrostatic testing. The Contractor shall provide all labor and equipment required for testing.

G. Testing Preparation

1. Pipes shall be in place, backfilled, and anchored before beginning pressure testing. The Contractor shall conduct pressure tests on exposed and aboveground piping after the piping has been installed and attached to the pipe supports, hangers, anchors, expansion joints, valves, and meters.

2. For buried piping, the pipe may be partially backfilled and the joints left exposed for inspection during an initial leakage test. However, perform the final pressure test after completely backfilling and compacting the trench.

3. The Contractor shall provide any temporary piping needed to carry the test fluid to the piping that is to be tested. After the test has been completed and demonstrated to comply with the Specifications, disconnect and

remove temporary piping. Do not remove exposed vent and drain valves at the high and low points in the tested piping; remove any temporary buried valves and cap the associated outlets. Plug taps or connections to the existing piping from which the test fluid was obtained.

4. Provide temporary drain lines needed to carry testing fluid away from the pipe being tested. Remove such temporary drain lines after completing the pressure testing.

H. Cleaning: Before conducting hydrostatic tests, the Contractor shall flush pipes with water to remove dirt and debris. For pneumatic tests, blow air through the pipes. Maintain a flushing velocity of at least 3 feet per second (fps) for water testing and at least 2,000 feet per minute (fpm) for pneumatic testing. Flush pipes for the period given by the formula:

$$T = \frac{2L}{3}$$

in which:
T = flushing time (seconds)
L = pipe length (feet).

For pipelines 24 inches or larger in diameter, acceptable alternatives to flushing are use of high-pressure water jet, sweeping, or scrubbing. Water, sediment, dirt, and foreign material accumulated during this cleaning operation shall be discharged, vacuumed, or otherwise removed from the pipe.

I. Testing and Disinfection Sequence for Potable Water Piping: Perform required disinfection after hydrostatic testing, unless otherwise indicated. Disinfection shall be performed as described in this Section.

J. Length of Test Section for Buried Piping: The maximum length of test section for buried pipe is 500 feet. Testing of longer pipe sections can only be done with the prior written approval of the Public Services Director or his Designee.

K. Initial Pipeline Filling for Hydrostatic Testing: The maximum rate of filling shall not cause the water velocity in the pipeline to exceed 1 fps. Filling may be facilitated by removing automatic air valves and releasing air manually.

L. Testing New Pipe Which Connects to Existing Pipe: Before testing new pipelines that are to be connected to existing pipelines, the Contractor shall isolate the new line from the existing line by permanently installing a gate valve to allow for isolation of the new piping form the existing piping.

M. Hydrostatic Testing of Aboveground or Exposed Piping: Open vents at high points of the piping system to purge air while the pipe is being filled with water.

Venting during system filling may also be provided by temporarily loosening flanges. Maintain the test pressure specified for buried piping for a minimum of 2 hours. Examine joints, fittings, valves, and connections for leaks. The piping system shall show zero leakage or weeping. Correct leaks and retest until zero leakage is obtained.

N. Hydrostatic Testing of Ductile Iron or PVC Buried Piping

1. Where any section of the piping contains concrete thrust restraints or encasement, the Contractor shall not make the pressure test until at least 10 days after the concrete has been placed. When testing mortar-lined or PVC piping, fill the pipe to be tested with water and allow it to soak for at least 24 hours to absorb water before conducting the pressure test. Apply and maintain the test pressure by a positive displacement hydraulic force pump.

2. Hydrostatic testing shall be performed at 150 psi pressure, unless otherwise approved by the Town, for a period of not less than 2 hours. Testing shall be in accordance with the applicable AWWA provisions for PVC – AWWA M23 and for ductile iron pipe – AWWA C600, Section 4. The allowable rate of leakage shall be less than the number of gallons per hour determined by the following formulas:

PVC	DIP
$L = \frac{N * D * P^{1/2}}{7400}$	$L = \frac{S * D * P^{1/2}}{133{,}200}$

For 150 psi; test: L = 0.00165 ND (PVC)
For 150 psi; test: L = 0.000092 SD (DIP)

Where:

L = allowable leakage in gallons per hour.
N= number of joints in section tested.
S = length of pipe tested, in feet.
D = nominal diameter of the pipe in inches.
P = average test pressure maintained during the leakage test in pounds per square inch

3. The testing procedure shall include the continued application of the specified pressure to the test system, for the 2-hour period, by way of a pipe taking supply from a container suitable for measuring water loss. The amount of loss shall be determined by measuring the volume displaced from said container.

4. Should the test fail, necessary repairs shall be accomplished by the Contractor and the test repeated until within the established limits. The Contractor shall furnish the necessary labor, water, pumps, gauges, and all

other items required to conduct the required water distribution system testing and perform necessary repairs.

5. After the first initial test, if there is a failure, an additional fee of $25.00 for every retest will be charged and must be paid to the Town.

O. HDPE Pressure Testing Procedures

1. All field tests shall be made in the presence of the Public Services Director or his Designee. Except as otherwise directed, all pipelines shall be tested. All piping to operate under liquid pressure shall be tested in sections of approved length, typically from valve to valve and in no case longer than 1,000 feet.

2. Hydrostatic testing shall consist of a combined pressure test and leakage test. The field test pressure shall be 150 psi, but shall in no case exceed the rated operating pressure printed on the pipe. The pressure shall be applied by a pump connected to the pipe in a manner satisfactory to the Public Services Director or his Designee. The pump, pipe connection, and all necessary apparatus shall be furnished by the Contractor and shall be subject to the satisfaction of the Public Services Director or his Designee.

3. The maximum duration for any test, including initial pressurization, initial expansion, and time at test pressure, must not exceed 8 hours. If the test is not completed due to leakage, equipment failure, etc., depressurize the test section and allow it to "relax" for at least 8 hours before bringing the test section up to test pressure again.

P. Monitored Make-Up Water Test: The test procedure consists of initial expansion and test phases.

1. During the initial expansion phase, the test section is filled with water. Once the line is filled, make-up water is added at hourly intervals as required to maintain the test pressure for 3 hours.

2. At the end of the initial expansion period, the addition of make-up water will cease. During the test phase the pipe will not have any water added to it for the following 2 hours. The 2 hours will be the actual leakage test. At the end of the 2-hour period, measured make-up water will be added to the pipe to return it to the original test pressure.
3. If the amount of make-up water added is greater than calculated using the numbers listed below, the section being tested will be considered to have a leak. The leak shall be found and fixed at the Contractor's expense and that section of the line retested before continuing with subsequent leakage tests.

Testing and repairs shall be repeated at the Contractor's expense until the amount of make-up water is less than the amount calculated using the numbers listed below.

Q. Leakage Test: The leakage test shall be a separate test following the pressure test and shall not be less than 2 hours long. All leaks evident at the surface shall be repaired and leakage eliminated regardless of the total leakage as shown by test. Lines that fail to meet tests shall be repaired and retested as necessary until test requirements are met. Defective materials, pipes, valves, and accessories shall be removed and replaced.

The allowable leakage for buried piping having threaded, brazed, or welded (including solvent welded) joints shall be zero.

ALLOWABLE FOR EXPANSION UNDER
TEST PRESSURE* POLYETHYLENE PIPE

Nominal Pipe Size (n)	Allowances for Expansion (US Gal/100 Feet of Pipe)		
	1-Hour Test	2-Hour Test	3-Hour Test
2	0.08	0.12	0.15
3	0.10	0.15	0.25
4	0.13	0.25	0.40
6	0.30	0.60	0.90
8	0.50	1.0	1.5
10	0.75	1.3	2.1
12	1.1	2.3	3.4
14	1.4	2.8	4.2
16	1.7	3.3	5.0
18	2.2	4.3	6.5
24	4.5	8.9	13.3
30	6.2	12.6	19.1
36	9.0	18.0	27.0
42	12.0	24.0	36.0
48	15.0	27.0	43.0

These allowances only apply to the test phase and not to the initial expansion phase.

Repair and retest any pipes showing leakage rates greater than that allowed in the criteria above.

R. Repetition of Test: If the actual leakage exceeds the allowable leakage, locate and correct the faulty work and repeat the test. Restore the work and all damage resulting from the leak and its repair. Eliminate visible leakage.

S. Tracing Wire Testing: After construction and backfilling is complete, but before final inspection, the Town inspector will test the tracer wire with standard Town locating equipment. If the inspector determines that the tracer is not operating properly, the Contractor shall locate and correct the problem. The water main will not be accepted and placed in operation until the tracer system is acceptable to the Town.

END OF SECTION

SECTION 13
DISINFECTION OF POTABLE WATER PIPING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section does not stand alone and is incorporated as part of the Town Construction Specification Manual (CSM). The CSM shall be used for other requirements that may not be covered in this Section.

B. This Section describes requirements for materials and procedures for disinfecting water mains by the continuous feed method and the slug method. The Contractor shall disinfect piping in accordance with Rule 62-555.340, FAC, and AWWA C651 and disinfect water storage facilities in accordance with Rule 62-555.340 FAC and AWWA C652, except as modified below.

C. Use potable water for chlorination.

D. Submit request to the Public Services Director or Designee for use of water from Town waterlines at least 48 hours in advance.

E. If water for disinfection and/or flushing is supplied from a temporary connection to the existing distribution system, appropriate backflow prevention methods shall be used.

F. Proper disposal of the chlorinated disinfection water and the flushing water is the Contractor's responsibility. Disinfected water shall be neutralized in accordance with AWWA C651 and AWWA C652 before discharge.

G. Before permit review and coordination with the Public Services Director or Designee and appropriate regulatory authorities, the Contractor shall provide a schedule for the rate of flow and locations of discharges for the disinfection of piping. The neutralized discharge water shall be disposed of by discharging to the nearest sanitary sewer to the local stormwater system through onsite swales or by other approved means. Discharge to the local stormwater system shall be routed to avoid swale overflow and/or erosion. The Contractor shall be responsible for any damage that occurs related to the discharging process. The Contractor shall repair or replace any damage caused by discharging to the Owner’s satisfaction at no additional expense to the Town.

H. It is the responsibility of the Contractor to implement and enforce strict adherence to safety guidelines that are addressed in AWWA C651 and AWWA C652 as well

as safety and handling instructions from the manufacturer. The Contractor shall comply with all applicable national, state, and local safety regulations and requirements, including OSHA.

1.02 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the time of construction. The following documents are a part of this Section.

A. American Water Works Association (AWWA)

1. AWWA B300—Hypochlorites.
2. AWWA B301—Liquid Chlorine.
3. AWWA C651—Disinfecting Water Mains.
4. AWWA C652—Disinfection of Water Storage Facilities.

B. Florida Administrative Code (FAC)

1. FAC 62-555.340—Disinfection and Bacteriological Evaluation of Public Water System Components.

PART 2 PRODUCTS

A. Liquid chlorine shall conform to AWWA B301 and shall be applied in strict accordance with AWWA C651 and AWWA C652.

B. Calcium Hypochlorite (Dry): Calcium hypochlorite shall conform to AWWA B300 and shall be applied in strict accordance with AWWA C651 and AWWA C652. Calcium hypochlorite intended for swimming pool chlorination shall not be used under any circumstances.

C. Sodium Hypochlorite (Solution): Sodium hypochlorite shall conform to AWWA B300 and shall be applied in strict accordance with AWWA C651 and AWWA C652.

2.02 CHLORINE RESIDUAL TEST KIT

A. For measuring chlorine concentration, the Contractor shall supply and use a medium-range, drop count, DPD drop dilution method kit in accordance with AWWA C651 and AWWA C652. Maintain kits in good working order available for immediate test of residuals at point of sampling.

2.03 GENERAL DISINFECTION PROCEDURE

A. Before disinfection, the Contractor shall inspect materials for quality. The Contractor shall use materials and equipment that are appropriate for the disinfection methods selected. The Contractor shall observe the precautionary guidelines given in AWWA C651 and AWWA C652.

B. During construction, the Contractor shall take preventative measures in accordance with AWWA C651 to protect materials from contamination.

C. Hydrostatic testing shall be successfully performed before disinfection.

D. Before disinfection, the Contractor shall clear water mains of foreign debris:

1. Pipelines that are less than 24 inches in diameter shall be flushed, while pipelines that are greater than 24 inches in diameter may be cleared via broom-sweeping in accordance with AWWA C651.

2. In accordance with AWWA C651 and AWWA C652 procedures, the Contractor shall disinfect all newly constructed materials and existing materials that may have been contaminated during construction. The Contractor shall provide adequate documentation that the required disinfection level (i.e., required chlorine residual and contact time) was successfully achieved.

E. In accordance with Rule 62-555.340, FAC, following disinfection the total chlorine residual in the water mains and water storage facilities shall be reduced to 4 milligrams per liter (mg/L). The chlorine residual may be reduced via flushing with potable water or by a neutralizing agent that conforms to AWWA C651 and AWWA C652.

F. After the total chlorine residual has been reduced to 4 mg/L, the Contractor shall conduct bacteriological testing for water mains and water storage facilities. Bacteriological sampling and testing shall be performed in accordance with Rule 62-555.340 FAC.

G. The Contractor shall dispose of residue from cleaning and other construction operations as well as water from dewatering operations in a manner satisfactory to Florida Department of Environmental Protection and the Lake County Department of Health.

2.04 CONTINUOUS-FEED METHOD FOR PIPELINES

A. Continuous-feed disinfection shall be performed in accordance with AWWA C651. The Contractor shall introduce potable water into the pipeline at a constant measured rate. Feed the chlorine solution into the same water at a measured rate. Proportion the two rates so that the free chlorine concentration in the pipeline is maintained at a minimum concentration of 25 mg/L. Inject chlorine into the main at a point no greater than 3 feet downstream of the start of the new water main. Using the appropriate test kits specified by AWWA C651, the Contractor shall check the concentration at points downstream during the filling to ascertain that sufficient chlorine is being added. The water main shall be completely filled with chlorinated water. The chlorine contact time shall be at least 24 hours. The water shall be chlorinated so that after 24 hours the concentration of free chlorine residual in the water main shall be not less than 10-mg/L.

2.05 SLUG METHOD FOR PIPELINES

A. The Contractor shall perform slug method disinfection in accordance with AWWA C651. Introduce the water in the pipeline at a constant measured rate. At a point no greater than 3 feet downstream of the start of the new water main, feed the chlorine solution into the pipeline at a measured rate so that the free chlorine concentration created in the pipeline is 100 mg/L. Using the appropriate test kits specified by AWWA C651, the Contractor shall check the concentration at points downstream during the filling to ascertain that sufficient chlorine is being added. Feed the chlorine for a sufficient period to develop a solid column or "slug" of chlorinated water that will expose all interior surfaces to a concentration of at least 100 mg/L for at least 3 hours.

2.06 DISINFECTION OF VALVES, BLIND FLANGES, AND APPURTENANCES

A. During the period that the chlorine solution is in the pipeline or as the slug encounters hydrants and valves, open and close valves at least three times to obtain chlorine residual at hydrants and other pipeline appurtenances. Swab exposed faces of valves and blind flanges before bolting flanges in place with a 1% sodium hypochlorite solution.

2.07 DISINFECTION OF CONNECTIONS TO EXISTING PIPELINES

A. The Contractor shall disinfect isolation valves, pipe, and appurtenances in accordance with AWWA C651, Section 4.7. Flush with potable water until discolored water, mud, and debris are eliminated. Swab interior of pipe and fittings with a 1% sodium hypochlorite solution. After disinfection, flush with potable water again until water is free of chlorine odor.

2.08 CONFIRMATION OF RESIDUAL

A. After the chlorine solution applied by the continuous feed method has been retained in the pipeline for 24 hours, the Contractor shall confirm that a free chlorine residual of 10 mg/L minimum exists along the pipeline by sampling at air valves and other points of access, such as tapping valves.

B. With the slug method, confirm by sampling as the slug passes each access point and as it leaves the pipeline that the free chlorine concentration in the slug is at least 50 mg/L. If the free chlorine residual is less than 50 mg/L, the flow shall be stopped and the slug residual concentration shall be increased to 100 mg/L before disinfection may resume.

2.09 PIPELINE FLUSHING

A. After confirming the free chlorine residual and sufficient contact time, the Contractor shall flush the excess chlorine solution from the pipeline until the free chlorine concentration in the water leaving the pipe is no higher than 4 mg/L.

2.10 BACTERIOLOGICAL SAMPLING AND TESTING

A. In accordance with Rule 62-555.340, FAC, the Contractor shall collect and deliver required samples to a certified laboratory and obtain a bacteriologic quality test to demonstrate the absence of coliform organisms in each separate section of the pipeline and in each structure after chlorination and refilling. Samples shall be delivered to a certified laboratory within 6 hours of sampling:

1. For water mains, collect at least one set of samples from every 1,200 feet of the new water main, or as required by the Department of Health, plus one set from the end of the line and at least one set from each branch. At each connection to an existing pipeline, take two additional samples.

B. The Contractor shall take chlorine residual samples at the time bacteriological samples are taken. If the chlorine residual is greater than 4 mg/L, the bacteriological test shall be considered invalid and the residual shall be reduced to 4 mg/L and the bacteriological testing shall be performed until the required criteria are satisfied.

2.11 REPETITION OF PROCEDURE

A. If the initial chlorination fails to produce required residuals and bacteriologic tests, the Contractor shall repeat the chlorination and testing until satisfactory results are obtained, at no cost to the Town.

B. If the water main is installed before satisfactory bacteriological results are achieved, a precautionary boil water notice must be issued if recommended by the water supplier or if recommended by the Department of Health's "Guidelines for the Issuance of Precautionary Boil Water Notices" in accordance with Rule 62-555.340, FAC.

2.12 TEST FACILITY REMOVAL

A. After satisfactory disinfection, the Contractor shall disinfect and replace air valves, restore the pipe coating, and complete the pipeline where temporary disinfection or test facilities were installed.

2.13 PIPING TO BE DISINFECTED

A. Disinfect all water main piping shown on the Drawings.

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 14
WASTEWATER GRAVITY SEWER SYSTEM

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section does not stand alone and is incorporated as part of the Town Construction Specification Manual (CSM). The CSM shall be used for other requirements that may not be covered in this Section.

B. This Section includes general technical criteria for the design and installation of wastewater gravity sewer systems. The Contractor shall provide all work necessary for the construction and testing of a gravity sewer system. This work shall include the installation of all gravity sewer mains, services lines, manholes, fittings, and appurtenances as may be required to complete the work as indicated in the Drawings and as specified herein.

C. The work shall also include such connections, reconnections, temporary service, and all other provisions regarding existing sewer operations and modifications as is required to perform the new work.

D. All references to Industry Standards (ASTM, ANSI, AWWA, etc.) shall be to the latest revision unless otherwise stated. Sewer service connections are specified in Section 15, Wastewater Service Connections. Only those materials included in the Town of Howey-in-the-Hills CSM shall be installed. All materials shall be new unless specifically called for otherwise.

E. All piping and equipment of the same type shall be from one manufacturer, unless authorized in writing by the Town or the Town's representative.

1.02 SUBMITTALS

A. All submittals shall be submitted in accordance with the shop drawing submittal requirements as specified in Section 1, General Provisions.

1. Shop Drawings: The Contractor shall submit catalog cut sheets, manufacturer's descriptive literature, and other necessary information to the Public Services Director for approval before installation.

2. Certifications: The Contractor shall submit a certification from the pipe and manufacturer that the pipes supplied are new, have been manufactured for this project, and have been inspected at the plant.

3. Manholes:

   a. Base sections, riser sections, eccentric and concentric conical top sections, flat slab tops, and grade rings with notarized certificate indicating compliance with ASTM C478.
   b. Location and elevation of all penetrations.
   c. Applicable lifting and installation details or instructions.
   d. Frames and covers with description literature and cut sheets and notarized certificate indicating compliance with specified standards (ASTM A48/A48M, Class 30; etc.).
   e. Method of repair for minor damage to precast concrete sections.
   f. Delivery, unloading, and receiving instructions.
   g. Buoyancy countermeasures.

4. Design Drawings shall demonstrate that the applicable industry design standards listed in this Section have been met.

5. Precast concrete structures:

   a. Sectional Drawings and elevations showing dimensions and reinforcing steel placement.
   b. Structural calculations including assumptions.
   c. Concrete design mix.

1.03 DESIGN STANDARDS

A. The Developer shall comply with the applicable requirements specified within WEF Manual of Practice No. 9, and Chapter 20 of the Ten-States Standards Recommended Standards for Sewage Works and as established by the Florida Department of Environmental Protection.

B. Average Daily Flow (ADF): The sewer system design shall be based on full ultimate development as known, or projected. The ADF from domestic units shall be calculated at the minimum rate of 250 gallons per day per equivalent residential unit, but should conditions be unfavorable such as high ground water conditions, an additional allowance shall be included for infiltration. Single-family residences shall be computed at the rate of 3.5 persons per connection and multi-family or mobile home dwellings at 2.5 persons per unit. Flow requirements from commercial, industrial, institutional, or other special development areas shall be established from existing records or by estimated projections using the best available data; however, in no case shall a rate of less than 2,000 gallons per acre per day be used, unless specifically approved otherwise. It shall be stated in the Developers Agreement that sizing of the sewer system shall be the responsibility

of the Developer, based upon his expected use of the land and flows generated therein. Any future upsizing of onsite improvements due to more intensive uses of the land shall be the responsibility of the Developer.

C. Maximum Flow Rates: Gravity sewers shall be designed on the basis of ultimate development maximum rates of flow. The maximum flow ranges from 2.0 as a minimum up to a maximum of 4.0 times the cumulative ADF, depending on the number of houses contributing, as recommended by the Ten States Standards.

D. Gravity Sewer Size Computation: Wastewater gravity sewers shall be sized to provide ample capacity for the maximum flow rates. The minimum allowable size for any sewer, other than service connections, shall be 8 inches in diameter. All sewers shall be designed at slopes providing a minimum velocity of not less than 2 feet per second, when flowing full. Sewers 48 inches or larger shall be designed to give mean velocities, when flowing full, of not less than 3.0 feet per second. Said computation shall be based on Manning's Formula using a roughness coefficient ("N") of not less than 0.013, unless justifiably approved otherwise. In general, the following minimum slopes shall be provided for sewer sizes to 24 inches:

Nominal Sewer Size (inches)	Minimum Slope in Feet Per 100 Feet
8	0.4
10	0.28
12	0.22
14	0.17
15	0.15
16	0.14
18	0.12
20	0.11
21	0.10
24	0.08

E. Minimum slopes slightly less than those indicated may be considered in extreme situations, providing the depth of flow will not be less than 0.3 of the pipe diameter or the velocity less than 1.6 feet per second at design average daily flow, and justifiable reasons for the modification are presented to the Town. On any design having slopes less than the “RECOMMENDED MINIMUM”, the Design Engineer shall submit flow calculations. The maximum allowable slope is 15.0%.

F. Design Considerations

1. Sewers 24 inches in diameter or less shall be installed with straight alignment and grade between manholes, with manhole spacing not to exceed 400 feet for sewers 15 inches or less, and 500 feet for sizes larger.

2. When a smaller sewer joins a larger one, the invert of the larger sewer should be lowered sufficiently to maintain the same energy gradient.

3. All wastewater gravity mains shall terminate at manholes.

G. Standard Requirements

1. General: The materials of construction and general installation procedures shall comply with the specific applicable standards set forth under Section 6, Utility Excavation, Trenching, and Backfilling; Section 9, Boring, Jacking, and Tunneling; and Section 11, Pipe, Fittings, Valves, and Appurtenances.

2. Pipe: Buoyancy of sewers shall be considered and flotation of the pipe shall be prevented with appropriate construction where high groundwater conditions are expected. Pipe for gravity sewage lines shall be ductile iron or polyvinyl chloride (PVC) as shown on the Drawings and as herein specified.

3. Protection of Water Supplies:

   a. When wastewater sewers are proposed in the vicinity of any water supply facilities, requirements of the "Recommended Standards for Water Works" (Ten States Standards for Water Works) and Florida Department of Environmental Protection (FDEP) shall be used to confirm acceptable isolation distances in addition to the following requirements.

      (1) There shall be no physical connections between a public or private potable water supply system and a sewer, or appurtenance thereto which would permit the passage of any wastewater or polluted water into the potable supply. No water pipe shall pass through or come into contact with any part of a sewer manhole.
      (2) The Contract Drawings shall show all existing waterwork units, such as basins, wells, or other treatment units within 200 feet of the proposed sewer. All minimum distances between sewers and all public water supply appurtenances required by FDEP shall be met.

4. Manholes and Cleanouts:

a. Manholes shall be precast concrete. The minimum inside diameter of manholes shall be 48 inches for sewer sized to 21 inches in diameter or less, with submittal of special designs for larger pipes. Manholes with single inside drops shall be 60 inches in diameter and manholes with double inside drops shall be 72 inches in diameter. Manholes are to be placed at the end of each line; at all changes in grade, size, or alignment; at all intersections; at the end of jack and bore section for gravity sewer lines and at distances not greater than 400 feet for sewers 15 inches or less, and 500 feet for sewers for larger sizes. Cleanouts may be used only for special conditions and shall not be substituted for manholes nor installed at the end of laterals greater than 150 feet in length.

b. All manholes and sewers shall be located in public rights-of-way. No manholes or sewers shall be located in side or back lot easements under any conditions.

c. All manholes on private property and not a part of the Town of Howey-in-the-Hills public sewer system shall have standard manhole covers with the word "SEWER" in the center. Manhole covers with the words "Town of Howey-in-the-Hills" shall not be permitted on manholes that are not the responsibility of the Town or be owned by the Town and shall be noted on the Drawings. Gravity sewers connecting manholes located on private property to Town-owned and operated manholes shall not be the responsibility of the Town and shall not be located in rights-of-way.

d. Sewer clean-outs not in the pavement shall have around their tops in concrete pads, which will be flush with the top of the curb, with minimum dimensions of 18 by 18 by 3 inches. Sewer clean-outs in the pavement shall be ductile iron pipe (DIP) up from the service and have around their tops in concrete pads, which will be flush with the top of the finished pavement surface.

e. Manholes shall not be located in drainage swales or any other low area likely to collect or pond water during rains. The top elevation of all manholes shall be greater than or equal to the 100-year flood elevation, unless watertight covers are provided to minimize inflow.

f. Pipe entry shall be at no less than a 90º angle from direction of flow of the existing manhole or incoming pipe, unless the inside drop is equal to the diameter of the lower pipe.

g. Manholes shall be design with buoyance countermeasures to prevent floatation of the manholes.

5. Drop Manholes:

a. Outside drop manhole shall not be allowed except as specifically authorized by the Public Services Director or his Designee.

b. Inside drops shall be secured to the interior wall of the manhole and provide a Tee or Cross access for cleaning. All inside drops greater than 1 foot require one joint (18 feet minimum of DIP adjacent to the manhole, including a 6-inch stub. Minimum diameter of inside drop manholes shall be 5 feet for single inside drops and 6 feet for double inside drops.

6. Pipe Bedding: Special care shall be exercised in the design and installation to provide adequate bedding for the type of pipe used, taking into consideration trench width and depth, superimposed loadings above grade and the material below trench grade. Pipe loadings capabilities shall be computed in accordance with established design criteria and special supporting bedding or facilities shall be provided as required.

H. Design Calculations: The Engineer/Developer shall submit signed, dated, and sealed design calculations by and Professional Engineer licensed in the State of Florida with the final Construction Drawings for all wastewater gravity sewer projects.

PART 2 PRODUCTS

2.01 GENERAL

A. The materials of construction shall comply with the specific applicable standards set forth under Section 6, Utility Excavation, Trenching, and Backfilling; Section 9, Boring, Jacking, and Tunneling; and Section 11, Pipe, Fittings, Valves, and Appurtenances. The Contractor shall provide all new materials free from defects impairing strength and durability and of the best commercial quality for the purpose specified. All material supplied shall have structural properties sufficient to safely sustain or withstand strains and stresses to which it is normally subjected and be true to detail.

B. Backfill shall be as specified in Section 6, Utility Excavation, Trenching, and Backfilling.

2.02 PIPE

A. Pipe material for wastewater gravity sewers and sizing and location of manhole shall be as shown on the Contract Drawing. Pipe material shall be in accordance with the design requirements in this Section and Section 11, Pipe, Fittings, Valves, and Appurtenances, unless otherwise shown on the Contract Drawings. Pipe supports shall be in accordance with pipe manufacturer's requirements.

2.03 PRECAST CONCRETE MANHOLES

A. Precast Concrete Manholes: Manholes shall meet the requirements of ASTM C478 with the exceptions specified in this Section, and shall consist of precast reinforced concrete riser sections, a monolithic base section, and concentric cones unless otherwise approved. Manholes shall be designed and constructed to withstand a minimum H-20 type loading. Cement shall meet the requirements of ASTM C150/C150M, Type II. Reinforcing steel shall be as shown on the standard manhole detail. Concrete shall meet the minimum compressive strength requirements of 4,000 psi at 28 days. Wall thickness shall be 5 inches minimum. The required minimum strength of concrete shall be confirmed by making and testing three standard cylinders at 7 days. Rings shall be custom made with openings to meet indicated pipe alignment conditions and invert elevations. Submit shop drawings consisting of the manufacturer's standard details of various sections for approval before placing an order for manholes. Drawings of individual manholes showing invert elevations, pipe sizes, and required construction details shall be submitted. Provide certification of proper cure period and Independent Testing Laboratory tests confirming concrete moisture less than 6%. Manhole interior walls, tables, and inverts shall be a smooth surface free of voids, depressions, chips, rough edges, and high spots. Lifting holes may be provided in each section for ease of handling.

1. Bases and Slabs: Bases and slabs for manholes shall be precast integrally with the bottom manhole section.

2. Joints: Joints shall be tongue and groove configuration formed with machined castings. Surfaces shall be exactly parallel with nominal 1/16-inch clearance. Sealing compound, conforming to Federal Specification SS-S-00210A. Joint shall be wrapped with a vapor barrier joint tape. Cement mortar joints will not be acceptable, except that each joint shall be wiped inside the manhole with cement mortar after assembly. Joints shall be watertight. Manufacturer shall be in accordance with Appendix A, Approved Manufacturer List.

3. Exterior Joint Sealant Membrane: All exterior joints below the top cone section of precast concrete manholes (including base and riser sections) shall be sealed with one12-inch-wide (minimum) exterior joint sealant membrane centered on joint. The tape shall be capable of sealing manhole joints against groundwater and sand infiltration. The installation of the membrane shall be in conformance with the recommendations of the manufacturer. Surface must be smooth, clean, dry and free of voids, loose aggregate, dirt, or other matter that will hinder the adhesion of the membrane. A primer shall be used in accordance with the recommendations of the membrane manufacturer. If recommended by the manufacturer, heat shall be applied to all areas being sealed.

4. Adjustment Rings (Manhole Collars): Adjustment rings shall be 8 inches wide (48-inch outside diameter (OD) x 32-inch diameter opening) concrete. Concrete adjustment rings shall be 4,000 psi (minimum) concrete, Type II cement. Minimum height of rings shall be 2 inches. Rings shall be grouted in place. Concrete mortar (1/2 inch thick) shall be applied to the interior and exterior surfaces of the concrete adjustment rings. The interior of the concrete ring shall be coated as specified. High Density polyethylene (HDPE) rings may be used for manholes located in non-traffic areas only (not in streets, parking areas, drive ways etc.). HDPE adjustment rings shall be stackable and have a minimum height of 2 inches and be installed with silicone sealant in accordance with the manufacturer's directions. Apply heavy amount (covering the entire joining surfaces) of silicone sealant between the manhole cone section and HDPE rings, between all stackable rings and between the HDPE ring and the manhole frame (note: do not use concrete grout during the assembly of HDPE rings). During the installation of HDPE rings, the Contractor shall apply downward pressure on the rings to squeeze out the excess silicone (tight fit).

5. Portland Cement: Shall conform to ASTM C150/C150M, Type II.

6. Sand: Washed silica sand shall conform to ASTM C144.

7. Mortar: Consists of one part cement and two parts sand.

B. Manhole Frames and Covers:

1. Sewage manhole frames shall have a minimum 23-3/8-inch opening unless otherwise specified on the Drawings and sewage manhole covers shall be of the type as shown in the Town of Howey-in-the-Hills Standard Details, marked with the word "Town of Howey-in-the-Hills Sanitary

Sewer". Frames and covers shall conform to ASTM A48/A48M, Class 30 (gray iron), or Grade 65-45-12 (ductile iron) meeting the requirements of ASTM A536, cast in a true symmetrical pattern of tough, dense, and even-grained iron free from warping, scales, lumps, blisters, sandholes, or any defects of any kind. Frames and covers shall be smooth, well-cleaned, and given a bituminous coating which is tough and tenacious when hot and not tacky or brittle. All castings shall be manufactured true to pattern, and component parts shall fit together in a satisfactory manner. Machine or grind frames and covers at touching surfaces to provide firm seats and prevent rocking. Cover shall set flush with rim of frame and shall have no larger than a 1/8 inch gap between frame and cover. Remove and replace any set not matching perfectly at no additional cost. Where manholes are constructed in paved areas, frames and covers. Frame and cover must be interchangeable with approved frames and covers and meet applicable weight criteria. In certain applications, the Utility Department may require locking lids and/or watertight lids. If required, the locking lid shall be a wedge camlock only. The Contractor shall provide two special tools to operate the camlock. If a watertight lid is required, the manhole lid shall have an o-ring seal (ORS) gasket factory-installed. The Contractor shall provide three loose ORS gaskets as spare parts. Frames and cover manufacture shall be in accordance with Appendix A, Approved Manufacturer List.

2. All manhole cover and ring assemblies shall be furnished and installed complete with an insert. The purpose of the insert to prevent intrusion of stormwater, dirt, debris, and to help control emissions from odors.

    a. The manhole insert shall be manufactured from corrosion-proof material, such as HDPE or stainless steel, suitable for atmospheres containing hydrogen sulfide and diluted sulfuric acid and other gases associated with wastewater collection systems.
    b. The minimum continuous uniform thickness of the HDPE insert, including all angles shall be 1/8 inch.
    c. The body of HDPE insert shall be maid of high density polyethylene co-polymer material that meets ASTM D1248, Class A, Category 5, Type 111, and have a minimum impact brittleness temperature of -180°F.
    d. At a minimum used in the manufacture of the body of the stainless steel insert shall be a minimum of 16 gauge Type 304 stainless steel.
    e. The insert shall be manufactured to the dimensions of the manhole opening to allow easy installation within the manhole frame. The manhole insert shall be manufactured to fit the manhole frame rim upon which the manhole cover rests.

f. A lift strap shall be attached to the rising edge of the bowl insert. The lift strap shall be maid of 1 inch wide woven polypropylene web and shall be seared on all cut ends to prevent unraveling. The lift strap shall be attached to the insert by means of a stainless steel rivet. Location of the strap shall provide easy visual location.

g. The manhole frame shall be cleaned of all dirt and debris before placing the manhole insert on the rim. The manhole insert shall be fully seated around the manhole frame rim to retard water from seeping between the cover and the manhole frame rim.

C. Non-shrink Grout: All holes in manholes, provided for their handling, and the annular space between the wall and the pipe coupling adapter shall be thoroughly plugged with non-shrinking mortar applied and cured in strict conformity with the manufacturer's recommendations so that there will be zero leakage through openings and around pipes. The mortar shall be finished smooth and flush with the adjoining interior and exterior manhole and/or wet well wall surfaces.

D. Coating:

1. General: All manhole exterior and interior surfaces shall be lined and coated as specified in this Section. The Contractor shall use an approved coating and lining subcontractor for all manhole preparation and application of coatings and/or linings.

2. Exterior: The exterior manhole surfaces shall receive two coats of materials by a manufacturer provided in Appendix A, Approved Manufacturer List of the Town CSM.

3. Interior:

a. Manholes into which force mains discharge, as well as the adjacent manhole downstream from the receiving manhole shall be lined with a manufacturer in accordance with the Appendix A, Approved Manufacturer List of the Town CSM. These are the only approved manhole liners. No other liners will be approved. The Contractor shall submit shop drawings consisting of manufacturer's standard details of various sections, for approval, before placing order for manholes.

b. Other manhole interior surfaces shall receive two coats of materials by a manufacturer provided in the Appendix A, Approved Manufacturer List of the Town CSM.

2.04 FLEXIBLE MANHOLE-TO-PIPE CONNECTOR

A. The manhole-to-pipe connector shall be manufactured from Neoprene EPDM. The connector shall be a minimum of 3/8-inch thick and shall conform to ASTM C443 and ASTM C923. The connector shall be resistant to ozone, weathering, aging, chemicals, animal and vegetable fats, oils, and petroleum products and designed to accommodate pipe movement up to 2 inches radically or 22 degrees angularly in any direction.

B. The connector shall be sized for the specific type and size pipe entering and leaving each manhole. The connector shall be precast into the manhole by the manhole manufacturer in accordance with the connector manufacturer's written instructions. A 304 stainless steel band and screw assembly shall be provided to seal the flexible neoprene connector against the pipe. During the invert construction stage, the interior annular space between the exterior of the pipe and the interior of the connector shall be filled with a Type II lean cement grout by the Contractor.

C. Manufacturer shall be in accordance with the Appendix A, Approved Manufacturer List of the Town CSM.

PART 3 EXECUTION

3.01 INSTALLATION

A. The general installation procedures shall comply with the specific applicable standards set forth under Section 6, Utility Excavation, Trenching, and Backfilling; Section 9, Boring, Jacking, and Tunneling; and Section 11, Pipe, Fittings, Valves, and Appurtenances.

B. The Contractor shall install all pipework meeting the requirements of AWWA for installation various types and classes of pipe. Lay all gravity sewers using laser beam methods. Obtain exact grade and alignment for each pipe by measuring to the invert of the pipe. Lay pipe upgrade, beginning at the lower end of the sewer, with pipe bell ends up-grade. Exercise extreme care to keep the pipe in exact alignment and elevation. It is the Contractor's responsibility to, coordinate utility locates with Sunshine State One-Call of Florida, Inc. (800-432-4770 or web site www.sunshine811.com), make exploratory excavations, and/or use other methods available to locate existing utilities before construction of any gravity sewers. If necessary, the Contractor shall adjust the new sewers and/or laterals, subject to approval by the Engineer, to avoid conflicts with existing piping. If a conflict is found between an existing utility and proposed grade, the Contractor is to furnish the Engineer all pertinent information so that remedial design can be performed. Install pipe joints on each line entering or leaving manhole, including stub lines,

as close to the manhole exterior wall as practical. In no case shall the pipe be walked on either before or after the joints have been made. Securely close all openings such as stubs, wyes, or other services along the lines by means of approved stoppers that fit into the bells of the pipe and are recommended by the pipe manufacturer. Install stoppers in such a manner that they may be removed at some future time without injury to the pipe bells. No bricking or grouting plugs in lines will be permitted.

C. Reference Points and Layout: The Contractor shall be responsible for setting all grade lines, centerline of construction, and locating property lines. Any reference points, points of intersection, property corners, or bench marks, which are disturbed during construction, shall be restored by a Land Surveyor registered to practice in the State of Florida, and all costs thereof shall be borne by the Contractor. The Contractor shall assume all responsibility for the correctness of the grade and alignment stakes.

D. Handling Pipe and Manholes: Every care shall be taken in handling and laying pipe and fittings to avoid damaging the pipe, scratching or marring machined surfaces, and abrasion of the pipe coating. The lined pipe and fittings must be handled only from the outside of the pipe and fittings. No forks, chains, straps, hooks, etc., shall be placed inside the pipe and fittings for lifting, positioning, or laying. If damaged, the material shall be repaired in accordance with the liner manufacturer's recommendations. Any fitting showing a crack and any fitting or pipe which has received a severe blow that may have caused an incipient fracture, even though no such fracture can be seen, shall be marked as rejected and removed at once from the work. In any pipe showing a distinct crack in which it is believed there is no incipient fracture beyond the limits of the visible crack, the cracked portion, if so approved by the Town, may be cut off before the pipe is laid so that the pipe used may be perfectly sound. The cut shall be made in the sound barrel at a point at least 12 inches from the visible limits of the crack. Except as otherwise approved, all cutting shall be done with a power driven cut off saw. All cut ends shall be examined for possible cracks caused by cutting. Keep gaskets away from oil, grease, excessive heat, and direct rays of the sun. Keep PVC pipe covered during storage to prevent damage by sunlight. All manhole sections shall be handled and installed in such a manner and by such means as to prevent damage. Manhole sections damaged during handling and installation will be rejected as directed by the Engineer, and replaced at no additional cost to the Town.

E. Laying Pipe: Pipe shall be installed in accordance with the manufacturer's instructions, at the Engineer of Record's direction. DIP shall be installed in accordance with all applicable provisions of ASTM A746; PVC pipe shall be installed in accordance with ASTM D2321. Take all necessary precautions to prevent the entrance of mud, sand, or other obstructing matter into the pipelines.

Lay pipe on bedding prepared in accordance specification Section 6, Utility Excavation, Trenching, and Backfilling. Provide uniform bearing under the full length of the pipe barrel. Pipe shall be laid to produce a straight line of pipe on a uniform grade. Each pipe shall be laid to form a close joint with the preceding pipe to form a smooth inside flow line. Excavate for pipe bells and carefully lay pipe true to line and grade. Make adjustments to line and grade by scraping away or filling in and tamping under pipe barrel and not by wedging or blocking up any portion of the pipe. Any pipe that has its grade alignment or joints disturbed will be taken up and re-laid. All misalignment of pipe shall be corrected by the Contractor at his expense. Take up and relay pipe that has the grade or joint disturbed after laying. The pipe shall not be driven down to grade by striking it with any unyielding object. About the spigot end of each pipe against the base of the socket of the adjacent pipe in such a manner that there will be no unevenness of any kind along the bottom halves of the pipes. Compact sufficient backfill, immediately after the pipe has been jointed and inspected, to protect the pipe adequately from injury and movement. Just before jointing the pipes, the mating ends shall be thoroughly cleaned of all dirt, debris, and foreign material. The pipe shall be jointed in accordance with the recommendations of the manufacturer of the pipe and gasket. At the close of each day's work, and at other times when pipe is not being laid, protect the end of the pipe with a close-fitting stopper approved by the Engineer. Replace with sound pipe any defective pipe which may have been laid.

1. Dewatering: Water shall not be allowed in the trenches while the pipe is laid. The use of a dewatering system is a requirement on any runs of pipe where such pipe will be below the ground water elevation at the specific Site. Sump and pump type trenching may be used only on short shallow runs where well points would be impractical and excessively expensive, and only with the prior approval of the applicable Regulatory Agency. In all cases, density testing up to a point at least 1 foot above the water table shall be completed before removal of dewatering equipment. On sewer lines installed using dewatering, service laterals shall be installed while the trench is dry.

2. Backfill and Defection: Immediately after the pipe has been jointed and inspected, backfilling shall be placed in accordance with Section 6, Utility Excavation, Trenching, and Backfilling. Before and during the backfilling of any trench, precaution should be taken against flotation of pipelines therein due to entry of large quantities of water into the trench, which could cause uplift of the pipeline. Upon completion, installed pipelines shall show a full circle of light when lamped between manholes. The diameter deflection of PVC pipe shall not exceed 5% after completion and approval of construction, and for a period of 1 year thereafter.

3. Compaction: The mechanical compaction of backfill over sewer lines and appurtenances, within right-of-way and under all roadways, drives (including dirt drives), and parking areas shall be in accordance with Section 6, Utility Excavation, Trenching, and Backfilling.

4. Joints: The Contractor shall submit the specific type of joint to be used on all pipe, including complete data on all material to be used, to the Engineer for approval before beginning any pipework. Make all joints conform to the requirements of the manufacturer's printed instructions as approved for the type of joint installed.

    a. All adapters necessary for the proper jointing of pipe shall be provided. Connections to other types of pipe shall be made with a watertight coupling in accordance with Appendix A, Approved Manufacturer List of the Town CSM.

    b. PVC joints shall form a watertight and airtight seal.

    c. Jointing PVC to Vitrified Clay Pipe: Unless specifically indicated otherwise, connections of PVC to vitrified clay pipe in the run of the sewer line shall be made with by a manufacture provided in the Town of Howey-in-the-Hills Approved Manufacturer List.

5. Pipe Depth: The minimum allowable cover for gravity sewers shall be 3 feet from the top of the pipe to finish grade, unless using DIP. The maximum allowable depth for gravity shall not exceed 18 feet without approval from the Town.

6. Horizontal and Vertical Separation:

    a. The horizontal separation between wastewater gravity sewers and existing or proposed water mains shall not be less than 10 feet, measured from edge to edge, or as specified by FDEP. Where local conditions prevent a lateral separation of 10 feet between new sewer lines and any existing or proposed water main, the sewer may be laid closer than 10 feet to the water main if it is laid in the same trench with the water main located at the side of a bench of undisturbed earth. In either case, the elevation of the top of the sewer pipe shall be at least 18 inches below the invert of the water main.

    b. Wherever new sewers must cross under water mains, the sewer shall be laid at such an elevation that the top of the sewer pipe is at least 18 inches below the bottom of the water main. When the

elevation of the sewer cannot be buried to meet the above requirements, special protection shall be provided or the water main shall be relocated to provide this separation and reconstructed with DIP for a distance of 10 feet on each side of the sewer with one full length of water main pipe centered over the sewer so that both joints are as far from the sewer as possible. Said protection shall consist of completely encasing, 6 inches minimum, the sewer pipe in concrete for a minimum distance of 10 feet each side of the water main, or installation of pressure-tight joint cast or DIP for the same dimension.

F. Gravity Sewer Mains: The horizontal separation from existing, proposed, and future structures (including above ground structures, concrete footers and top of bank of ponds) shall be a minimum of 2 times the vertical depth of the deepest portion of the manhole-to-manhole sewer run.

G. Precast Concrete Manholes: The Contractor shall construct manholes as shown and specified or directed in these documents. Manhole installation shall be as shown and in strict compliance with the manufacturer's printed instructions where specials are used for connections.

1. Manhole tops shall be set to the proper elevation as shown on the Drawings or as directed by the Engineer and properly anchored to the masonry. Tops shall be adjusted using precast concrete rings. Concrete adjustment rings shall be 4,000 psi (minimum) concrete, Type II cement. Minimum height of rings shall be 2 inches. Rings shall be grouted in place. Concrete mortar (1/2-inch thick) shall be applied to the interior and exterior surfaces of the concrete adjustment rings.

    a. Manholes in paved areas shall conform to the crown and grade of the existing adjacent pavement.

    b. Tops of manholes in maintained grass areas shall be 3 inches above finished grade. Prior approval must be obtained for covers set flush with the ground.

    c. Manholes in wooded areas or unmentioned areas shall be a minimum of 18 inches above grade level. Manholes on sloped ground in unmentioned areas shall be a minimum of 18 inches above ground level on uphill side of manhole unless approved otherwise.

2. Riser and top sections shall be installed plumb and such that all manhole steps are in alignment. Joints shall be made in accordance with the manufacturer's recommendations, and to insure a watertight installation.

3. Inverts: Base sections shall be set level on bedding so prepared to prevent settlement and misalignment. Pipe openings shall be placed at the exact elevation and location to receive entering pipes. Base section shall be set such that the center of the manhole will coincide with the intersection of the incoming and outgoing pipes. The resulting angle shall be no less than 90 degrees and so constructed that both halves of an invert-channel shall be of equal length and radius. Manhole bases set off center shall be removed and reset. Shape inverts while manholes are under construction. Lay pipe continuously through manhole, build invert, break out pipe above mid-point, and smooth broken edges with cement mortar or cut off pipe at inside faces of manhole and construct invert to exact shape and size of pipe indicated. Manhole flow channels shall have smooth and carefully shaped bottoms, built up sides and benching sloped no less than 1/2 inch per foot constructed from concrete. No lateral sewer, service connection, or drop manhole pipe shall discharge onto the surface of the bench. Channels shall conform to the dimensions, grade, and alignment of the connecting pipe. The channel walls should be formed or shaped to the full height of the crown of the outlet sewer in such a manner to not obstruct maintenance, inspection, or flow in the sewer. Provide a true curve of the largest radius possible for changes in direction of the sewer and entering branch or branches.

4. Clean all joint surfaces (remove all sand, oil, debris, and other foreign items) and provide additional primer if recommended by the joint manufacturer.

5. The joint sealant and the manhole surfaces shall be dry during the installation period (shall not be installed if wet or during rain events). Joint sealant is applied to both the top and bottom joint surfaces (double ring method). The joint sealant shall be installed continuously around all joints with the ends placed butt-to-butt (not overlapped and no open gaps between sealants). The excess joint sealant shall be trimmed flush to the inside surfaces of the manhole. Trim the outside surfaces if an exterior joint sealant/tape is applied. Manholes with leaking joints (infiltration of ground water) will not be accepted by the Town.

6. Prime and double seal joint surfaces with premolded plastic joint sealer manufacture shall be in accordance with Appendix A, Approved Manufacturer List of the Town CSM.

7. All holes in sections used for handling and the annular space between the wall and entering pipes shall be thoroughly plugged with non-shrinking mortar or grout applied and cured in strict conformance with the manufacturer's recommendations so that there will be zero leakage through openings and around pipes. The mortar shall be finished smooth and flush with the adjoining interior and exterior manhole wall surfaces. Provide interior and exterior coating as specified above.

8. Apply a special primer and an exterior joint sealant membrane to the outside surfaces of all manhole joints/seams which are located below the top cone section. Apply the primer and joint membrane in accordance with the recommendations of the membrane manufacturer.

H. Drop Connections: Where shown on the Drawings or directed by the Engineer, the Contractor shall construct inside drop connections to the manholes as shown and specified in this Section. Provide pipe restraints and supports as required. Outside manhole drops are not permitted. For inside manhole drops, inside piping shall be secured to manhole wall by a minimum of two 304 stainless steel straps and minimum 304 stainless steel hardware securely anchored to manhole wall. The space between the pipe and opening shall be sealed with a nonshrink grout.

I. Stub Lines: The Contractor shall provide plugged stub lines where shown or directed by the Engineer for the connection of future sewer lines to manholes. Provide bell end closed with an approved stopper. Install bell of stub line as close to the manhole exterior's surface as practical. Accurately reference each stub line size for direction and record, complete with the actual invert elevation. Furnish the Engineer with two copies of the data on stub lines.

J. Cleanouts: Construct as shown in the Town of Howey-in-the-Hills Standard Details using pipe and fittings as specified in this Section. Applicable portions of these Specifications shall apply to the construction of this item.

K. Connections at Structures: Where wastewater gravity sewers connect to structures, core bore into the existing manholes and use flexible connectors with stainless steel straps on all pipe to manhole connectors. The Contractor shall core suitable openings using a coring machine, jigsaw, or hole-saw into the existing structure or remove the existing pipe to accommodate the pipelines as indicated on the Contract Drawings and as specified. The portion of each existing structure removed for new installation shall be confined to the smallest opening possible, consistent with the work to be done. Manufacture shall be in accordance with Appendix A, Approved Manufacturer List of the Town CSM.

1. Repair – Concrete Structures: After the pipe is installed the Contractor shall carefully close up the openings around the pipe, using non-shrink

mortar and repair the existing structure invert, if necessary, in a manner satisfactory to the Engineer. If the existing structure has a specialty coating, repair that coating using coating manufacturer's product and installation requirements.

L. Connecting to Existing Sewers: Where shown on the Drawings or directed by the Engineer, new sewers shall be connected to existing sewers by constructing a manhole over an existing line or by coring through the wall of an existing manhole. After approval of the new sewer line project by the Town, the old sewer shall be broken out and the inverts properly formed. On manholes without turns in direction, it will be permitted to use the lower half of the old pipe as the new invert.

1. For an existing manhole, an opening shall be made and sewer pipe inserted. The opening shall be completely filled around the pipe with non-shrink grout so as to be watertight. A channel shall then be formed over the manhole table, or the table cut through and the channel formed in it, as may be required by the grade.

M. Transition Connections: Where pipes of alternate materials are to be connected between manholes, suitable approved transition couplings shall be installed.

N. Tracer Wire and Warning Tape Installation:

1. General: Wherever nonmetallic pipe is installed, #10 tracer wire and warning tape shall be installed to facilitate future location of the gravity main.

2. Tracer wires shall begin and terminate in the test boxes or cleanouts. Wire shall run continuously through test stations for the entire length of the pipe line and shall be strapped to the pipe at 10-foot intervals Test boxes shall be installed at each location as shown on the Drawings, spaced at intervals not exceeding the manhole spacing. Test boxes shall not be installed in streets or driveways. Tracer wire between boxes shall be continuous, unbroken lengths. The tracer wire shall not be installed in tension, but neither shall there be "coils" in the wire. The ends of the tracer wires shall be installed in the test boxes. The length of each tracer wire in each box or cleanout shall be long enough to extend no less than 1 foot and no greater than 2 feet above ground level. Breaks shall be repaired by splicing with a product by a manufacturer in accordance with the Town of Howey-in-the-Hills Approved Manufacturer List. Repairs by "twisting" the two ends together will not be accepted.

3. Warning tape shall be buried in the backfill approximately 1 foot over the top of the PVC gravity main. Tape shall be laid in continuous lengths. Any breaks or tears shall be repaired before proceeding with the backfilling operations.

3.02 TESTING

A. General

1. The Contractor shall inspect all work constructed for faults or defects and any deviation from these documents or omissions shall be corrected at once. The Contractor shall conduct all tests The Contractor shall bear all costs for these tests and inspections.

2. Pipe testing shall closely follow pipe laying. No more than 1,000 feet of pipe shall remain untested at any time. Testing shall not proceed until all facilities are in place and concrete cured. All piping shall be thoroughly cleaned before testing to clear the lines of all foreign matter.

B. Gravity Piping: The Contractor will use low-pressure air testing in accordance with Uni- Bell PVC Pipe Association, UNI-B-6-90, “Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe”, latest revisions. Infiltration and exfiltration shall not exceed 0 gallons per day per inch of diameter per mile as measured between manholes. Testing shall proceed for a continuous period of 2 hours, with infiltration amounts measured by methods approved by the Utility Department.

C. Manholes

1. Manholes shall be true circles of acceptable concrete or masonry work with properly corbeled tops, satisfactory inverts, and properly placed frames, covers, and steps.

2. Vacuum Testing: All manholes shall be subjected to a vacuum test in accordance with ASTM C1244. The Contractor will furnish all necessary equipment and labor needed for conducting the tests. The Contractor shall have the option to test manholes before backfilling. All manholes tested by vacuum test shall be required as follows:

   a. Plug pipes entering and leaving manhole.
   b. Apply vacuum to the manhole after setting up of all mortar joints.
   c. Draw a vacuum of 10 inches of mercury (HG).
   d. The test shall pass if the vacuum remains at 10 inches HG or drops to 9 inches HG in a time longer than 1 minute.

e. If the manhole fails the test, the Contractor shall locate the leak(s), make proper repairs, and then re-test until a successful test is obtained.

3. High-Voltage Spark Testing: Installed protective lining shall be tested for pinholes after a minimum 24-hour cure at a temperature of 70°F. Pinhole testing shall be accomplished using a Town approved device. Test voltage of 100-125 volts/mil of coating thickness shall be applied. All pinholes shall be marked and repaired using manufacturer's approved patch kit, or other approved method. High-voltage spark testing shall be approved by the product manufacturer.

D. The Town will require internal color closed circuit television (CCTV) inspection (televising) of the sewer lines at the expense of the developer. The CCTV inspection shall be completed before the Contractor paving. The CCTV inspection will consist of a detailed computerized written report along with a DVD recording. The information on the report must coincide with the recording. The start screen of the recording shall have the project name, date, pipe size, the Contractors name, and the Developer's name. The inspection shall start at the most upstream manhole and work towards the most downstream or existing manhole.

1. CCTV Report Information:

a. Manholes: The Report and Recording shall start with zero (00+00) station numbers at each manhole upstream and end with the station number at the next downstream manhole. (If an inspection has to be performed starting at the downstream manhole a written explanation must be submitted to the inspector with the Report and Recording.

b. Pipe Line: Provide start and end station numbers for pipe material changes.

c. Taps: Each tap shall have a station number shown on the Recording and coincide with the Report and Record Drawings. The Report and Recording shall indicate the lot number and/or address the tap in intended to serve.

d. Dead Ends or Abandonment's: If a future stub, dead end, or obstruction cause (not ending in a manhole) or abandonment of video do to obstruction etc., a still image shall be shown on the Report and Recording for inspection. The Report and Recording shall show an explanation for what is shown.

e. Existing Sewer System: The existing sewer system must be inspected and shown on the Report. The existing system shall be inspected by CCTV before its connection to the Town's system. This shall be from the tie-in manhole to the next downstream manhole. The Town of Howey-in-the-Hills reserves the right to request additional CCTV information or reinsertion to insure an acceptable completion. The project inspector also has the right to request a Town CCTV crew to inspect any and/or all of the proposed system.

E. Deformation/Deflection Limits: Pipe shall be tested with a nine-point mandrel for deformation or deflection. Any pipe found to be deformed and/or deflected in excess of 5% of the nominal diameter of the pipe shall be removed and replaced with new pipe at no additional cost to the Town. All mandrels used in testing shall be available to be checked for proper sizing by use of truing rings at the request of a Town Representative. Results of the test shall be submitted to the Town for review and approval. The use of a re-rounding device or other similar equipment is not permitted to correct deflected (egg shape) pipe.

F. Manhole Inspection: All manholes shall be inspected for leaks and any defects that may cause infiltration, or weaken the structural integrity. Before the final inspection, manholes shall be trimmed of any excess Ram-Nek joint sealant. Any voids in pre-cast shall be filled with non-shrink grout and the manhole shall be thoroughly painted, excluding invert and bench, as required. The gasket on the manhole cover shall be inspected for cuts, tears, scraps, and proper fit. If found damaged, the entire gasket seal shall be replaced in accordance with the manufacturer's recommendation, at the Contractor's expense.

G. Warranty Test: To ensure the adequacy of the pipe described above and the manhole installation procedures, the Contractor shall remobilize to the work site 20 months following final approval-acceptance of the complete project, such time being within the 2-year warranty period. The date for such remobilization will be stated in the Final Approval issued by the Engineer of Record.

1. The Contractor together with representatives of the Engineer of Record and the Town shall visually inspect every manhole and new line sections installed within the project area for cracks, damaged lining, leaks, or abnormal conditions. The line sections will be chosen by the Engineer of Record/Town at random subsequent to the manhole inspections.

2. The Contractor shall appropriately correct any deficiencies that are found by such visual inspection, as approved by the Engineer of Record. To

adequately locate certain deficiencies, the Contractor shall be required to use CCTV inspection and other methods.

3. All costs involved in remobilizing, inspecting, or correcting deficiencies will be considered incidental to the project and shall be the responsibility of the Contractor at no additional cost to the Town.

H. Repair of Piping: At the option of the Engineer of Record, if piping is found to be defective during the warranty test period and if the Engineer of Record does not approve a method of pipe repair by the Contractor, the Contractor shall remove and replace the faulty pipe in an approved manner at no additional cost to the Town.

END OF SECTION

SECTION 15
WASTEWATER SERVICE CONNECTIONS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section does not stand alone and is incorporated as part of the Town Construction Specification Manual (CSM). The CSM shall be used for other requirements that may not be covered in this Section.

B. This Section covers the requirements for the construction of service connections to Town-owned lines.

C. All piping and equipment of the same type shall be from one manufacturer, unless authorized in writing by the Town or the Town's representative.

1.02 SUBMITTALS

A. All submittals shall be submitted in accordance with the shop drawing submittal requirements as specified in Section 1, General Provisions.

1. Shop Drawings: The Contractor shall submit catalog cut sheets, manufacturer's descriptive literature, and other necessary information to the Public Services Director for approval before installation.

1.03 GENERAL

A. Service connections shall be installed at the locations designated by the contract drawing. All connections and ties to the Town's sewer system will be performed by the Contractor under supervision of the Town. Catalog cuts and related date for all material shall be submitted to the Engineer of Record for review.

B. Shown below is a schematic of a typical residential sewer service connection. This schematic shows the locations of both homeowner and Town cleanouts and Town and homeowners limits of responsibility for the service line.

1.04 DESIGN STANDARDS

A. The minimum service pipe size shall be 6 inches in diameter. Double service lines are strictly prohibited.

B. All service connections from restaurants, commercial food preparers, or others as designated by the Town for the removal of fats, oils, and grease (FOG) from discharges to the Town system shall be equipped with an appropriately sized grease trap as specified in Section 21, Utility Department Policies for Fats, Oils, and Grease.

PART 2 PRODUCTS

2.01 MATERIALS

A. All materials used to make service connections shall be compatible with each other and with the pipe materials to be joined and shall be corrosion proof.

B. Fittings shall be as shown in the Town of Howey-in-the-Hills Standard Details for single and double service connections. Tees will not be allowed.

C. Service pipe installed as part of main sewer line construction shall be polyvinyl chloride (PVC) standard dimension ratio (SDR) 35 conforming to ASTM D3034, ASTM F794, or ASTM F949 with gasketed joints and all required markings consistent with main line material as specified in Section 14, Wastewater Gravity Sewer System.

D. Service pipe installed by a plumber in conjunction with a main line tap, existing stub out or manhole shall be either ductile iron, or SCH 40 PVC drain, waste, and vent (DWV) pipe consistent with the existing stub out pipe.

E. Adapters and Flexible Couplings: Prefabricated polyvinyl joint sealer adapters and sewer pipe couplings shall be by a manufacturer in accordance with Appendix A, Approved Manufacturer List of the Town CSM. Flexible couplings shall be installed with stainless steel (SS) bands and adjusting screws.

F. Backwater Valve

1. Backwater valves shall be installed on all sewer laterals and service connections for medical and industrial facilities that connect to the Town's sewer system.

2. Valve shall be PVC and have a clear-view top for inspection and an integral clean out.

3. Valve shall be normally open with no flow restrictions.

4. Valve shall be located outside of the right-of-way and shall be the responsibility of the property owner.

5. Valve shall be installed with an access box that has a 4-inch-thick reinforced concrete collar pour around the access box lid and body.

6. Nuts, bolts, and other hardware shall be stainless steel.

7. Manufacturers shall be in accordance with Appendix A, Approved Manufacturer List of the Town CSM.

G. Service Connection to Existing Lines:

1. Minimum pipe size connection to either existing sewer main lines or manholes shall be 6 inches unless otherwise approved, before construction, by the Public Services Director or his designee.

2. The saddle shall include a ductile iron saddle casting with corrosion-resistant paint, styrene butadiene rubber (SBR) gasket, 304 SS band with 304 SS adjusting bolts and 304 SS pipe clamp.

3. Taps directly into manholes shall be made using ductile iron or PVC pipe.

4. Non-shrink grout for holes to manholes shall be as specified in Section 14, Wastewater Gravity Sewer System.

H. Manhole Water Stop: Shall be a neoprene gasket and SS clamp by a manufacturer in accordance with Appendix A, Approved Manufacturer List of the Town CSM.

PART 3 EXECUTION

3.01 INSTALLATION

A. Service connections shall be properly installed at the required locations. All wyes, bends, service pipe, and other appurtenances shall be provided as required for each connection. The service pipe shall be terminated at the property line or easement line unless indicated otherwise on the Drawings or directed otherwise by the Public Services Director or his Designee. All joints shall be installed to provide watertight connections.

B. All new services shall include tracing wire. Wire shall have a type THW insulated PVC copper conductor, #10 solid strand copper wire strapped to the pipe at 10-foot intervals and brought to grade at the cleanout. This branch run wire shall not

be connected to the gravity sewer main tracer wire. Wire shall meet National Electric Codes and Underwriter Laboratories, Inc. requirements.

C. All active lateral connections on sanitary sewers to be replaced shall be connected to the new sanitary sewer. The Contractor shall be responsible for locating lateral connections before construction.

D. Unless approved otherwise by the Town, no gravity sewer main with sewer service laterals shall be constructed with a depth of cut greater than 18 feet.

E. On curbed streets, the exact location for each installed service shall be marked by etching or cutting as "S" in the concrete curb and painted green. Where no curb exists or is planned, locations shall be adequately marked by a method approved by the Town. Method: 1/2-inch steel rebar, 3 inches below final grade. In addition, for new development areas where the sewer lateral is "not in use", a landscape timber (3-inch x 3-inch minimum pressure-treated (PT) timber, top painted green) shall be installed to mark the location of the 6-inch plug.

F. Wye joints shall be installed as directed, with the branch turned to the proper direction, or as shown on the Drawings. Wyes shall be firmly supported by methods and materials used for bedding of main line pipe. Branch of wyes shall be installed at an angle 45 degrees to the springline unless grade requirement dictate otherwise.

G. Bends for service lines shall be placed in the wyes where directed by the Engineer, or where necessary for proper alignment. No horizontal bends between the property line and the main line pipe are permitted.

H. When installed during sewer line construction, service pipe shall be installed to the proper line and grade from the sewer line to the property line at a grade of not less than 1/4 inch per foot. Backfilling and bedding procedures shall be as for sewer line mains as specified in Sections 6, Utility Excavation, Trenching, and Backfilling and Section 14, Wastewater Gravity Sewer System. Watertight plugs shall be placed in the end of service line stubs. Plugs shall be as recommended by the pipe manufacturer and shall be installed in accordance with the manufacturer's recommendation.

I. Yard piping shall be defined as the sewer service piping and appurtenances privately owned and located entirely on private property. All yard piping shall conform to local plumbing code and all applicable building codes. The property owner must obtain a plumbing permit before installing sewer services on their property. The homeowner is responsible for maintaining sewer service lines beyond the right-of-way line. The Town accepts no responsibility for installation or maintenance of any service line outside the Town's right-of-way line.

J. Service Connections to Existing Lines

1. Taps will not be made before applicable fees being paid and a sewer connection permit being obtained from the Town.

2. The main line will be tapped only when no service line stub is available. In the event the service line stub cannot be located by the Town personnel, the Plumber/Contractor will be allowed to tap the line. The Town will locate the service stub if, and only if, a reasonable effort has been made by the Plumber/Contractor. Service line shall be installed at an angle of 45° to the springline unless grade requirements dictate otherwise.

   a. Ties to Existing Service Line Stubs:

      (1) Connection shall be made with a watertight flexible coupling suitable for the application.
      (2) Connection shall remain visible until inspection by the Town Inspector.
      (3) Backfill shall be carefully placed and tamped around the connection as to prevent any settlement or movement.

   b. Taps to Sewer Main Lines:

      (1) When authorized for use, tapping saddles may be used for lateral connections to 14-inch and larger ductile iron pipe or may be used in the construction of a new sewer service lateral which is tapping an existing (in-use) clay or PVC gravity sewer main. A sewer saddle shall not be used on completely new sewer system work. Tapping saddles shall be installed in accordance with manufacturer's recommendations. Under no condition shall the circular opening in the pipe wall be made with a cutting torch. Holes shall be laid out with a template at an angle of 45° to the vertical (unless grade requirements dictate otherwise) and shall be deburred and carefully beveled to provide a smooth hole shaped to conform to the fitting. Care shall be taken to prevent any foreign material from entering the cut-in pipe opening. Any material or debris that does enter the line shall be removed. Taps shall be accomplished by a cutting machine method subject to the approval of the Engineer. Should the ductile iron pipe lining be damaged during the cutting of the pipe to receive the saddle, the defective area shall be repaired.

(2) Where applicable, saddle and pipe mating surfaces shall be wiped clean and dry. Epoxy cement shall be used in cementing in accordance with the cement manufacturer's recommendations and ASTM D2855.

(3) The service line shall be connected to the saddle by means of a "Donut" as specified by the tap saddle manufacturer.

(4) A Town tap inspection shall be conducted after the hole is cut, but before connection is made up.

(5) Any sewer main line broken or crushed during the installation of a tap shall be replaced by the plumber at no cost to the Town.

(6) In the event water is entering into the ditch, the Contractor/Plumber shall pump the ditch as dry as necessary to make the complete connection visible at the time of inspection.

(7) Backfill shall be carefully placed and tamped around the connection to prevent any settlement or movement.

(8) Where multiple taps for service connections are proposed to be made to existing vitrified clay pipe (VCP) or Orangeburg pipe, the entire section of pipe between manholes shall be replaced as directed by the Town with either PVC or ductile iron pipe to assure no inflow/infiltration (I/I).

c. Taps to Manholes:

(1) Service line must enter manhole at angle no less than 90° to the direction of flow.

(2) Unless authorized by the Engineer in writing, or shown on the Drawings, lateral connections shall be limited to two ties into new or existing dead end manholes.

(3) For manholes less than 12 feet in depth:

(a) The Plumber/Contractor shall either core drill or bust out the manhole wall directly above the manhole table. If slope of table is less than 2-1/2 inches per foot, the invert of service line shall enter the manhole 6 inches above table.

(b) The service pipe shall be pushed through the newly formed hole approximately 1 inch past the inside face of the manhole wall.

(c) The core hole shall be filled with non-shrink grout and walls shall be troweled smooth.

(d) A curved trough shall be formed on/in manhole table to direct flow into the main invert. If the service enters below the table, then table must be removed and a new trough formed.

(e) A Town tap inspection shall be held before backfilling commences. Work must be visible and dewatered during inspection.

(f) Backfill shall be carefully placed and tamped around the connection so as to prevent any settlement or movement and shall commence only after non-shrink grout has sufficiently hardened.

(4) For manholes greater than 12 feet in depth:

(a) The Plumber/Contractor shall either core drill or bust out manhole wall a minimum of 4 feet below ground surface. If 4 feet cannot be obtained, notify the Town Engineering Department before proceeding.

(b) Service pipe shall be inserted through the manhole wall. A tee shall be placed on pipe with run vertical for clean out. Pipe shall extend to manhole table and a 45° bend shall be installed on the end to direct flow into the invert. Inside piping shall be secured to manhole wall by means of two aluminum or SS straps securely anchored to manhole wall. The space between the entering pipe and the manhole opening shall be sealed with a non-shrink grout.

(c) A curved trough shall be formed on/in manhole table to direct flow into main invert. The trough shall extend beyond the opening of 45° bend to its curvature or change in direction.

(d) The cored hole shall be filled with non-shrink grout and walls shall be troweled smooth.

(e) A Town tap inspection shall be held before backfilling commences. Work must be visible and dewatered.

(f) Backfill shall be carefully placed and tamped around the connection so as to prevent any settlement or movement only after non-shrink grout has sufficiently hardened.

3.02 TESTING

A. The Plumber shall contact the Town approximately 2 hours before tap inspection will be needed. Tap to main lines shall remain disconnected and dewatered until the tap has been approved by the Town Inspector. In the event a road or street must be cut in order to make the connection, the Plumber will obtain a road/street cut permit and have it at the job site at the time of the inspection. If the road/street cut permit is not available at this time, the tap will not be inspected.

B. During the final inspection or project acceptance inspection, the Town may elect to field test the installed electronic markers using Town locate equipment. The Contractor shall assist in the field locate services required to complete this test.

END OF SECTION

SECTION 16
WASTEWATER FORCE MAIN SYSTEM

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section does not stand alone and is incorporated as part of the Town Construction Specification Manual (CSM). The CSM shall be used for other requirements that may not be covered in this Section.

B. This should be used only after the installation of a gravity system has been exhausted. This Section includes the general requirements for design and installation of force main systems serving sanitary sewage pumping stations. The relevant provisions of other sections of this specification shall be applicable to this Section unless otherwise indicated herein or approved by the Town.

C. The Contractor shall provide all work necessary for the construction and testing of a force main system. This work shall include the installation of all force main lines, fittings, and appurtenances as may be required to complete the work as indicated in the Drawings and as specified herein.

D. The work shall also include such connections, reconnections, temporary service, and all other provisions regarding existing sewer operations and modifications as is required to perform the new work. All references to Industry Standards (ASTM, ANSI, AWWA, etc.) shall be to the latest revision unless otherwise stated. Only those materials included in the Town of Howey-in-the-Hills CSM shall be installed. All materials shall be new unless specifically called for otherwise.

E. All piping and equipment of the same type shall be from one manufacturer, unless authorized in writing by the Town or the Town's representative.

1.02 SUBMITTALS

A. All submittals shall be submitted in accordance with the shop drawing submittal requirements as specified in Section 1, General Provisions.

1. Shop Drawings: The Contractor shall submit catalog cut sheets, manufacturer's descriptive literature, and other necessary information to the Engineer for approval before installation.

2. Certifications: The Contractor shall submit a certification from the pipe manufacturer that the pipe and fittings supplied are new, have been manufactured for this project, and have been inspected at the plant.

1.03 DESIGN STANDARDS

A. The Developer shall comply with the applicable criteria set forth in WEF Manual of Practice No. 9, Latest Edition, Recommended Standards for Wastewater Facilities, Latest Edition, and Florida Department of Environmental Protection (FDEP) requirements. Additionally, American Society of Civil Engineers (ASCE) publication Pipeline Design for Water and Wastewater may be used as a design guide, if not in conflict with other requirements.

B. System Design

1. Force Main systems shall be of adequate size to efficiently transmit the total ultimate peak operational flows, applied by the connected sewage pumping station(s) to the effluent point. Consideration shall be given to possible future connection of other gravity sewer, pump stations, and force mains, and this probability shall be reviewed with the Town. Capacity computations shall be coordinated with the proposed pumping system(s), along with any future flow requirements, if applicable in order to provide adequate pipeline cleansing. Force main flow velocity shall not be less than 2 feet per second at ultimate design minimum pumping capacity, however, with multiple pumping station systems or phase development, this requirement may be difficult to meet and the system design shall receive special attention regarding cleaning, maintenance, pumping rates, future upgrading of systems by changing impellers, pump changes, parallel force mains, and other ways to increase future capability. Minimum force main diameter shall be 4 inches.

2. Operational Cost Considerations: In addition to initial capital expenditure, long-term pumping station operational costs shall also receive consideration when sizing force main systems or making decisions concerning whether gravity service or lift station service is to be provided.

3. Pipe for force main lines in sizes up to and including 48 inches shall be ductile iron, polyvinyl chloride (PVC), or high density polyethylene (HDPE), as shown on the Drawings and as herein specified. Pipe for force main lines larger than 48 inches shall be ductile iron as shown on the Drawings and herein specified. Pipe with diameters of 4 to 10 inches for sewer force mains shall have a minimum dimension ration (DR) of 25, Class 100. Pipe with diameters of 12 inches and larger for sewer force mains shall have a minimum DR of 26, Class 165. Pipe of any diameter

buried at 10 feet or more for any part of the pipe shall have a minimum DR of 26. Pipe to be installed underground shall be push-on joint or mechanical joint type. Pipe installed on bridges, piles or other above ground installations shall be push-on restrained joint using fast-grip gaskets, Field-Lok gaskets, restrained mechanical joint ductile iron pipe (DIP) or flanged DIP as described in these specifications. (Bell and rod restraints shall not be used unless approved otherwise by the Town). PVC or HDPE piping shall not be used on bridges or other above ground applications. Pipe sizes and applications shall conform to the following chart.

Pipe	Pipe Size	Joint Type	Application
Ductile Iron	4 inches and larger	Mechanical joint, push-on joint, flanged joint, ball joint, etc.	Any
PVC DR 25 or 26	4 inches and larger	Push-on joint	below ground
PVC (Sch. 40)	3 inches and smaller	Solvent Weld	below ground
PVC (Sch. 80)	3 inches and smaller	Solvent Weld	below ground
Polyethylene (HDPE)	2 inches and larger	Fused	below ground

4. Restraint joints shall be provided at all changes in alignment.

5. The use of surge valves, surge tanks or other suitable means to protect the force main against severe pressure changes shall be evaluated.

6. An automatic air relief valve shall be placed at high points in the force main sewer to prevent air locking.

7. Force mains tying into manholes shall enter the manhole at or below the flow line of the receiving manhole, and at an angle of not less than 120 degrees, measured from the centerline of downstream (outlet) pipe.

C. Design Calculations: The Engineer/Developer shall submit signed, dated, and sealed design calculations by and Professional Engineer licensed in the State of Florida with the final Construction Drawings for all wastewater projects. Calculations should show that the force mains will have sufficient hydraulic capacity for the peak hourly flows while meeting the requirements of this Section. Minor head losses shall be incorporated in the calculations.

PART 2 PRODUCTS

2.01 MATERIALS

A. The materials of construction shall comply with the specific applicable standards set forth under Section 6, Utility Excavation, Trenching, and Backfilling;

Section 9, Boring, Jacking, and Tunneling; and Section 11, Pipe, Fittings, Valves, and Appurtenances. All material shall be free from defects impairing strength and durability, shall be of the best commercial quality for the purpose specified, and shall have structural properties sufficient to safely sustain or withstand strains and stresses to which it is normally subjected and be true to detail.

B. Pipe material for force mains shall be as shown on the Construction Drawing. Pipe material shall be in accordance with the design requirements in this Section and Section 11, Pipe, Fittings, Valves, and Appurtenances, unless otherwise shown on the Contract Drawings. Pipe, fittings, valves, restrainers, and other appurtenances shall be as specified in Section 11, Pipe, Fittings, Valves, and Appurtenances. Additional valves and appurtenances are specified below. In order to preclude possible domestic water tapping, all installed underground nonmetallic wastewater force mains shall be green or DIP marked with a continuous green stripe located within the top 90 degrees of the pipe.

C. Nonmetallic Marking Tape: Marking tape shall be “Extra-Stretch” marking tape for wastewater, colored green. Extra-Stretch marking tape shall consist of 6-ply copolymer film bonded together without the use of adhesives, specifically formulated for prolonged use underground. It shall be highly resistant to alkalis, acids, and other destructive agents found in the soil. Extra-stretch tape shall have a minimum thickness of 6 mils, minimum tensile strength of 80 pounds per 3-inch-wide strip, and a minimum elongation of 600%. Tape shall bear a continuous printed message repeated every 16 to 36 inches warning of the installation buried below. Installation instructions for the tape shall be printed with each message along the entire length. Manufacturer shall be in accordance with Appendix A, Approved Manufacturer List of the Town CSM.

D. Tracer wire shall have a green, type TWH insulated PVC copper conductor, #10 solid strand copper wire that is strapped to the pipe at 10-foot intervals installed. Wire shall meet National Electric Codes and Underwriter Laboratories, Inc. requirements. Manufacturer shall be in accordance with Appendix A, Approved Manufacturer List of the Town CSM.

E. Air release valves shall have with 316 stainless steel service saddle, 316 stainless steel piping, and 316 stainless steel ball valve. Air release valve manufacturer shall be in accordance with Appendix A, Approved Manufacturer List of the Town CSM.

F. Combination air valves shall have a 316 stainless steel service saddle, 316 stainless steel piping, and 316 stainless steel ball valve. Combination air valves manufacturer shall be in accordance with Appendix A, Approved Manufacturer List of the Town CSM.

G. Piping Supports: The Contractor shall furnish and install all supports necessary to hold the piping and appurtenances in a firm, substantial manner at the lines and grades indicated on the Drawings or as specified. Piping within pumping stations shall be adequately supported from floors, walls, ceilings, or beams. Supports from the floor shall be by approved saddle stands or suitable concrete piers as indicated or approved.

1. Pipe saddles shall be shaped to fit the pipe with which they will be used and shall be capable of screw adjustment. Concrete piers shall conform accurately to the bottom one-third to one-half of the pipe. Piping along walls shall be supported by approved wall brackets with attached pipe rolls or saddles or by wall brackets with adjustable hanger rods. For piping supported from the ceiling, approved rod hangers of a type capable of screw adjustment after erection of the piping and with suitable adjustable concrete inserts or beam clamps shall be used. If required, piping supports shall be placed so as to provide a uniform slope in the pipe without sagging. Supports shall be located wherever necessary, and in no case shall they exceed 4 feet on centers for PVC pipe or manufacturer's recommendations for DIP.

H. All material shall be free from defects impairing strength and durability, shall be of the best commercial quality for the purpose specified, and shall have structural properties sufficient to safely sustain or withstand strains and stresses to which it is normally subjected and be true to detail.

PART 3 EXECUTION

3.01 INSTALLATION

A. The general installation procedures shall comply with the specific applicable standards set forth under Section 6, Utility Excavation, Trenching, and Backfilling; Section 9, Boring, Jacking, and Tunneling; and Section 11, Pipe, Fittings, Valves, and Appurtenances.

B. General: The Contractor shall install all pipework meeting the requirements of AWWA for installation various types and classes of pipe. It is the Contractor's responsibility to, coordinate utility locates with Sunshine State One-Call of Florida, Inc. (800-432-4770 or website www.sunshine811.com), make exploratory excavations, and/or use other methods available to locate existing utilities before construction of any gravity sewers. If necessary, the Contractor shall adjust the new force mains, subject to approval by the Engineer, to avoid conflicts with existing piping. If a conflict is found between an existing utility and proposed grade, the Contractor is to furnish the Engineer of Record all pertinent information so that remedial design can be performed.

C. Reference Points and Layout: The Contractor shall be responsible for setting all grade lines, centerline of construction, and locating property lines. The Town will provide a bench mark. Any reference points, points of intersection, property corners, or bench marks, which are disturbed during construction, shall be restored by a Land Surveyor registered to practice in the State of Florida, and all costs thereof shall be borne by the Contractor. The Contractor shall assume all responsibility for the correctness of the grade and alignment stakes.

D. Pipe Handling: Every care shall be taken in handling and laying pipe and fittings to avoid damaging the pipe, scratching or marring machined surfaces, and abrasion of the pipe coating. The lined Pipe and Fittings must be handled only from the outside of the pipe and fittings. No forks, chains, straps, hooks, etc. shall be placed inside the pipe and fittings for lifting, positioning, or laying. Carry pipe into position – do not drag. Do not dump or drop any of the materials of this Section into the trench. Lower pipe and accessories into trench by means of ropes, belt slings, or other equipment approved by the Engineer. Thoroughly clean interior of pipe and accessories before lowering pipe into trench. Keep clean during laying operations by plugging or other methods approved by the Engineer. Before installation, inspect each piece of pipe and fitting for defects. Material found to be defective before or after laying shall be replaced with sound material meeting the specified requirements, and without additional cost to the Town. If damaged, the material shall be repaired in accordance with the liner manufacturer's recommendations. Any fitting showing a crack and any fitting or pipe which has received a severe blow that may have caused an incipient fracture, even though no such fracture can be seen, shall be marked as rejected and removed at once from the work. In any pipe showing a distinct crack in which it is believed there is no incipient fracture beyond the limits of the visible crack, the cracked portion, if so approved by the Town, may be cut off before the pipe is laid so that the pipe used may be perfectly sound. The cut shall be made in the sound barrel at a point at least 12 inches from the visible limits of the crack. Except as otherwise approved, all cutting shall be done with a power driven cut off saw. All cut ends shall be examined for possible cracks caused by cutting. Keep gaskets away from oil, grease, excessive heat, and direct rays of the sun. Keep PVC pipe covered during storage to prevent damage by sunlight.

E. Pipe Installation: Pipe shall be installed in accordance with AWWA C600 for ductile iron force main, ASTM D2321 for PVC force main, the manufacturer's instruction, and the Engineer's direction. Underground pipe shall be furnished in nominal 18- or 20-foot laying lengths unless indicated otherwise on the Drawings. Pipe shall be cut to length as required to fit installation conditions.

1. Rest the full length of each section of pipe solidly on the pipe bed, with recesses excavated to accommodate bells, couplings, and joints.

2. Take up and relay pipe that has the grade or joint disturbed after laying.

3. Special Construction Requirements for 24-Inch and Larger PVC Pipe: For PVC pipe 24 inches and larger, unless approved otherwise by the Town, a foundation bed of granular material (57 stone) shall be placed under and around all ductile iron fittings and valves for additional support of heavy system components. A foundation bed of granular material shall be provided for all valves 20-inch size and larger. For granular materials, the minimum vertical limit is 12 inches under the fitting or valve, up to one-third the overall height of the fitting or valve. The minimum horizontal limits of the granular material shall be 12 inches in all directions beyond the outer edges of the fitting or valve. The compaction of soils below the granular material shall be at 98% of the maximum density. All spool pieces between 24 inches and larger ductile fittings and valves shall be at least 5 feet long. Where possible, a full joint of pipe (no short pipe lengths) shall be connected to all fittings and valves. No joint deflection shall be allowed at the fittings or valves.

4. Pipe Depth: The standard minimum cover for sewage force main systems shall be 36 inches from the top of the pipe to finish grade. The maximum allowable depth of cover for sewage force main shall be 84 inches. Where these conditions cannot be met, special consideration will be given. Additional depth may be required where future surface improvements are planned or anticipated.

5. Horizontal and Vertical Separation:

    a. The horizontal separation between sanitary force mains and existing or proposed water mains shall not be less than 10 feet, or as specified by FDEP. The elevation of the top of the sewer pipe shall be at least 18 inches below the invert of the water main.

    b. Wherever new sanitary force mains must cross under water mains, the sewer shall be laid at such an elevation that the top of the sewer pipe is at least 18 inches below the bottom of the water main. When the elevation of the sanitary force main cannot be buried to meet the above requirements, special protection shall be provided or the water main shall be relocated to provide this separation and reconstructed with DIP for a distance of 10 feet on each side of the sewer with one full length of water main pipe centered over the sewer so that both joints are as far from the sewer as possible. Said protection shall consist of completely encasing, 6 inches minimum, the sewer pipe in concrete for a minimum distance of 10 feet each

side of the water main, or installation of pressure-tight joint cast or DIP for the same dimension.

6. Joints: The Contractor shall submit the specific type of joint to be used on all pipe, including complete data on all material to be used, to the Engineer for approval before beginning any pipework. Make all joints conform to the requirements of the manufacturer's printed instructions as approved for the type of joint installed.

   a. Underground pipe shall be installed using push on joints or mechanical joints as shown on the Drawings. All adapters necessary for the proper jointing of pipe shall be provided. Connections to other types of pipe shall be made with a dresser restrained joint coupling or watertight couplings suitable for application.

   b. PVC Joints shall form a watertight and airtight seal.

F. Tracer Wire and Warning Tape Installation

1. General: Wherever nonmetallic pipe is installed, No. 10 tracer wire and warning tape shall be installed to facilitate future location of the force main. Manufacturers shall be in accordance with Appendix A, Approved Manufacturer List of the Town CSM.

2. Tracer wires shall begin and terminate in the test boxes. Wire shall run continuously through test stations for the entire length of the pipeline and shall be strapped to the pipe at 10-foot intervals Test boxes shall be installed at each location as shown on the Drawings, spaced at intervals not exceeding 500 feet. Test boxes shall not be installed in streets or driveways. Tracer wire between boxes shall be continuous, unbroken lengths. The tracer wire shall not be installed in tension, but neither shall there be "coils" in the wire. The ends of the tracer wires shall be installed in the test boxes. The length of each tracer wire in each box shall be long enough to extend no less than 1 foot and no greater than 2 feet above ground level. Breaks shall be repaired by splicing with a split-bolt clamp. Repairs by "twisting" the two ends together will not be accepted.

3. Warning tape shall be buried in the backfill approximately 1 foot over the top of the PVC force main. Tape shall be laid in continuous lengths. Any breaks or tears shall be repaired before proceeding with the backfilling operations.

4. For pipe installed via horizontal directional drill, see Section 10, Horizontal Directional Drilling, for tracer wire requirements.

G. Sewer Air Release Valve or Combination Sewer Valve

1. General: Where the force main profile is such that air pockets or entrapment could occur resulting in flow blockage, provisions for automatic air release and/or venting shall be provided. Where free-flow will occur during operation or after pumping stops, combined air release and vacuum valve assemblies shall be provided. Construction shall provide for minimum contact between operating mechanisms and sewage.

2. Install gravel drainage bed and doghouse manhole as specified in the Town of Howey-in-the-Hills Standard Details. Manhole shall be installed with wall section plumb and level and in accordance to Section 14, Wastewater Gravity Sewer System.

H. Thrust Restraint: All non-flanged fittings and valves shall be restrained. In addition, restraint joints shall be provided at all changes in alignment. Restrained joints shall be of the type specified in Section 11, Pipe, Fittings, Valves, and Appurtenances. The use of thrust blocks shall be limited to situations such as point repair where exposing several joints of pipe is not feasible due to existing ground conditions and also must be used with mechanical restraining devices in the judgment of the Engineer. Locate thrust blocking between solid ground and the fitting to be anchored. Unless otherwise shown or directed by the Engineer, place the base and thrust bearing sides of thrust blocking directly against undisturbed earth. Place thrust blocking so the fitting joints will be accessible for repair.

I. System Connections: All connections and ties to the Town sewer system and transfer of services will be performed by the Contractor under supervision of a Town representative.

J. Valves and Valve Locations: Valves shall be installed on all subsidiary force mains at the point of connection to the major main and where force mains are to be extended and at intervals not exceeding 1,000 feet. At future connection branches or ends, the valves shall be restrained by methods to facilitate said connection without system shut down. All valves on force mains shall be plug type valves only.

K. Tapping Sleeve and Valve Connections: Unless approved otherwise by the Town, tapped connections in the barrel of a pipe shall be less than the diameter of pipe being tapped except 4-inch pipe which may be tapped with a 4-inch tapping sleeve and valve. No taps shall be made within 5 feet of a joint.

L. Branch Connections: Branch connections are not allowable. All force mains must terminate at manholes, wet wells, or force mains. Force mains shall not terminate into gravity sewers.

M. Terminal Discharge: Force mains shall enter the terminal facility (gravity sewer manhole, pumping station wet well, or other) at a point equal to the operational water level of said receiving unit. Should an elevation drop be required to obtain the outlet connection, the prior down-slope of the force main shall not exceed 45 degrees, and adequate air venting shall be provided at the profile breakpoint.

N. Force Main Connection to Existing Manhole: Where a new force main is connected into an existing manhole, the manhole shall be properly prepared to receive the new force main and repaired or replaced as indicated or specified. Manhole inverts shall be reshaped as required by the new connection to provide a smooth flowing channel of the exact shape of the sewer to which it connects. An approved gate valve or plug valve must be installed immediately before the 45º bends going into the manhole. Force mains tying into manholes shall enter the manhole at or below the flow line of the receiving manhole, and at an angle of not less than 120 degrees, measured from the centerline of downstream (outlet) pipe.

O. Clean Out Connections: Should force mains appear to be susceptible to sedimentation clogging, as created by depressed crossings or extended low flow (velocity) periods, suitable clean out connections shall be provided in accordance with the Town of Howey-in-the-Hills Standard Details.

P. Identification: In order to preclude possible domestic water tapping, all installed underground nonmetallic sanitary sewage force mains shall be green or DIP marked with a continuous green stripe located within the top 90 degrees of the pipe.

3.02 TESTING

A. HDPE pipe testing procedures shall be as specified in Section 11, Pipe, Fittings, Valves, and Appurtenances. The Contractor shall perform leakage and pressure testing of all other (non-HDPE pipe) sanitary sewage force mains, as set forth in the following, and shall conduct said tests in the presence of representatives from the Town and/or other authorized agencies with 48 hours' advance notice provided.

B. Piping and appurtenances to be tested shall be within sections between valves or adequate plugs, not exceeding 2,000 feet with prior approval from the Town. Testing shall not proceed until restraining devices are installed. All piping shall be thoroughly cleaned and flushed before testing to clear the lines of all foreign

matter. While the piping is being filled with water, care shall be exercised to permit the escape of air from extremities of the test section, with additional release cocks provided if required.

C. Leakage and pressure testing shall be performed simultaneously at 100 psi for all sizes of force mains. The testing procedure shall continue for an uninterrupted period of not less than 2 hours by way of a pump taking supply from a container suitable for measuring water loss. The amount of loss shall be determined by measuring the volume displaced from said container. No pipe will be accepted if pressure loss is greater than 5 psi regardless of the leakage test results. Testing shall be in accordance with the applicable AWWA provisions for PVC, AWWA M23, and for DIP, AWWA C600, Section 4. The allowable rate of leakage shall be less than the number of gallons per hour determined by the following formulas:

PVC	DIP
$L = \frac{N * D * P^{1/2}}{7400}$	$L = \frac{S * D * P^{1/2}}{133{,}200}$

For 100 psi; test: L = 0.00135 ND (PVC)
For 100 psi; test: L = 0.000075 SD (DIP)

Where:

L = allowable leakage in gallons per hour.
N= number of joints in section tested.
S = length of pipe tested, in feet.
D = nominal diameter of the pipe in inches.
P = average test pressure maintained during the leakage test in pounds per square inch.

D. Should the test fail, necessary repairs shall be accomplished by the Contractor and the test repeated until within the established limits. The Contractor shall furnish the necessary labor, water, pumps, gauges, and all other items required to conduct the required sanitary sewage force main testing and shall perform the necessary system repairs required to comply with the specified pressure and leakage testing.

E. During the pressure and leakage testing, all exposed pipe, fittings, valves, and joints shall be examined carefully during the test. Any damaged or defective pipe, fittings, or valves that are discovered following the pressure test shall be repaired or replaced with sound material and the test shall be repeated until it is satisfactory. For new installations, the Contractor shall be limited to the number of repair couplings used to repair pipe joint leaks. Unless approved otherwise by the Town, the Contractor is limited to two repair couplings per 1,000 linear feet installed pipe. Should the actual number of joint leaks exceed the above limit, then the Town may require the Contractor to remove and re-install the entire associated main or certain sections of the main at the Contractor's expense. For

new work “bell joint leak clamps” or similar devices are not acceptable for the repair of leaks at the joint.

F. All tapping saddle/valve assemblies shall be subject to a 1-hour pressure test at 125 psi with no allowable leakage, before making tap.

G. Tracing Wire Testing: After construction and backfilling is complete, but before final inspection, the Town inspector will test the tracer wire with standard Town locating equipment. If the inspector determines that the tracer is not operating properly, the Contractor shall locate and correct the problem. The force main will not be accepted and placed in operation until the tracer system is acceptable to the Town.

END OF SECTION

SECTION 17
WASTEWATER LIFT STATIONS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section does not stand alone and is incorporated as part of the Town Construction Specification Manual (CSM). The CSM shall be used for other requirements that may not be covered in this Section.

B. This Section includes the general requirements for the design criteria and installation of sewage pumping stations including all labor, materials, tools, equipment, and performance of all work necessary or incidental to furnish an operable wastewater lift station as shown on the Drawings and specified herein. The relevant provisions included in these Specifications shall be applicable to this Section, unless otherwise indicated herein or approved by the Town.

C. A Sanitary Sewer Lift Station Design Data sheet shall be submitted with all lift station design proposals. All references to Industry Standards (ASTM, ANSI, etc.) shall be to the latest revision unless otherwise stated. Only those materials included in the Town CSM, (including, but not limited to, submersible pumps, VFD equipment and control panels), shall be installed. All materials shall be new unless specifically called for otherwise. All structures, pumps, and panels shall require a complete shop drawing submittal, as detailed in this specification for the Town's review and approval. All precast concrete duplex and triplex lift station shall conform to the respective Town of Howey-in-the-Hills Standard Detail. Any private pumping station that connects to the Town's sewer system that has any pump over 3 Hp shall conform to the Town standards and shall be reviewed by the Town.

D. All piping and equipment of the same type shall be from one manufacturer, unless authorized in writing by the Town or the Town's representative.

E. Private Sanitary Sewer Lift Station Requirements: Privately owned collection systems connected to the Town's system shall comply with the following.

1. Discharger of private wastewater collection system must provide a copy of the contract with a reputable person or firm experienced in the operations, maintenance, and repairs of lift stations to the Town. The Lift Station Maintenance Contractor must have access to equipment needed to pull and service pumps as well as pumping and hauling lift station waste. The Contractor must be able to have a 24-hour/7-days-a-week response time

and be able to respond to the site within 2 hours after notification of spill or overflow.

2. The Lift Station Maintenance Contractor shall provide 24-hour emergency telephone numbers for themselves and the property owner, enabling the Town to notify the property owner and Contractor of a reported emergency.

3. Upon expiration or change of status of the Contractor, the Town of Howey-in-the-Hills Wastewater Department shall be notified in writing within 72 hours.

4. A sign shall be posted on or adjacent to the lift station site (preferably on the control panel). The sign size should be approximately 24- x 30-inch, white background with red letters. The letters should be of a size legible from a distance of 30 feet. The sign shall state the following:

   a. Private Sanitary Sewer Lift Station.
   b. In case of Emergency call (phone number).
   c. Owner or Business Name and phone number.
   d. Contractors name and phone number.

5. The Town shall have the right to inspect all private wastewater collection systems and appurtenances, and to cause discontinuance of sewer service if the private wastewater collection system is not maintained in a sanitary and effective operating condition or if the public sewer facilities may be harmed thereby

6. Report spills immediately to Florida Department of Environmental Protection (FDEP), and provide spill response contact information if differing from contact information provided.

1.02 SUBMITTALS

A. All submittals shall be submitted in accordance with the shop drawing submittal requirements as specified in Section 1, General Provisions.

B. All structures, pumps, and panels shall require a complete shop drawing submittal, as detailed in this specification for the Town's review and approval.

C. Product Data:

1. Before fabrication, pump station manufacturer shall submit submittal data for review and approval.

2. Submittal shall include shop drawings, electrical ladder logic drawings, and support data as follows: catalog cuts sheets reflecting characteristics for major items of equipment, materials of construction, major dimensions, motor and V-belt drive data, pump characteristic curves showing the design duty point capacity (GPM), head (FT), net positive suction head required (NPSHr), and hydraulic brake horsepower (BHP). Electrical components used in the motor branch and liquid level control shall be fully described.

D. Submittals shall include at least the following:

1. Wet well:

a. Base sections, riser sections, eccentric and concentric conical top sections, flat slab tops, and grade rings with notarized certificate indicating compliance with ASTM C478.
b. Location and elevation of all penetrations.
c. Applicable lifting and installation details or instructions.
d. Access covers with description literature and cut sheets.
e. Method of repair for minor damage to precast concrete sections.
f. Delivery, unloading, and receiving instructions.
g. Buoyancy calculations and counter measures by a Professional Engineer licensed in the State of Florida and shall be signed, dated, and sealed.

2. All precast structures shall be designed by a Professional Engineer licensed in the State in Florida. Calculations and Design Drawings shall be signed, dated, and sealed, and submitted for review before fabrication. Design Drawings shall demonstrate that the applicable industry design standards listed in this Section have been met.

3. Precast concrete structures:

a. Sectional Drawings and elevations showing dimensions and reinforcing steel placement.
b. Structural calculations including assumptions.
c. Concrete design mix.

4. The Contractor shall submit written certification from the pump supplier that the wet well size and layout are acceptable for the pump installation.

5. The Contractor shall submit integrated shop drawings for the pumping system illustrating the mechanical and electrical equipment and components specified in this Section and including the following:

   a. Product Data: For each mechanical, structural, and electrical component, include the manufacturer's descriptive literature, product specifications, published details, technical bulletins, performance, and capacity-rating curves with primary and secondary design conditions clearly noted, charts, and schedules, catalog data sheets, and other submittal materials as required to verify that the proposed products conform to the quality and function of the specified products.

      (1) Identification: Clearly indicate by an arrow on submissions covering more than one product type or style exactly which product is being submitted for approval.
      (2) Equipment Characteristics: Provide bearing ratings, complete motor data, service factors, shaft diameters, coupling type, and weights of principal parts and assembled equipment.
      (3) Manufacturer: Include the catalog name, company name, address, and telephone number for the manufacturer of each product submitted.
      (4) Equipment Drawings: Submit completely dimensioned plan, elevations, and cross-sections of system equipment and sub-assemblies.
      (5) Layout Drawings: Submit completely dimensioned drawing of pump, pump base, anchor bolt size and patterns, wet well hatch, wet well vent, installation notes, recommended grout configuration of wet well bottom, pipe support material and spacing, and other pertinent setting details.
      (6) Product List: Provide a list of equipment and components on each drawing with each product identified by legend reference. Include product name, manufacturer, and model number.
      (7) Wiring Diagrams: Submit complete interconnecting wiring diagrams and schedules for electrical apparatus showing numbered wiring terminals in the pump control panel conforming to NEMA ICS-1-101. Identify field device terminals, wire number, wire sizes, control and power wire types, and interfaced elements.
      (8) Control Panel Drawing: Submit a dimensioned drawing of the control panel indicating the primary electrical components and panel face with control devices, lights,

indicators, and other panel-face-mounted apparatus located and identified. Provide an internal face view of the equipment arrangement with equipment identified.

6. Pump Test Report: Submit certified copies of factory-run pump performance test curves. Factory-certified performance test curves shall indicate the following:

   a. Flow in gallons per minute.

   b. Total head in feet of water.

   c. Horsepower.

   d. Pump efficiency in percent of input shaft horsepower.

   e. Pump data:

      (1) Model number.
      (2) Serial number.
      (3) Impeller diameter and type.
      (4) Impeller speed.

   f. Test condition data:

      (1) Date of test.
      (2) Mean water temperature.

E. Operations and Maintenance Manuals:

1. Operation shall be in accordance with written instructions provided by the pump station manufacturer. Comprehensive instructions supplied at time of shipment shall enable personnel to properly operate and maintain all equipment supplied. Content and instructions shall assume operating personnel are familiar with pumps, motors, piping and valves, but lack experience on exact equipment supplied.

2. Documentation shall be specific to the pump station supplied and collated in functional sections. Each section shall combine to form a complete system manual covering all aspects of equipment supplied by the station manufacturer. Support data for any equipment supplied by others, even if mounted or included in overall station design, shall also be provided. Instructions shall include the following as a minimum:

a. Functional description of each major component, complete with operating instructions.

b. Instructions for operating pumps and pump controls in all modes of operation.

c. Calibration and adjustment of equipment for initial start-up, replacement of level control components, or as required for routine maintenance.

d. Support data for commercially available components not produced by the station manufacturer, but supplied in accordance with the Specifications, shall be supported by literature from the prime manufacturer and incorporated as appendices.

e. Electrical schematic diagram of the pump station circuits shall be in accordance with NFPA 70. Schematics shall illustrate, to the extent of authorized repair, pump motor branch, control, and alarm system circuits including interconnections. Wire numbers and legend symbols shall be shown. Schematic diagrams for individual components, not normally repairable by the station operator, need not be included. Details for such parts shall not be substituted for an overall system schematic. Partial schematics, block diagrams, and simplified schematics shall not be provided in lieu of an overall system diagram.

f. Mechanical layout drawing of the pump station and components, prepared in accordance with good commercial practice, shall provide installation dimensions and location of all pumps, motors, valves, and piping.

3. Operation and maintenance instructions that rely on vendor cut-sheets and literature that include general configurations or require operating personnel to selectively read portions of the manual shall not be acceptable. Operation and maintenance instructions must be specific to equipment supplied in accordance with these Specifications.

1.03 DESIGN STANDARDS

A. Reference: The Developer shall comply with the applicable regulations established by FDEP. Additionally, the criteria provided in the Recommended Standards for Wastewater Facilities, Latest Edition, and Water Environment Federation (WEF) Manual of Practice No. 9, Latest Edition, may generally be used as design guidelines, if not in conflict with state, county, Town, or other

regulatory agency requirements. See the Town of Howey-in-the-Hills Standard Details for a standard precast concrete duplex and triplex lift station.

B. Lift station structures and equipment shall be protected from physical damage by flooding to the 100-year flood elevation. An all-weather access road shall be provided to the lift station.

C. Design Flows: Sewage pumping stations shall be designed for the total ultimate development flow from all contributory areas. The design average daily flow shall be computed at the unit rates set forth under Section 14, Wastewater Gravity Sewer System. The maximum required pumping capability shall be the product of selected peak factors times the accumulative average daily flow (ADF) from the total service area. In general, the following factors shall be applicable for the range of flow contributions indicated (million gallons per day average daily flow: MGD - ADF), unless larger values are required or smaller amounts are justified, with prior approval from the Town.

FLOW RANGE	PEAK FACTOR
0.00 to 0.05 MGD-ADF	3.5 to 4.0
0.05 to 0.25 MGD-ADF	3.0
0.25 to 2.00 MGD-ADF	2.5
Note: Special analysis shall be made for flows beyond 2.00 MGD-ADF and peak factors less than 2.5.	

D. No wastewater lift station shall be allowed to be connected to a downstream system that is undersized to handle the design flows. The Developer/Contractor shall be responsible for the cost to upsize any downstream affected system components in order for the Town to accept the flow. Should the Town desire to increase the capacity beyond the added flow, it may participate in the cost.

E. Pump Selection:

1. For pumping stations with a peak flow demand of 1,000 gallons per minute (GPM) or less, a minimum of two pump units of equal capacity shall be provided (with one pump operating to meet peak hourly flow, and one pump on standby). Where the peak hourly design flow exceeds 1,000 GPM, three or more units shall be included in the facility (with two pumps operating to meet maximum demand and one pump on standby).

2. The selected sewage pump system shall have the minimum capability of pumping the design peak flow at the maximum computed system total dynamic head (TDH) requirements.

3. Head-Capacity curves shall be prepared for the proposed pumping system in order to determine the various operational conditions. Hydraulic computations shall be in accordance with good engineering, practice, with pipe friction loss calculated by the "Hazen-Williams Formula", using standard friction factors based on the materials used.

4. Provision shall be made to automatically alternate pumps in use.

F. Wet Well Design

1. The wet well structure shall provide a minimum capacity between operational water levels sufficient to allow a minimum of 5 minutes between successive starts of the pumps, when the effluent rate is one-half the maximum one pump capacity. The filling time at the initial and design average flow shall not exceed 30 minutes unless the facility is designed to provide flow equalization. Low water levels shall provide adequate submergence to preclude pump inlet vortexing, air binding, or other design considerations. Operational maximum high water levels shall not exceed the invert elevation of the lowest influent pipe, with high water alarm no higher than the 0.8 of said pipe. A minimum size hopper bottom shall be provided, with the wet well floor sloping to the bottom at a slope of not less than one to one (1/1). Additionally, where the wet well extends below the ground water table, the structure shall be designed to eliminate any possibility of flotation.

2. Minimum wet well size shall be 6-foot diameter. A 12-foot-diameter wet well (minimum) shall be used in cases where the pump discharge piping (in the wet well) is 10-inch-diameter or larger.

3. The wet well shall have a vent.

4. Odor control shall be provided as required and specified by the Town utility department for remote stations and/or areas of low flow, at the discretion of the Public Services Director.

5. Any station that receives flow from another lift station or which is designed to pump 250 GPM or more shall be provided with a cast in place high-density polyethylene (HDPE) liner.

G. Station Water System (Non-Potable): All sewage pumping stations shall be provided with a station water system, with adequate capacity and pressure, for wash down or other requirements. System must meet the Town's requirement for cross-connection and back flow prevention.

H. Emergency Power Provisions: Generators and Emergency Power Connections. It is in the best interests of the public to maintain uninterrupted wastewater flow even during periods of commercial power outages. Therefore, any lift station with a design wastewater flow of 250 GPM or greater will be provided with an onsite standby, diesel, power generator, and automatic transfer switch. In addition, at the discretion of the Director of Environmental Services, any proposed station that is located in a remote area, or area located at a considerable distance from the Environmental Services Offices, may be required to be equipped with an emergency generator. Any other lift station not falling onto the above criteria shall be equipped with standby power generator connections for emergency auxiliary pumping. Standard generator plugs manufacturer shall be in accordance with Appendix A, Approved Manufacturer List of the Town CSM.

I. Sewage Pumps, Motors, and Standby Generators:

1. Sewage pumping units shall be capable of handling raw, unscreened sewage and shall be capable of passing a sphere of at least 3 inches in diameter and the suction and discharge openings shall be at least 4 inches in diameter. Pumps shall be electric motor driven and of a proven design that has been in sewage service under similar conditions for at least 5 years. Pumps shall provide the required peak design performance requirements and be suitable for operation within the total hydraulic range of operation. Pumps manufacturer shall be in accordance with Appendix A, Approved Manufacturer List of the Town CSM. Also provide a 3-inch camlock quick coupling for emergency by-pass at pumping stations with plug valve.

2. Operating conditions and unit sizes shall be shown on the Drawings.

3. The pump design operating conditions shall be within 20% +/- of the best efficiency point, unless otherwise approved by the Town. When possible, the pump selection shall be made in the center of the family of curves.

4. Pump motors should be non-overloading, excluding service factor, throughout the entire operating range of the pumps. Two or more normally closed heat sensing miniature switches connected in series and embedded within the motor windings shall be provided to shut off power and initiate alarm light for motor over-temperature condition. See attached Drawing.

J. On-Site Standby Generator: See Section 20, Standby Power Generator – Diesel, of these Specifications for information on standby generators for lift stations.

K. Pump Controls and SCADA System: See Section 19, Wastewater Pump Controller/Remote Terminal Unit (RTU), of these Specifications for information on the pump control and SCADA control panels.

L. Factory Built Facilities: Factory built facilities shall have prior Town approval before inclusion in Drawings.

M. Valves and Valve Vaults:

1. Valve Vaults: Valve vaults must be a minimum of 6 feet by 6 feet (inside dimension), with no less than 12 inches from the sidewall to the valve clearance. Vault must be coated, with Inextol epoxy inside and outside with a finish coat of 32 mils. All metal on the inside of the valve vault shall be coated with Inextol Epoxy and will also have a finish coat of 32 mils.

2. Valves: A shutoff and check valve shall be placed on the discharge line of each pump outside the wet well in a separate valve vault. The check valve shall be located between the shutoff valve and the pump. All valves used in station valve boxes (except for check valves) shall be plug valves. All valves shall be in accordance with Section 11, Pipe, Fittings, Valves, and Appurtenances.

N. Each lift station shall be fenced or secured in a locked building/enclosure or be located in a restricted access area to prevent access by unauthorized persons. A weather durable sign with a 24-hour emergency telephone number shall be located at a conspicuous point on the fence or structure of the lift station, unless the lift station is located within a restricted area.

O. Design Calculations: The Engineer/Developer shall submit signed, dated, and sealed design calculations by and Professional Engineer licensed in the State of Florida with the final Construction Drawings for all wastewater lift stations. Calculations shall include high head and low head condition system curves plotted on the manufacturer's pump curve, hydraulic analysis of force main system including all friction and minor losses, operating cycles with wet well sizing, and buoyancy calculations. System curves shall verify that the pumps are operating at peak efficiency and are suitable for the design flow application. Pump and motor selection shall be designed based on the hydraulic grade line at the point of connection.

1.04 WARRANTY

A. Lift station Warranty: The station manufacturer shall warranty the complete lift station and all equipment provided to be free from defects in materials and

workmanship for 2 years from the date it is placed in permanent operation by the manufacturer's representative. Warranty shall include 100% coverage of the manufacturer's labor, materials and equipment to remove and replace defective materials and workmanship at no cost to the Town.

B. Pump Manufacturer Warranty: The manufacturer shall warrant to the Town for permanent installation in municipal sewage service submersible pump and motor against defects in materials and workmanship including normal wear and tear to the following parts for a period of 5 years, mechanical seals, bearings, shafts, motor electrical cables, and motor stators.

1. The manufacturer shall warrant to the Town for permanent installation in municipal sewage service submersible pump and motor against defects in materials and workmanship including normal wear and tear to the following parts for a period of 5 years, mechanical seals, bearings, shafts, motor electrical cables, and motor stators. The warranty shall include no less than 100% coverage for original equipment manufactured (OEM) parts and in-shop labor for pump/motor repairs for the full 5 years at no cost to the Town. This warranty shall not apply to parts that fail due to abuse, neglect, mishandling, or acts of God. The warranty period shall commence upon the date of final acceptance for use the pumping station and/or of the replacement pump by the Town.

2. Verification of guarantees of performance and warranty certificate shall be indicated in the shop drawing submittal and in the Operation and Maintenance Manual.

3. The pump distributor shall employ and make available proficient manufacturer-authorized service technicians to perform service calls to pumps supplied to the Town on a 24-hour basis, 7 days a week. The pump distributor shall provide service technicians company-owned service vehicles equipped with lifts/booms capable of retrieving all sizes of submersible pumps from wet wells, all necessary tools, test and safety equipment, etc., that are required to make field repairs. Service personnel shall adhere to all of the Town's Safety Rules and Regulations and be trained and certified for confined space entries and carry liability and workers' compensation insurance.

4. During the warranty period, the pump distributor shall at no cost to the Town repair and re-install the subject pump within 24 hours or provide a loaner pump(s) which can be transported, installed, and capable of maintaining operation of the Town's sites. The location address, contact names, phone numbers, (including emergency, mobile, etc.) and fax numbers of the manufacturer-authorized warehouse and service center

shall be indicated in the shop drawing submittal and in the Operation and Maintenance Manual.

C. Specialty Wet Well Liner Manufacturer Warranty: The liner manufacturer shall warrant the liner against defects for at least 5 years after the date of acceptance by the Town. Defects are defined as cracking, delaminating, or leaking. The warranty shall require the manufacturer to supply all necessary labor, materials, and equipment to repair defects to satisfaction of the Town. The Contractor and/or manufacturer shall not make any exemption or exception to the above stated conditions or warranty.

D. Fiberglass Wet Well and Valve Box Warranty: The basin/structure manufacturer shall warrant the wet well against defects for at least 5 years after the date of acceptance by the Town. Defects are defined as cracking, delamination, or leaking. The warranty shall require the manufacturer to supply all necessary labor, materials, and equipment to repair defects to the satisfaction of the Town. The Contractor and/or manufacturer shall not make any exemptions or exception to the above stated conditions or warranty.

PART 2 PRODUCTS

2.01 GENERAL

A. All material shall be free from defects impairing strength and durability and be of the best commercial quality for the purpose specified. Unless indicated otherwise on the Drawings, all metal components in the wet well, with the exception of pumps and motors shall be 316 stainless steel as specified herein or on the Drawings. The pumps, motors, and guide rail system shall be supplied by the pump supplier to ensure unit compatibility. Major items of equipment shall include wet well, valve vault, non-clog submersible pumps, pump discharge piping, and fittings, valves, and gauges inside the wet well and valve vault, access hatches, pump support brackets, pump guide rails, coatings, wet well liner, floats, and backflow prevention.

2.02 PRECAST CONCRETE WET WELL

A. Precast concrete wet well shall consist of one monolithically cast base section and a 12-inch long (at a minimum) base slab extension for counter flotation. The wet well floor shall have stainless steel anchor bolts for mounting of pump bases. Wet well bases, sections, and miscellaneous structures shall conform to the requirements of ASTM C478 (specification for precast concrete manhole sections and structures) except as modified herein. Cement shall meet the requirements of ASTM C150/C150M (specification for Portland cement, Type II). Wall thickness shall be as specified on the Contract Drawings and in accordance the Town of

Howey-in-the-Hills Standard Details. If no wall thickness is specified, then the minimum wall thickness shall be 1/12 the inside diameter in inches plus 1 inch. Rings shall be custom-made with openings to meet indicated pipe alignment conditions and invert elevations. Both top slab and bottom slab shall be 12 inches thick (at a minimum). For concrete base and risers, the reinforcing steel shall be designed, signed and sealed by a Florida Registered Structural Engineer and shall be submitted with the shop drawings. All openings in wet well sections shall be cast-in with the exception of the influent pipe opening which shall be cored in the wall. Joint contact surfaces shall be formed with machined castings and shall be exactly parallel and specifically designed by a Professional Engineer. Wet well diameter and height shall be as shown on the Contract Drawings and in accordance with the Town of Howey-in-the-Hills Standard Details. The wet well shall be HDPE lined with material by a manufacturer in accordance with Appendix A, Approved Manufacturer List of the Town CSM, with a minimum thickness of 2 mm, mechanically anchored to the concrete and with all joints extrusion welded by certified welders. The Contractor shall submit shop drawings consisting of manufacturer's standard details of various sections, for approval, before placing order for structures.

1. Joints: Joints shall have sealing compound, conforming to Federal Specification SS S-00210. Joint shall be wrapped with a vapor barrier joint tape. Cement mortar joints will not be acceptable, except that each joint shall be wiped inside the manhole with cement mortar after assembly. Joints shall be watertight. Manufacturers shall be in accordance with Appendix A, Approved Manufacturer List of the Town CSM.

2.03 FIBERGLASS WET WELL – (ALTERNATE WET WELL CONSTRUCTION)

A. Unless noted otherwise by the Town, the Contractor may construct a fiberglass wet well in lieu of a precast concrete wet well. The fiberglass wet well shall be designed (signed and sealed) by a Florida Professional Engineer. The design shall include the operating conditions as noted on the Drawings, a 24-inch (minimum) thick (12 inches thick inside the wet well and 12 inches thick outside the wet well) reinforced concrete hold-down base which extends 24 inches beyond the outside of the wet well, a 6-inch-thick (minimum) reinforced concrete top slab, pump access frame and cover and other standard wet well features as shown on the Drawings. Pumps shall be anchored to a 1-inch-thick steel plate. The complete design (designed by a Florida Professional Engineer) must be submitted in the form of a shop drawing for the Town’s review and approval. Fiberglass reinforced polyester wet wells shall be manufactured from commercial grade unsaturated polyester resin with fiberglass reinforcements. Unless approved otherwise by the Town, the wet well shall be a one-piece unit.

1. Reinforcing Material: The reinforcing materials shall be a commercial Grade "E" type glass in the form of mat, continuous roving, chopped roving, roving fabric, or a combination of the above, having a coupling agent that will provide a suitable bond between the glass reinforcements and the resin.

2. Surfacing Materials: If reinforcing materials are used on the surface exposed to the contained substance, it shall be a commercial grade chemical-resistant glass that will provide a suitable bond with the resin and leave a resin rich surface.

3. Fillers and Additives: Fillers, when used, shall be inert to the environment and wet well construction. Additives, such as thixotropic agents, catalysts, promoters, etc., may be added as required by the specific manufacturing process to be used. The resulting reinforced plastic material must meet the requirement of this specification.

4. Exterior Surface: The exterior surface shall be relatively smooth with no sharp projections. Hand-work finish is acceptable if enough resin is present to eliminate fiber show. The exterior surface shall be free of blisters larger than 1/2 inch in diameter, delamination and fiber show.

5. Interior Surface: The interior surface shall be resin rich with no exposed fibers. The surface shall be free of crazing, delamination, blisters larger than 1/2 inch in diameter, and wrinkles of 1/8 inch or greater in depth. Surface pits shall be permitted if they are less than 3/4 inch in diameter and less than 1/16 inch deep.

6. Defects Not Permitted:

    a. Exposed fibers: glass fibers not wet out with resin.
    b. Resin runs: runs of resin and sand on the surface.
    c. Dry areas: areas with glass not wet out with resin.
    d. Delamination: separation in the laminate.
    e. Blisters: light colored areas larger than 1/2 inch in diameter.
    f. Crazing: cracks caused by sharp objects.
    g. Pits or Voids: air pockets.
    h. Wrinkles: smooth irregularities in the surface.
    i. Sharp Projection: fiber or resin projections necessitating gloves for handling.

7. Installation of Brackets: Manufacturer or manufacturer certified field personnel shall glass in all stainless steel fasteners and brackets, discharge

piping brackets, etc. Manufacturer of wet well shall be responsible for integrity of all field glassing.

8. Marking and Identification: Each wet well shall be marked with the following information:

   a. Manufacturer's name or trademark.
   b. Manufacturing special number.
   c. Total length and nominal diameter.

9. Load Rating: The complete wet well shall have a minimum dynamic-load rating of 16,000 ft-lbs when tested in accordance with ASTM D3753, Section 8, test methods ASTM D790 and ASTM D695. To establish this rating the complete wet well shall not leak, crack, or suffer other damage when load tested to 40,000 ft-lbs and shall not deflect vertically downward more than 1/4 inch at the point of load application when loaded to 24,000 pounds.

10. Stiffness: The wet well cylinder shall have a minimum pipe-stiffness value as shown in Table 1 (at a minimum) when tested in accordance with ASTM D3757, Section 8.

Table 1: Stiffness Requirements (Minimum)

Length, Feet	F/AY psi
10 to 20	2.01
21 to 30	3.02
31 to 40	5.24

2.04 VALVE PIT

A. The valve pit shall consist of a concrete structure sized to adequately house the equipment and allow room for removal of equipment and regular maintenance as shown on the Contract Drawings in accordance to the Town of Howey-in-the-Hills Standard Details. All pipe wall penetrations shall be through cast-in or cored holes with flexible rubber sealing connections.

2.05 CONCRETE CEMENT AND REINFORCING

A. Concrete cement shall be Type II, having a maximum Tri-calcium aluminate (3CaOAL203) content of 8%. Coarse aggregate shall be sound, crushed, angular granitic stone only. Smooth or rounded stone is not acceptable. Fine aggregate and coarse aggregate shall meet the requirements of ASTM C33/C33M. Calcium chloride or admixtures containing calcium chloride shall not be used in the concrete mix.

B. Reinforcing shall meet or exceed the minimums described in ASTM C478.

2.06 FLEXIBLE PIPE-CONNECTORS

A. Watertight connections between all pipe and wet well shall be achieved with neoprene-EPDM flexible pipe connectors. The neoprene-EPDM material the connector is manufactured from shall conform to ASTM C443 and shall be a minimum of 3/8 inch (9.4 mm) thick or greater. The material shall be resistant to ozone, weathering, aging, and chemicals, including acids, alkalis, animal and vegetable fats, oils, and petroleum products.

2.07 SUBMERSIBLE NON-CLOG SEWAGE PUMPS

A. The pumps shall be designed to pump raw sewage wastewater, sludge, and other fibrous materials without injurious damage during operation and conform to the requirements of the National Electrical Code. The design shall be such that the lifting cover, stator housing and volute casing are of ASTM A48/A48M, Class 25 gray iron construction, with all nuts, bolts, washers, and other fastening devices coming into contact with the sewage constructed of 316 stainless steel. All mating surfaces (pump assembly), of major components shall be machined and fitted with O-rings where watertight sealing is required. All rotating parts shall be accurately machined and shall be in as nearly perfect rotational balance as possible. Excessive vibration shall be sufficient cause for rejection of the equipment. The pump impellers shall be re-balanced after being trimmed. Pumps shall be submersible pumps by a manufacturer in accordance with Appendix A, Approved Manufacturer List of the Town CSM.

B. Pump Performance and Sizing: Each pump shall have the necessary characteristics and be properly selected to perform under the operating characteristics shown on the attached "Pump Data Sheets".

C. Seals: Pumps shall have mechanical seals, which shall require neither maintenance nor adjustment and shall be readily accessible for inspection and replacement. The seals shall not rely upon the pumped media for lubrication and shall not be damaged if the pump is run un-submerged for extended periods while pumping under load. Mechanical seals shall be solid hard faced, (not laminated type). The top and bottom seal shall be carbon-ceramic faced, tungsten carbide, or silicon carbide material. A double electrode shall be mounted in the seal chamber to detect any water entering the chamber through the lower seal. Water in the chamber shall cause a red light to turn on at the control box. This signal shall not stop motor but shall act as a warning only, indicating service is required. One spare upper and lower seal each shall be provided for each pump by the manufacturer.

D. Impeller shall be cast iron and of the non-clog enclosed type. The impeller casing shall have well-rounded water passages and smooth interior surfaces free from cracks, porosity, blowholes, or other irregularities. The impeller shall be a single or double vane of hard alloy gray iron construction, dynamically balanced, double shrouded, with a smooth long thoroughfare and having no acute angles, with not more than two non-clog passages and capable of passing a minimum 3-inch solids. Screw impellers are not acceptable. A stainless steel rotating wear ring shall be installed on the impeller with a bronze stationary volute wear ring of, to provide efficient sealing between the volute and impeller. Impeller is to be driven by stainless steel shaft key and impeller is held in place with stainless steel lock screw and washer. Impeller and motor shall lift off of case as a unit without disturbing piping.

E. Motors: The pump shall be driven by a totally submersible electric motor. Pump motor shall be of sufficient horsepower as to be non-overloading over the entire length of the pump curve. The stator housing shall be a watertight casing. Motor insulation shall be moisture resistant, Class F, 155ºC at a minimum. Motor shall be NEMA Design B. Motor shall be designed to operate in a totally, partially, or non-submerged condition without damage to the motor. Motors shall not contain any insulating fluid consisting of material classified as hazardous waste by the US Environmental Protection Agency (EPA) such as tetrachloroethylene or polychlorinated biphenyl (PCB). Motors shall be provided with thermal sensors in the motor windings designed such that the pump will automatically shut off and set off an alarm condition on high temperature condition.

F. Power Cords and Control Cords: Sufficient cord shall be provided to suit the arrangement shown on the Drawings, minimum 25 feet of each cord. Cords shall be STW-A, water resistant 600V, 60ºC, UL and CSA approved, and applied dependent on amp draw for size. Cords shall be attached to the pump in accordance with the manufacturer's recommendations to protect against leakage. Both control and power cords shall have a green carrier ground conductor that attaches to motor frame. Power cords and control cords shall junction at a box mounted outside the well, but not inside the control panel. Cords shall be connected in a manner to allow removal of pumps for maintenance.

G. Discharge Base Elbow: The pump manufacturer shall furnish a discharge base and discharge elbow for the pump supplied. The base shall be sufficiently rigid to firmly support the guide rails, discharge piping and pump under all operating conditions. The base shall be suitable for bolting to the floor, (bolting to a standard 1 inch thick metal plate, see details on Drawings), of the wet well. The face of the discharge elbow inlet flange shall make contact with the face of the pump discharge nozzle flange. The pump and motor assembly shall be a "quick disconnect" type connected to and supported by the discharge base and guide rails

allowing the pump to be removed from the wet well and replaced without the need for unbolting any flange, lowering the liquid level or requiring operating personnel to enter the wet well. Pump shall be provided with a sealing flange and guide rail sliding bracket. The bracket shall be designed to obtain a leak proof seal between flange faces as final alignment of the pump occurs in the connected position. The bracket shall maintain proper contact and a suitably sealed connection between flange faces under all operating conditions. Metal-to-metal mating surfaces are acceptable, if machined finished.

H. Exterior of pump shall be coated with manufacturer's standard finish (powder coated epoxy finish is preferred, not required).

I. The pump supplier shall provide a vinyl or aluminum placard or tag which indicates all operating conditions of the pumps, including name plate data, impeller size and part number, design flow, TDH, and other pump-related data.

J. Pump Test: A written report of pump tests shall be provided with each pump before shipment. The required manufacturer testing is detailed below in the testing section of this Section. The manufacturer shall furnish the Engineer of Record with three copies of certified performance curves for each pump.

2.08 PUMP DATA SHEET

A. The pump data sheet submitted to the Town by the Contractor before pump purchase shall contain the following:

1. Lift station No: ____.
2. Description – Service: Solids Handling Lift station.
3. GPM: ____.
4. Total Head – Feet: ____.
5. Fluid: Domestic Wastewater.
6. Hp: ____.
7. Temperature Degree F.: Ambient.
8. pH: 5 to 8.
9. Specific Gravity: 1.0.
10. Minimum Sphere Diameter: 3 inches.
11. Power Service: ____.
12. Maximum Speed: ____.
13. Number Required: ____.
14. Electrical Cable Required/Pump: ____.
15. Electrical Circuit Breaker Rating: Supplier to furnish.
16. Maximum Full Load Amps: Supplier to furnish.
17. Maximum Starter Amps: Supplier to furnish.
18. Maximum Locked Rotor KVA: Supplier to furnish.

19. NEC Code Letter: Supplier to furnish.
20. Remarks: _____.

2.09 PIPE, FITTINGS, PRESSURE GAUGES, AND VALVES

A. All external piping shall be ductile iron pressure Class 350 (flanged joint for exposed pipe and mechanical joint for buried pipe) and all internal wet well piping from the pump discharge elbow to the valve box shall be a minimum of standard dimension ratio (SDR) 11 HDPE. All piping, fittings, valves, and appurtenances shall meet the specifications in Section 11, Pipe, Fittings, Valves, and Appurtenances. Pipe supports shall be provided as needed. Pressure gauges shall be stainless steel with stainless steel diaphragm, liquid filled, 4-inch-diameter dial with 0- to 100-psi range. Gauges and diaphragms manufacturers shall be in accordance with the Appendix A, Approved Manufacturer List of the Town CSM.

2.10 ACCESS COVERS

A. Access covers shall have clear opening of 36 x 84-inch access . Access frame and cover shall have a 1/4-inch-thick, one-piece, mill finish, extruded aluminum frame, incorporating a continuous concrete anchor. Door panel(s) shall be 1/4-inch-thick aluminum diamond plate, reinforced to withstand a live load of 300 psi. Door(s) shall open to 90 degrees and automatically lock with stainless steel hold open arms with aluminum release handles. Door(s) shall close flush with the frame. Unit shall lock with a noncorrosive locking bar. All access frame, cover, hardware and fasteners shall be constructed of 316 stainless steel. All surfaces in contact with concrete shall have a shop coat of zinc chromatic primer, approved alkali resistant paint or approved protective coating. Double door access covers shall have removable center bar support. Cover must be compatible with enclosed equipment. Padlocks for access covers shall be brass padlock, keyed alike, and furnished with two keys per lock. Bolts in locking device shall be stainless steel. Manufacturers shall be in accordance with Appendix A, Approved Manufacturer List of the Town CSM.

2.11 BRACKETS, SUPPORTS, AND MISCELLANEOUS METAL PARTS

A. Brackets, supports, and miscellaneous metal parts shall be stainless steel and provided as needed to support piping, floats, controls, and their equipment for a complete installation. Anchor bolts shall be 300 series stainless steel and shall be provided. All metal shall be stainless steel. A lifting chain and hook, minimum 3/8 inch stainless steel, shall be provided with each pump. Three feet of excess chain above the top of the wet well shall be provided to expedite removal. A chain/motor electric cable holder shall be provided and appropriately sized to accommodate the lift chains and motor electrical cables provided without

deformation. Chain/electric cable holder shall include extra heavy duty 3/8 inch rod hooks for attaching control floats, lifting chains, and other wet well accessories (six hooks minimum) and be located on the side of the wet well hatch opening opposite to the discharge piping.

2.12 PUMP GUIDE RAILS WITH END BRACKETS

A. Pump guide rails with end brackets shall be provided for each pump. Guide rails shall be a minimum of 2.0-inch stainless steel pipe and sized to fit the discharge base and the sliding bracket and shall extend upwards from the discharge base to the access hatch cover at the top of the wet well. Intermediate rail braces shall be supplied and solidly secured to the wet well wall. Guide rails and brackets shall be 316 stainless steel. Each pump shall connect automatically and firmly to the discharge piping when lowered into place. It shall not be necessary to enter the wet well to remove or replace a pump.

2.13 POWER-POLE

A. The Contractor shall confirm service arrangements with the power company before commencing work. The Contractor shall run underground wiring to nearest transformer or hand hole. If no power pole is available, the Contractor shall provide a power pole and shall connect to local power company at pole's weatherhead. Pole shall have mounted on it:

1. 250-watt mercury vapor lighting fixture, 120-volt with photo cell, and 2-foot mounting arm.
2. A lightning arrestor.
3. A volt surge capacitor.
4. The meter base box, by local power company.
5. A fusible, 304 stainless steel disconnect switch.

2.14 MOTOR BRANCH COMPONENTS

A. Mounting: All motor branch components shall be of the highest industrial quality, securely fastened to a removable sub-plate with screws and lockwashers. The sub-plate shall be tapped to accept all mounting screws. Self-tapping screws shall not be used to mount any components.

B. Circuit Breaker and Operating Mechanisms: A properly sized heavy-duty air circuit breaker shall be furnished for each pump motor, and shall have a symmetrical RMS interrupting rating as noted on the Drawings. All circuit breakers shall be sealed by the manufacturer after calibration to prevent tampering. A padlocking operating mechanism shall be installed on each motor circuit breaker. Operating handles for the mechanisms shall be located on the

exterior of the control compartment door, with interlocks which permit the door to be opened only when circuit breakers are in the OFF position.

C. Motor Starters: An open frame, across-the-line, National Electrical Manufacturers Association (NEMA)-rated magnetic motor starter shall be furnished for each pump motor. Starters of NEMA Size 1 and above shall be designed for addition of at least two auxiliary contacts. Starters rated "O", "OO", or half size are not acceptable. Power contacts shall be double-break and made of cadmium oxide silver. All motor starters shall be equipped to provide under-voltage release and overload protection on all three phases. Motor starter contacts shall be easily replaceable without removing the motor starter from its mounted position. Acceptable starters manufacturer shall be in accordance with Appendix A, Approved Manufacturer List of the Town CSM.

2.15 ALARMS

A. High Pump Temperature Protection: Each control panel shall be equipped with circuitry to override the level control system and shut down the pump motor(s) when required to protect the pump motor from damage caused by excessive temperature. A thermostat shall be mounted in each motor to detect its temperature, and a single relay shall be supplied for each thermostat. If the pump motor temperature should rise to a level which could cause damage, the thermostat shall cause the signal relay to drop out of the motor starter. An electrical indicator, visible on the front of the control panel, shall indicate that the pump motor has been stopped because of a high temperature condition. The pump shall remain locked out until the pump has cooled and the circuit has been manually reset. Automatic reset of such a circuit shall not be acceptable.

B. High Water Alarm: When the wet well level reaches a preset high water level, a switch shall energize a signal relay circuit to visibly indicate such on the front of the control panel. The relay shall maintain the signal until manually reset.

2.16 WIRING

A. Wiring: The pumping system as furnished by the manufacturer shall be completely wired, except for the power feeder lines to the panel main disconnect, final connections to remote alarm devices, pumps, and level switches. The Contractor shall be responsible for all interconnecting wiring and conduit. All wiring, workmanship, and schematic wiring diagrams shall be in compliance with applicable standards and specifications set forth by the National Electrical Code (NEC).

B. Wire Identification and Sizing: Control circuit wiring inside the panel, with the exception of internal wiring of individual components, shall be 14-gauge

minimum, Type MTW or THW, 600 volts. Wiring in conduit shall be 14-gauge minimum. Motor branch wiring shall be 10-gauge minimum. Motor branch conductors and other power conductors shall not be loaded above 75°C temperature rating. Wires shall be clearly numbered at each end in conformance with applicable standards. All wire connectors in the control panel shall be of the ring tongue type with nylon insulated shanks. All wires on the sub-plate shall be bundled and tied. All wiring outside the panel shall be in conduit.

C. Wire Bundles: Control conductors connecting components mounted on the panel enclosure door shall be bundled and tied in accordance with good commercial practice. Bundles shall be made flexible at the hinged side of the enclosure. Adequate length and flex shall be allowed so that the door can swing to its full open position without undue mechanical stress or abrasion on the conductors or insulation. Bundles shall be clamped and held in place with mechanical fastening devices on each side of the hinge.

2.17 WIRE BUNDLES

A. Power Supply: All stations shall be provided with a control power transformer, single phase primary, to 120 volts/1 ph/60 hertz secondary. Transformer shall be rated for the loads of the lights, alarms, and control power. Power service for the pump motor circuits shall be as indicated on the pump data sheets.

B. Backflow Protection for Potable Water Supply: Backflow preventing devices shall be of the type specified in Section 11, Pipe, Fittings, Valves, and Appurtenances.

2.18 EMERGENCY POWER PROVISIONS

A. It is in the best interests of the public to maintain uninterrupted wastewater flow even during periods of commercial power outages. Therefore, any lift station with a design wastewater flow of 250 GPM or greater will be provided with an onsite standby, diesel, power generator, and automatic transfer switch. In addition, at the discretion of the Public Services Director, any proposed station that is located in a remote area, wetland, or area located at a considerable distance from the operation center, may be required to be equipped with an emergency generator. Any other lift station not falling onto the above criteria shall be equipped with standby power generator connections for emergency auxiliary pumping. Standard generator plugs manufacturer shall be in accordance with the Appendix A, Approved Manufacturer List of the Town CSM. Refer to Section 20, Standby Power Generator – Diesel, for technical specifications on automatic standby emergency generator with diesel engine drive and above ground fuel storage tank. All generators shall be sized to run two pumps, at a minimum.

PART 3 EXECUTION

3.01 INSTALLATION

A. Submersible Pump Facilities: Installation shall include the removable pump units, aluminum access frame and cover, stainless steel pipe pump guide bars, pump discharge connection, and other necessary appurtenances. All piping and structures shall be installed in accordance to the manufacturer's recommendations, Section 6, Utility Excavation, Trenching, and Backfilling, as shown on the Contract Drawings, and described herein.

B. Equipment furnished and installed shall be fabricated, assembled, erected, and placed in proper operating condition in full accordance with Drawings, Specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted and approved by the Town. Before commencing the pumping station installation and/or the furnishing of replacement pumps, the pump distributor shall submit for approval, detailed and dimensioned shop drawings for pumps including factory curves of identical model pumps provided to the Town. The pump distributor shall furnish and deliver one hard copy and one electronic copy on CD/DVD at the time of acceptance for use of the pumping station and/or of the replacement pump(s) by the Town Operation and Maintenance data and motor and pump nameplate data (including serial numbers) for each pump supplied.

C. Reference Points and Layout: The Contractor shall be responsible for setting all grade stakes, lines, and levels. The Contractor or Contractor’s Surveyor will provide centerline of construction and will establish a bench mark. Any reference points, points of intersection, property corners, or bench marks, which are disturbed during construction, shall be restored by a Land Surveyor registered to practice in the State of Florida, and all costs thereof shall be borne by the Contractor. The Contractor shall assume all responsibility for the correctness of the grade and alignment stakes.

D. The Contractor shall be responsible for all bypass pumping as required. A bypass pumping plan shall be submitted at the time or permit application to the environmental services director. Citizen consideration will be reviewed when bypass pumping equipment is required. Sound attenuating enclosures may be required at the discretion of the Environmental Services Director.

E. The station and valve vault shall be installed level and plumb by the Contractor in accordance with the manufacturer's recommendations, Section 6 Utility Excavation, Trenching, and Backfilling, as shown on the Drawings, and described herein.

F. Wet Well and Valve Vault shall be handled and installed in such a manner and by such means as to prevent damage. All sections damaged during handling will be rejected as directed by the Engineer of Record and replaced at no additional cost to the Town. All holes in sections used for their handling and the annular space between the wall and entering pipes shall be thoroughly plugged with an approved, non-shrinking mortar or grout, applied and cured in strict conformance with the manufacturer's recommendations, so that there will be zero leakage through openings and around pipes. The mortar shall be finished smooth and flush with the adjoining interior and exterior manhole wall surfaces. Wet well base shall be installed on a firm 12-inch (minimum) leveling course of granular material (57 stone) foundation as shown on the Drawings so prepared to prevent settlement and misalignment.

G. Wet Well Sections shall be installed plumb and with all pipe holes at the proper elevation. If not approved otherwise by the Town, the construction schedule for setting wet well base and riser sections shall be approved by a Town representative. The Town representative shall be present, on site, during this installation.

H. Wet Well Riser Sections of the wet well shall be installed using joint sealant and shall be made in accordance with manufacturer's recommendations and to insure a watertight installation. Steps shall be in proper alignment and shall be placed so that safety entry-egress to the wet well is achieved.

I. Wet Well Joints shall be sealed with joint sealer and wrapped with joint tape manufacturers shall be in accordance with the Appendix A, Approved Manufacturer List of the Town CSM., over the entire joint surface, with joints pre-primed. Joints shall be watertight. Upon completion of installation, excess joint sealer shall be trimmed flush with inside and outside surface of structure. All exterior joints of precast concrete wet wells shall be sealed with one 12-inch-wide exterior joint sealant membrane centered on joint. The tape shall be capable of sealing joints against groundwater infiltration. The installation of the membrane shall be in conformance with the recommendations of the manufacturer. Surface must be smooth, clean, dry, and free of voids, loose aggregate, dirt, or other matter that will hinder the adhesion of the membrane. A primer shall be used in accordance with the recommendations of the membrane manufacturer. If recommended by the manufacturer, heat shall be applied to all areas being sealed. Each joint shall be wiped inside the manhole with cement mortar after assembly.

J. A flexible pipe connector shall be used to connect sewer pipes to the precast concrete wet well.

K. During the wet well invert construction stage, the interior annular space between the exterior of the pipe and the interior of the connector shall be filled with a Type II lean cement grout by the Contractor.

L. Corrosion Protection: Precast concrete wet well interior shall be lined with a cast in place HDPE liner with a minimum thickness of 2 mm, mechanically anchored to the concrete and with all joints extrusion welded by certified welders. Manufacturers shall be in accordance with Appendix A, Approved Manufacturer List of the Town CSM. The exterior of the wet well (below grade), shall be given two coats of bituminous water proofing materials which meets the coating requirements as specified for sewage manholes in Section 14, Wastewater Gravity Sewer System. All exposed metal shall be painted with two coats of exterior black enamel paint. Inside and outside of valve vault shall be painted with two coats of material by a manufacturer in accordance with Appendix A, Approved Manufacturer List of the Town CSM, applied in accordance with the manufacturer’s recommendations.

M. Pumps and piping shall be installed in accordance with the written instructions provided in the shop drawings and as indicated on the Drawings. The manufacturer shall furnish such detailed instructions as may be required for proper installation. The manufacturer shall also furnish the services of a qualified service representative to inspect equipment installation, make minor adjustments and place equipment in permanent operation. The manufacturer's representative shall provide whatever items required for proper installation, operation, and instruction. Service shall be not less than 2 days and divided into not less than two trips to the site. The first trip shall be for inspection, minor adjustments, initial operational services, and initial instruction. A second trip, 30 days later after pump has been placed into operation, shall be for final adjustments and orientation of the Town's operation personnel. The Town and Engineer of Record shall be notified at least 24 hours in advance of each trip. A manufacturer-supplied pump nameplate for each pump shall be placed (with adhesive) inside the front panel of the pump control panel.

N. Pump discharge base shall be leveled, plumbed, and aligned into position to fit connecting piping. The discharge base shall be solidly secured to the wet well floor using a 1 inch thick steel hold-down plate (see details) and appropriately sized 316 stainless steel anchors then grouted after initial fitting and alignment and before final bolting of the discharge piping. This work shall be inspected by the Town before any liquid being allowed into the wet well. After final alignment and bolting, pump discharge base and all connections shall be inspected. If any movement or opening of any joints is observed, any and all piping, including pump discharge base, shall be corrected.

O. Pump performance shall be stable and free from cavitation and noise throughout the specified operating head range at minimum suction submergence.

P. Lifting cables shall be cut off flush to finish grade after installation.

Q. Float switches, probes and transducers shall be installed separately and at elevations shown on Drawings and shall be equipped with individual weights in the floats or on the cables.

R. Backflow-preventing devices shall be installed as specified in Section 11, Pipe, Fittings, Valves, and Appurtenances. Backflow device shall be tested by a certified tester within 5 days of installation, with written results provided to the Town.

S. After installation and cleaning up of construction debris, wet well shall be provided with water sufficient to provide start up and pump down tests as necessary to verify pump operation and efficiency for as long a period of time as necessary to accomplish such tasks.

T. Changes in structures, piping, electrical work, or other work which is necessary to accommodate equipment supplied by the Contractor shall be made at no additional cost to the Town. No equipment structure shall be constructed until certified equipment dimensions and requirements are available to the Contractor in the form of approved shop drawings.

3.02 QUALITY ASSURANCE AND CERTIFICATION

A. Factory Pump Certificate Test: The pumps and motors shall be given an operations performance test in accordance with the standards of the Hydraulic Institute. Recordings of the tests shall substantiate the correct performance of the equipment at the design submergences to include a ten percent variance of the head, capacity, speed, and efficiency as herein specified. A complete written report certifying the foregoing test results shall be submitted to the Engineer of Record before shipment of pumps.

B. The pump manufacturer shall also perform the following testing on each pump before shipment.

1. Megger the pump motor and cable for insulation breaks or moisture intrusion.

2. Before submergence, run pump dry and check for correct rotation.

3. Pump shall be run continuously for 30 minutes in a submerged condition, with a minimum submergence of 10 feet.

4. Pump shall be removed from test tank, meggered immediately for moisture, and all seals checked for water intrusion.

5. Pumps shall be operated at a minimum of six points to establish the hydraulic curve. KW input shall be monitored and recorded. One test point shall be performed with discharge valve closed. Pumps shall develop appropriate capacity and head within Hydraulic Institute Standards without excessive noise, vibration, or cavitations. If specifically requested by the Town a vibration test shall be performed on each pump to demonstrate compliance.

6. For pumps less than 100 Hp, the pump supplier shall submit copies of certified Hydraulic Institute test reports including factory pump curves of identical model pump(s) provided to the Town (in lieu of written certified test reports for each pump supplied).

7. For pumps 100 Hp and greater, the above certified pump performance test (at a minimum) must be completed on each actual pump supplied. A Town representative(s) may choose to be present to witness the certified test (Town's travel expenses by the Town).

C. The manufacturer shall demonstrate the ability to fabricate the various lift station structural components, as specified, using adequate numbers of skilled workmen, tools, and facilities.

D. Concrete Certification: All concrete units shall be poured and vibrated using steel forms, in a Prestressed Concrete Institute (PCI) certified manufacturing facility.

E. Final Certification: After installation and final testing of equipment and instrumentation, the manufacturer furnishing supervision and/or inspection services shall make written certification to both the Engineer of Record and the Town that his equipment and the controls have been properly installed and operate in accordance with the Specifications and Drawings, and that the operating and maintenance instructions have been furnished to the Engineer of Record.

3.03 TESTING

A. Field Acceptance Testing:

1. Pre-Final Inspection: Before final inspection, the Contractor shall conduct a pre-final site inspection (including energizing each pump), in the presence of a Town representative. Any deficiencies noted at this time shall be corrected before scheduling of the final inspection.

2. Final Inspection: The Contractor shall be responsible for conducting the following field acceptance tests and start-up procedures in the presence of a Town representative. The Contractor shall notify the Town, the Engineer, and the pump manufacturer's representative 48 hours before start-up. The time and date of this final inspection shall be scheduled by the Town. The Contractor shall furnish all labor, piping, equipment, water, and materials required to perform the acceptance testing. The Contractor shall ensure the force main is full of water before the pump test.

3. Wet well shall be tested for exfiltration by filling up with water to a level 2 feet below the top of the flat slab and measuring the amount of drop over 1 hour. Exfiltration shall be 0 gallons per foot diameter per foot depth per day.

4. The Contractor shall demonstrate that the pump mounting and guide rail systems are fully operational. The Contractor shall remove and reinstall the pumps in the presence of the Town representative, before conducting the performance test.

5. Pump Performance: Before acceptance, as part of the final inspection, and before placing the station in operation, the Contractor shall conduct a pump performance test. Pumps shall operate according to the operating conditions indicated on the Drawings without excessive vibration or overheating. Testing shall be performed using clean water. The Contractor shall supply water at its own expense to perform the required testing. Pumping rates shall be determined by pumping a calculated volume of water in a specified time interval. Head and flow conditions shall be measured and recorded. Water levels during testing shall fall within the pump control levels shown on the Drawings. Amperage draws shall be monitored to determine effectiveness and efficiency of equipment. The test shall be repeated until satisfactory results are obtained. The test results shall be recorded on the Pump Test Report sheet included at the end of this Section. If the Contractor is unable to demonstrate to the Town that the pumping unit performs satisfactorily, the unit shall be rejected. The Contractor shall then remove and replace the defective unit at its own expense. Satisfactory performance includes, but is not limited to, the following:

   a. Pumps: Pumps shall deliver rated GPM at rated TDH.

b. Motors: Running amperage shall be noted and recorded on each leg of power cord while pump is operating under full load.
c. All self-test trip relays shall demonstrate ability to simulate a fault condition. All test results shall be recorded on the pump test report and be submitted to the Engineer.
d. Pumps shall operate within 5 % of the approved, certified, head-capacity curve.
e. Following performance testing, pumps shall be meggered for pump-moisture intrusion.
f. Pump spare parts shall be in accordance with the manufacture's recommendations.
g. For dry-pit submersible pumps, the closed loop cooling system shall provide adequate cooling, in accordance with the pump manufacturer's recommendation, throughout the pumping range.

6. SCADA Inspections: A Town representative shall be present to verify that the pump sensors and controls perform control sequences satisfactorily including but not limited to correct start and stop elevations, proper high-level alarm functions. Town SCADA equipment manufacturer shall be in accordance with Appendix A, Approved Manufacturer List of the Town CSM. SCADA inspections will include communication testing.

END OF SECTION

PUMP TEST REPORT

PROJECT:_____ DATE:_____
LOCATION:_____
GPS COORDINATES: _____
LONGITUDE / LATITUDE: _____
WATER METER NO: _____
ELECTRIC METER NO: _____

PUMP DATA

Manufacturer:_____
Model / Impeller Size: _____
Motor HP:_____ RPM:_____
Wet Well Diameter:_____ Gals / V. Ft_____
Pump Design Point:_____ GPM @_____ Feet TDH _____

TEST DATA

Pump No: _____
Serial No: _____
Start Time: _____
Stop Time: _____
Elapsed Time (min.): _____
Water Elevation Start (HWL) (ft.): _____
Water Elevation Stop (MWL) (ft.): _____
Net Draw down (ft.) _____
(Subtract water El. Stop from water El. start)
Total Gallons: _____
Gallons / Minute: _____
(Divide total gallons by minutes)
Pressure Gauge Reading (ft.) _____
Gauge Elevation to MWL (ft.)_____
Height to Gauge (ft.) _____
Total Head @ Pump (ft.) _____
Ampmeter Reading (amps) _____
Guide Rail Operation Checked _____

Contractor Representative: _____

Town's Inspection Representative: _____

Town's Maintenance Representative: _____

Pump Manufacturer's Representative: _____

Engineering of Record Representative: _____

SECTION 18
WASTEWATER ABOVEGROUND
SELF-PRIMING LIFT STATIONS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This section does not stand alone and is incorporated as part of the Town Construction Specification Manual (CSM). The CSM shall be used for other requirements that may not be covered in this Section.

B. Work under this Section includes but is not limited to furnishing and installing a factory-built, above-ground, self-priming duplex sewage pump station as indicated on the Standard for Wastewater and Reclaimed Water – Construction Specification Manual and as specified herein for proper and complete performance. All piping and equipment of the same type shall be from one manufacturer, unless authorized in writing by the Town or the Town's Representative.

C. All piping and equipment of the same type shall be from one manufacturer, unless authorized in writing by the Town or the Town's Representative.

1.02 SUBMITTALS

A. All submittals shall be submitted in accordance with the shop drawing submittal requirements as specified in Section 1, General Provisions.

B. All structures, pumps and panels shall require a complete shop drawing submittal, as detailed in this Specification for the Town's review and approval.

C. Product Data:

1. Before fabrication, pump station manufacturer shall submit submittal data for review and approval.

2. Submittal shall include shop drawings, electrical ladder logic drawings, and support data as follows: catalog cuts sheets reflecting characteristics for major items of equipment, materials of construction, major dimensions, motor and V-belt drive data, pump characteristic curves showing the design duty point capacity (GPM), head (FT), net positive suction head required (NPSHr), and hydraulic brake horsepower (BHP).

Electrical components used in the motor branch and liquid level control shall be fully described.

D. Submittals shall include at least the following:

1. Wet Well:
   a. Base sections, riser sections, eccentric and concentric conical top sections, flat slab tops, and grade rings with notarized certificate indicating compliance with ASTM C478.
   b. Location and elevation of all penetrations.
   c. Applicable lifting and installation details or instructions.
   d. Access covers with description literature and cut sheets.
   e. Method of repair for minor damage to precast concrete sections.
   f. Delivery, unloading, and receiving instructions.
   g. Buoyancy calculations and counter measures by a Florida-licensed Professional Engineer and shall be signed, dated, and sealed.

2. All precast structures shall be designed by a Florida-licensed Professional Engineer. Calculations and design Drawings shall be signed, dated, and sealed, and submitted for review before fabrication. Design Drawings shall demonstrate that the applicable industry design standards listed in this Section have been met.

3. Precast Concrete Structures:
   a. Sectional plans and elevations showing dimensions and reinforcing steel placement.
   b. Structural calculations including assumptions.
   c. Concrete design mix.

4. The Contractor shall submit written certification from the pump supplier that the wet well size and layout are acceptable for the pump installation.

5. The Contractor shall submit integrated shop drawings for the pumping system illustrating the mechanical and electrical equipment and components specified in this Section and including the following:

   a. Product Data: For each mechanical, structural, and electrical component, include the manufacturer's descriptive literature, product specifications, published details, technical bulletins, performance, and capacity-rating curves with primary and secondary design conditions clearly noted, charts, and schedules, catalog data sheets, and other submittal materials as required to

verify that the proposed products conform to the quality and function of the specified products.

(1) Identification: Clearly indicate by an arrow on submissions covering more than one product type or style exactly which product is being submitted for approval.
(2) Equipment Characteristics: Provide bearing ratings, complete motor data, service factors, shaft diameters, coupling type, and weights of principal parts and assembled equipment.
(3) Manufacturer: Include the catalog name, company name, address, and telephone number for the manufacturer of each product submitted.
(4) Equipment Drawings: Submit completely dimensioned plan, elevations, and cross-sections of system equipment and sub-assemblies.
(5) Layout Drawings: Submit completely dimensioned drawing of pump, pump base, anchor bolt size and patterns, wet well hatch, wet well vent, installation notes, recommended grout configuration of wet well bottom, pipe support material and spacing, and other pertinent setting details.
(6) Product List: Provide a list of equipment and components on each Drawing with each product identified by legend reference. Include product name, manufacturer, and model number.
(7) Wiring Diagrams: Submit complete interconnecting wiring diagrams and schedules for electrical apparatus showing numbered wiring terminals in the pump control panel conforming to NEMA ICS-1-101. Identify field device terminals, wire number, wire sizes, control and power wire types, and interfaced elements.
(8) Control Panel Drawing: Submit a dimensioned drawing of the control panel indicating the primary electrical components and panel face with control devices, lights, indicators, and other panel-face-mounted apparatus located and identified. Provide an internal face view of the equipment arrangement with equipment identified.

6. Pump Test Report: Submit certified copies of factory-run pump performance test curves. Factory-certified performance test curves shall indicate the following:

a. Flow in gallons per minute.

b. Total head in feet of water.

c. Horsepower.

d. Pump efficiency in percent of input shaft horsepower.

e. Pump data:

(1) Model number.
(2) Serial number.
(3) Impeller diameter and type.
(4) Impeller speed.

f. Test condition data:

(1) Date of test.
(2) Mean water temperature.

E. Operations and Maintenance Manuals:

1. Operation shall be in accordance with written instructions provided by the pump station manufacturer. Comprehensive instructions supplied at time of shipment shall enable personnel to properly operate and maintain all equipment supplied. Content and instructions shall assume operating personnel are familiar with pumps, motors, piping, and valves, but lack experience on exact equipment supplied.

2. Documentation shall be specific to the pump station supplied and collated in functional sections. Each section shall combine to form a complete system manual covering all aspects of equipment supplied by the station manufacturer. Support data for any equipment supplied by others, even if mounted or included in overall station design, shall also be provided. Instructions shall include the following as a minimum:

a. Functional description of each major component, complete with operating instructions.

b. Instructions for operating pumps and pump controls in all modes of operation.

c. Calibration and adjustment of equipment for initial start-up, replacement of level control components, or as required for routine maintenance.

d. Support data for commercially available components not produced by the station manufacturer, but supplied in accordance with the specifications, shall be supported by literature from the prime manufacturer and incorporated as appendices.

e. Electrical schematic diagram of the pump station circuits shall be in accordance with NFPA 70. Schematics shall illustrate, to the extent of authorized repair, pump motor branch, control, and alarm system circuits including interconnections. Wire numbers and legend symbols shall be shown. Schematic diagrams for individual components, not normally repairable by the station operator, need not be included. Details for such parts shall not be substituted for an overall system schematic. Partial schematics, block diagrams, and simplified schematics shall not be provided in lieu of an overall system diagram.

f. Mechanical layout drawing of the pump station and components, prepared in accordance with good commercial practice, shall provide installation dimensions and location of all pumps, motors, valves, and piping.

3. Operations and maintenance instructions that rely on vendor cut-sheets and literature that include general configurations or require operating personnel to selectively read portions of the manual shall not be acceptable. Operations and maintenance instructions must be specific to equipment supplied in accordance with these Specifications.

1.03 DESIGN STANDARDS

A. Publications listed below form part of this Specification to the extent referenced in the text by basic designation only. Consult latest edition of publication unless otherwise noted.

1. American National Std. Institute (ANSI)/American Water Works Association (AWWA)

a. ANSI B16.1– Cast Iron Pipe Flanges and Flanged Fittings.
b. ANSI B16.10 – Cast Iron Pipe Flanges and Flanged Fittings.
c. AWWA C110 – Ductile-Iron and Gray-Iron Fittings.
d. AWWA C111 – Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
e. ANSI/AWWA C115/A21.51 – Cast/Ductile Iron Pipe with Threaded Flanges.
f. AWWA C150 – Thickness Design of Ductile-Iron Pipe.

g. AWWA C151– Ductile-Iron Pipe, Centrifugally Cast.
h. AWWA C153 – Ductile-Iron Compact Fittings.
i. ANSI 253.1 – Safety Color Code for Marking Physical Hazards.
j. ANSI B40.1 – Gages, Pressure and Vacuum.
k. AWWA C508 – Single Swing Check Valves.

2. American Society for Testing and Materials (ASTM)

a. ASTM A48 – Gray Iron Castings.
b. ASTM A126 – Valves, Flanges, and Pipe Fittings.
c. ASTM C150 – Standard Specification for Portland Cement.
d. ASTM A307 – Carbon Steel Bolts and Studs.
e. ASTM A312 – Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
f. ASTM A36 – Structural Steel.
g. ASTM C33 – Standard Specification for Concrete Aggregates.
h. ASTM C478 – Standard Specification for Circular Precast Reinforced Concrete Manhole Sections.
i. ASTM C923 – Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals.

3. Institute of Electrical and Electronics Engineers (IEEE)

a. IEEE Std 100 – Standard Dictionary of Electrical Terms.
b. IEEE Std 112 – Test Procedure for Polyphase Induction Motors.
c. IEEE Std 242 – Protection of Industrial and Control Power Systems.

4. National Electric Code (NEC)/National Electrical Manufacturers Association (NEMA)

a. NEC – National Electrical Code.
b. NEMA Std MG1 – Motors and Generators.

B. Miscellaneous References:

1. Ten-State Standards Recommended Standards for Sewage Works.
2. Hydraulic Institute Standards for Centrifugal, Rotary and Reciprocating Pumps.
3. ISO 9001 – International Organization for Standardization.
4. ISO 14001 – International Organization for Standardization.

C. Design Calculations: Engineer/Developer shall submit signed, dated, and sealed design calculations by and a Florida-licensed Professional Engineer with the final Construction Drawings for all wastewater lift stations. Calculations shall include high head and low head condition system curves plotted on the manufacturer's pump curve, hydraulic analysis of force main system including all friction and minor losses, operating cycles with wet well sizing, and buoyancy calculations. System curves shall verify that the pumps are operating at peak efficiency and are suitable for the design flow application. Pump and motor selection shall be designed based on the hydraulic grade line at the point of connection.

1.04 SYSTEM DESCRIPTION

A. Design requirements consist of a factory-built pump station design including materials of construction, pump features, valves and piping, and motor controls shall be in accordance with requirements listed under PART 2 - PRODUCTS of this Section.

B. The Contractor shall furnish and install the factory-built aboveground automatic pump station as shown on the Drawings. The station shall be complete with all equipment specified herein, factory assembled in a fiberglass-reinforced polyester resin enclosure.

C. In addition to the station enclosure, principal items of equipment shall include two horizontal, self-priming, centrifugal sewage pumps, V-belt drives, motors, internal piping, valves, motor control panel, automatic liquid level control system, and internal wiring.

D. Performance Criteria:

1. Pumps must be designed to handle raw, unscreened, domestic sanitary sewage and capable of passing at a minimum a 3-inch spherical solid. Pumps shall have ___-inch suction connection and ___-inch discharge connection. Each pump shall be selected to perform under following operating conditions:

Capacity (GPM)	_____
Total Dynamic Head (FT)	_____
Total Dynamic Suction Lift (FT)	_____
Maximum Repriming Lift (FT)	_____
Maximum Static Suction Lift (FT)	_____
Total Discharge Static Head (FT)	_____
Minimum Submergence Depth (FT)	_____

E. Utility Power Requirements: Site power furnished to the pump station shall be ___ phase, ___ hertz, ___ volts, ___ wire, maintained within industry standards. The available fault current provided at the pump station control panel is _____-kA rms symmetrical. Voltage tolerance shall be plus or minus 10 percent. Phase-to-phase unbalance shall not exceed 1-percent average voltage as set forth in NEMA Standard MG-1. Control voltage shall not exceed 132 volts.

1.05 QUALITY ASSURANCE

A. Manufacturer's Qualifications:

1. The pumps and pump station manufacturer must be ISO 9001:2008 revision certified, with scope of registration including design control and service after sales activities.

2. At the Engineer's request, the pump station manufacturer shall prove financial stability and ability to produce the station within the specified delivery schedules. Evidence of facilities, equipment, and expertise shall demonstrate the manufacturer's commitment to long-term customer service and product support.

3. The manufacturer shall show proof of original product design and testing.

4. The term "pump manufacturer" or "pump station manufacturer" shall be defined as the entity that designs, machines, assembles, hydraulically tests, and warranties the final product. Any entity that does not meet this definition will not be considered a "pump manufacturer" or "pump station manufacturer" and is not an acceptable supplier. For quality control reasons and future pump and parts availability, all major castings of the pump shall be sourced and machined in North America.

B. Pump Performance Certifications:

1. All internal passages, impeller vanes, and recirculation ports shall pass a 3-inch spherical solid. Smaller internal passages that create a maintenance nuisance or interfere with priming and pump performance shall not be permitted. At the Engineer's request, manufacturer's certified drawings showing size and location of the recirculation port(s) shall be submitted for approval.

2. Reprime Performance:

a. Consideration shall be given to the anticipated sanitary sewage service, in which debris is expected to lodge between the suction check valve and its seat, resulting in the loss of the pump suction leg and siphoning of liquid from the pump casing to the approximate centerline of the impeller. Such occurrence shall be considered normal, and the pump must be capable of automatic, unattended operation with an air-release line installed.

b. During unattended operation, the pump shall retain adequate liquid in the casing to ensure automatic repriming while operating at its rated speed in a completely open system. A suction check valve or external priming device shall not be required.

c. Pump must reprime at a minimum of 3 vertical feet from the pump casing invert in the wet well at the specified speed and impeller diameter. Reprime lift is defined as the static height of the pump suction above the liquid, while operating with only one-half of the liquid remaining in the pump casing. The pump must reprime and deliver full capacity within 5 minutes after the pump is energized in the reprime condition.

3. At the Town's or Engineer's request, certified reprime performance test results prepared by the manufacturer, and certified by a registered professional engineer, shall be prepared and forwarded to the Engineer and the Town.

C. Factory System Test:

1. All internal components including the pumps, motors, valves, piping, and controls shall be tested as a complete working system at the manufacturer's facility. Tests shall be conducted in accordance with Hydraulic Institute Standards at the specified head, capacity, rated speed, and horsepower.

2. Factory operational test shall simulate actual performance anticipated for the complete station.

3. At the Engineer's or Town's request, the operational test may be witnessed by the Engineer or Town and/or representatives of his choice, at the manufacturer's facility.

1.06 MANUFACTURER'S WARRANTY

A. The pump station manufacturer shall warrant all equipment to be of quality construction, free of defects in material and workmanship. A written warranty shall include specific details described below.

1. In addition to defects in material and workmanship, fiberglass-reinforced polyester station enclosures are warranted for 60 months to be free from rust, corrosion, corrosive soils, and effects of airborne contamination or physical failures occurring in normal service for the period of the pump station warranty.

2. All other equipment, apparatus, and parts furnished shall be warranted for 60 months, excepting only those items that are normally consumed in service, such as light bulbs, oils, grease, packing, gaskets, O-rings, etc. The pump station manufacturer shall be solely responsible for warranty of the station and all components.

B. Components failing to perform as specified by the Engineer, as represented by the manufacturer, or as proven defective in service during the warranty period shall be replaced, repaired, or satisfactorily modified by the manufacturer at no cost to the Owner or Town.

C. A start-up report completed by an authorized manufacturer’s representative must be provided to the Town. The warranty shall become effective on the date of substantial completion or acceptance by the Town, whichever comes last.

PART 2 PRODUCTS

2.01 UNITARY RESPONSIBILITY

A. To unify responsibility for proper operation of the complete pumping station, it is the intent of these Specifications that all mechanical and electrical system components shall be furnished by a single supplier (unitary source). The pumping station must be totally warranted by the manufacturer. Under no circumstances shall a system consisting of parts compiled and assembled by a manufacturer's representative or distributor be accepted.

2.02 MANUFACTURER

A. The pump station system integrator must be ISO 9001:2000 revision certified, with scope of registration including design control and service after sales activities.

B. The Specifications and Basis of Design depict equipment and materials manufactured by The Gorman-Rupp Company.

2.03 STATION ENCLOSURE

A. The station enclosure shall contain and protect all pumps, interior piping, valves, and associated controls. Enclosure shall incorporate the following design and service features:

1. Access panels must be supplied on all sides. Location and size shall permit access for routine maintenance functions such as pump and motor inspection, drive belt adjustment, and pump clean-out. Non-hinged panels shall be secured with stainless steel tamper-proof hardware.

2. A continuous hinge and latch shall be installed on at least two access panels. The hinged panels shall allow easy access to the electrical controls for frequent adjustments and inspections. A two-point mechanical latch assembly shall secure the panel at top and bottom. Latch handle locks shall be match keyed, requiring only one key to open all access panels.

3. A vent in one access panel shall allow free air flow for enclosure ventilation.

4. The complete station enclosure, less base, shall be completely removable after disengaging reusable hardware. After disassembly, no portion of the enclosure (except electrical service entrance) shall project above the base surface to interfere with maintenance or endanger personnel.

5. Disassembly and removal of the enclosure shall require no more than two people working without assistance of lifting equipment.

B. Station enclosure shall be manufactured of molded reinforced orthophthalic polyester resins with a minimum of 30 percent (30%) fiberglass, and a maximum of 70 percent (70%) resin. Resin fillers or extenders shall not be used.

1. Chopped glass fibers of 1-1/4-inch average length shall be sprayed and rolled. Major design consideration shall be given to structural stability, corrosion resistance, and watertight integrity. The polyester laminates shall provide a balance of mechanical, chemical, and electrical properties to ensure long life. They must be impervious to microorganisms, mildew, mold, fungus, corrosive liquids, and gases that are expected to be present in the environment surrounding the wet well.

2. All interior surfaces of the housing shall be coated with a polyester-resin-rich finish providing maintenance-free service, abrasion resistance, and protection from sewage, greases, oils, gasoline, and other common chemicals.

3. Outside surfaces of the enclosure shall be coated with gel-coat pigmented resin to ensure long maintenance-free life and UV protection. Color used shall be green.

C. Station base shall be constructed of pre-cast, reinforced concrete encapsulated in a fiberglass mold. The design shall resist deformation of the structure during shipping, lifting, or handling. The base shall incorporate drainage provisions and an opening sized to permit installation of piping and service connections to the wet well. After installation, the opening shall serve as a grout dam to be used by the Contractor.

D. The base shall incorporate anchor bolt recesses for securing the complete station to a concrete pad in accordance with the Town's Standard Details.

E. A blower mounted in the station roof shall be sized to exchange station air volume at least once every 2 minutes. Blower motor shall energize automatically at approximately 70 degrees F and turn off at 55 degrees F. The blower motor control circuit shall incorporate a thermal-magnetic circuit breaker providing overcurrent and overload protection. Exhaust and inlet locations shall prevent the entrance of rain or debris.

F. Tall Enclosure with Split Doors: The station shall be equipped with a 91-inch-tall fiberglass enclosure. The control panel side and suction side of the fiberglass enclosure shall have split doors with the upper section of the doors raised vertically and the lower section of the doors opening horizontally outward. The upward portion of the split doors shall have additional equipment installed to prevent premature closing of the door. The pump station shall be furnished with 1-inch-thick spray foam insulation, which shall be applied to the roof, doors, and corner panels.

G. The station enclosure shall be designed and installed to be capable of withstanding a minimum wind load of 120 mph.

2.04 PUMP DESIGN

A. Pumps shall be horizontal, self-priming centrifugal type, designed specifically for handling raw, unscreened, domestic sanitary sewage. Pump solids handling capability and performance criteria shall be in accordance with requirements listed under PART 1 - GENERAL of this Section.

B. The pump manufacturer must be ISO 9001:2000 revision certified, with scope of registration including design control and service after sales activities.

C. Materials and Construction Features:

1. Pump casing: Casing shall be cast iron Class 30 with integral volute scroll. Casing shall incorporate following features:

    a. Mounting feet sized to prevent tipping or binding when pump is completely disassembled for maintenance.
    b. Fill port coverplate, 3-1/2-inch diameter, shall be opened after loosening a hand nut/clamp bar assembly. In consideration for safety, hand nut threads shall provide slow release of pressure, and the clamp bar shall be retained by detente lugs. A Teflon gasket shall prevent adhesion of the fill port cover to the casing.
    c. Casing drain plug shall be at least 1-1/4-inch NPT to ensure complete and rapid draining.
    d. Liquid volume and recirculation port design shall be consistent with performance criteria listed under PART 1 - GENERAL of this Section.

2. Coverplate: Coverplate shall be cast iron Class 30. Design shall incorporate following maintenance features:

    a. Retained by hand nuts for complete access to pump interior. Coverplate removal shall provide ample clearance for removal of stoppages, and allow service to the impeller, seal, wearplate or check valve without removing suction or discharge piping.
    b. A replaceable wearplate secured to the coverplate by weld studs and nuts shall be AISI 1015 HRS.
    c. In consideration for safety, a pressure relief valve shall be supplied in the coverplate. Relief valve shall open at 75-200-PSI.
    d. Two O-rings of Buna-N material shall seal the coverplate to pump casing.
    e. Pusher bolt capability shall assist in the removal of the coverplate. Pusher bolt threaded holes shall be sized to accept same retaining capscrews as used in rotating assembly.
    f. Easy-grip handle shall be mounted to the face of the coverplate.

3. Rotating Assembly: A rotating assembly, which includes impeller, shaft, mechanical shaft seal, lip seals, bearings, sealplate, and bearing housing, shall be removable as a single unit without disturbing the pump casing or piping. The design shall incorporate following features:

   a. Sealplate and bearing housing shall be cast iron Class 30. Separate oil-filled cavities, vented to the atmosphere, shall be provided for shaft seal and bearings. Cavities must be cooled by the liquid pumped. Three lip seals will prevent oil leakage.

      (1) The bearing cavity shall have an oil level sight gauge and fill plug check valve. The clear sight gauge shall provide easy monitoring of the bearing cavity oil level and condition of oil without removal of the fill plug check valve. The check valve shall vent the cavity but prevent introduction of moist air to the bearings.
      (2) The seal cavity shall have an oil level sight gauge and fill/vent plug. The clear sight gauge shall provide easy monitoring of the seal cavity oil level and condition of oil without removal of the fill/vent plug.
      (3) A double-lip seal shall provide an atmospheric path providing positive protection of bearings, with capability for external drainage monitoring.

   b. Impeller shall be ductile iron, two-vane, semi-open, non-clog, with integral pump out vanes on the back shroud. Impeller shall thread onto the pump shaft and be secured with a lockscrew and conical washer.

   c. Shaft shall be AISI 17-4 pH stainless steel.

   d. Bearings shall be anti-friction ball type of proper size and design to withstand all radial and thrust loads expected during normal operation. Bearings shall be oil lubricated from a dedicated reservoir. Pump designs that use the same oil to lubricate the bearings and shaft seal shall not be acceptable.

   e. Shaft seal shall be oil-lubricated mechanical type. The stationary and rotating seal faces shall be tungsten titanium carbide alloy. Each mating surface shall be lapped to within three light bands flatness (35 millionths of an inch), as measured by an optical flat under monochromatic light. The stationary seal seat shall be double floating by virtue of a dual O-ring design: an external O-ring secures the stationary seat to the sealplate and an internal

O-ring holds the faces in alignment during periods of mechanical or hydraulic shock (loads that cause shaft deflection, vibration, and axial/radial movement). Elastomers shall be Viton. Cage and spring shall be stainless steel. Seal shall be oil lubricated from a dedicated reservoir. The same oil shall not lubricate both shaft seal and shaft bearings. Seal shall be warranted in accordance with requirements listed under PART 1 - GENERAL of this Section.

f. Pusher bolt capability to assist in removal of rotating assembly. Pusher bolt threaded holes shall be sized to accept same capscrews as used for retaining rotating assembly.

4. Adjustment of the impeller face clearance (distance between impeller and wearplate) shall be accomplished by external means.

a. Clearances shall be maintained by a four-point external shimless coverplate adjustment system, using a four-collar and four-adjusting screw design allowing for incremental adjustment of clearances by hand as required. Each of the four points shall be lockable to prevent inadvertent clearance increases or decreases due to equipment vibration or accidental operator contact. The four-point system also allows for equal clearance gaps at all points between the impeller and wear plate. Realignment of belts, couplings, etc., shall not be acceptable. The coverplate shall be capable of being removed without disturbing clearance settings. Clearance adjustment systems that use less than four points shall not be considered.

b. There shall be provisions for additional clearance adjustment in the event that adjustment tolerances have been depleted from the coverplate side of the pump. The removal of stainless steel shims from the rotating assembly side of the pump shall allow for further adjustment as described above.

c. Clearance adjustment that requires movement of the shaft only, thereby adversely affecting seal working length or impeller back clearance, shall not be acceptable.

5. Suction check valve shall be molded neoprene with integral steel and nylon reinforcement. A blow-out center shall protect pump casing from hydraulic shock or excessive pressure. Removal or installation of the check valve shall be accomplished through the coverplate opening, without disturbing the suction piping. Sole function of check valve shall be to save energy by eliminating need to reprime after each pumping

cycle. Pumps requiring a suction check valve to assist reprime shall not be acceptable.

6. Spool flanges shall be one-piece cast iron Class 30 fitted to suction and/or discharge ports. Each spool shall have one 1-1/4-inch NPT and one 1/4-inch NPT tapped hole with pipe plugs for mounting gauges or other equipment.

D. Serviceability:

1. The pump manufacturer shall demonstrate to the Engineer's satisfaction that consideration has been given to reducing maintenance costs.

2. No special tools shall be required for replacement of any components within the pump.

E. Drain Kit:

1. Pumps to be supplied with a drain kit for ease of maintenance. The kit shall contain a 10-foot length of reinforced plastic hose with a female quick-connect fitting at one end and factory-installed drain fittings in each pump. Fittings include a stainless steel pipe nipple, stainless steel bushing, stainless steel ball valve, and aluminum male quick-connect fitting.

F. Spare Parts Kit:

1. The following minimum spare parts shall be furnished with the pump station:

a. One pump mechanical seal.
b. One cover plate O-Ring(s).
c. One rotating assembly O-Ring(s).
d. One set of impeller clearance adjustment spacers.
e. Four pilot light bulbs.

2.05 VALVES AND PIPING

A. Check Valve: Each pump shall be equipped with a full-flow type check valve capable of passing a 3-inch spherical solid. Valve shall be constructed with flanged ends and fitted with an external lever and torsional spring. Valve seat shall be constructed of stainless steel, secured to the body to ensure concentricity, sealed by an O-ring, and shall be replaceable. The valve body shall be cast iron incorporating a clean-out port large enough to allow removal and/or replacement of the valve clapper without removing valve or piping from the line. Valve

clapper shall have a molded neoprene seating surface incorporating low-pressure sealing rings. Valve hinge pin and internal hinge arm shall be stainless steel supported on each end in brass bushings. Shaft nut shall have double O-rings that shall be shall be easily replaceable without requiring access to interior of valve body. All internal hardware shall be stainless steel. Valve shall be rated at 175-PSI water working pressure and 350-PSI hydrostatic test pressure. Valves other than full-flow type or valves mounted in such a manner that prevents the passage of a 3-inch spherical solid shall not be acceptable.

B. Plug Valve: A three-way plug valve must allow either or both pumps to be isolated from the force main. The plug valve shall be non-lubricated, tapered type. Valve body shall be cast iron with flanged end connections drilled to 125-pound ANSI standard. The drip-tight shutoff plug shall be mounted in stainless steel bearings and shall have a resilient facing bonded to the sealing surface. Valve shall be operated with a single lever actuator providing lift, turn, and reseat action. The lever shall have a locking device to hold the plug in the desired position.

C. Automatic Air-Release Valves:

1. An automatic air-release valve shall be furnished for each pump designed to permit the escape of air to the atmosphere during initial priming or unattended repriming cycles. Upon completion of the priming cycle or repriming cycle, the valve shall close to prevent recirculation. Valves shall provide visual indication of valve closure and shall operate solely on discharge pressure. Valves that require connection to the suction line shall not be acceptable.

2. All valve parts exposed to sewage shall be constructed of cast iron, stainless steel, or similar corrosion resistant materials. Diaphragms, if used, shall be of fabric-reinforced neoprene or similar inert material.

3. A 3-inch-diameter cleanout port shall be provided for ease of inspection, cleanout, and service.

4. Valves shall be field adjustable for varying discharge heads.

5. Connection of the air-release valves to the station piping shall include stainless steel fittings, piping, and isolation valves.

D. Gauge Kit:

1. A gauge kit shall be supplied for each pump. Suction pressure must be monitored by a glycerin-filled compound gauge and discharge pressure by a glycerin-filled pressure gauge. Gauges shall be at least 4 inches in

diameter, graduated in feet water column. Rated accuracy shall be 1% of full scale reading. Compound gauge shall be graduated -34-foot to +34foot water column minimum. Pressure gauge shall be graduated 0- to 140-foot water column minimum.

2. Gauges to be factory mounted on a resilient panel with frame assembly secured to pumps or piping. Gauge installations shall be complete with all hoses and stainless steel fittings, including a shutoff valve for each gauge line at the point of connection to suction and discharge pipes.

E. Pump Bypass:

1. The bypass shall be installed as a 4-inch Schedule 316 stainless steel (Schedule 10) ASTM A312 with flanged end connections drilled to 125-lb ANSI standard in the wet well at the same level as the pump suction piping. This pipe shall penetrate the top slab of the wet well and end with a Camlock quick-connect male coupling with dust cap as shown on the Town's pump station Standard Details.

2. Where it is possible, the pump bypass pipe shall be one continuous piece. Only one welded pipe-to-pipe joint shall be allowed in the suction pipe. Pipes welded together must be welded straight and hung plumb. All weld splatter shall be removed from the exterior of the pipe. The joint shall be pressure tested to verify it is leak free.

F. Suction and Discharge Piping and Fittings:

1. Piping to be field installed and within the wet well shall be Schedule 316 stainless steel (Schedule 10) ASTM A312 with flanged end connections drilled to 125-lb ANSI standard.

2. Where it is possible, the suction pipe shall be one continuous piece with no joints between the open end of the pipe in the wet well to the flange joint that connects to the pump end. Only one welded pipe-to-pipe joint will be allowed in the suction pipe. Pipes welded together must be welded straight and hung plumb. All weld splatter shall be removed from the exterior of the pipe. The joint shall be pressure tested to verify it is leak free.

3. The discharge pipe shall be one continuous piece with no joints or welded seams between the pumps and connection to the 90-degree bend in the wet well.

4. The stainless steel discharge pipe shall extended 5 feet beyond the wet well wall where it will transition to the force main material (see Drawings).

G. Station Aboveground Fittings and Piping:

1. All piping above ground shall be Protecto 401 lined ductile iron. All ductile iron piping shall be designed and manufactured in accordance with AWWA C150 and AWWA C151. Pipe for threaded flange fabrication shall be Special Thickness Class 53 in accordance with AWWA C110, AWWA C111, and AWWA C115. Bolt circle and bolt holes shall match those of ANSI B16.1 Class 125 flanges. The flanges shall be rated for a maximum working pressure of 250 PSI. Threaded flanges shall be individually fitted and machine tightened on the pipe ends. Flange facing shall be smooth or with shallow serrations in accordance with AWWA C115.

2. All fittings above ground shall be Protecto 401 lined ductile iron. Ductile iron pipe fittings shall be the compact type meeting the requirements of ANSI/AWWA C110 and C153 where applicable. Where taps are shown on fittings, tapping bosses shall be provided. At a minimum, fittings shall have the same pressure rating as the connecting pipe. Flanged joints shall conform to ANSI/AWWA C110/21.10 and ANSI B16.1, faced and drilled 125-pound ANSI standard.

   a. A tee shall be used to transition from the vertical suction pipe to the inlet of the pump. A blind flange shall be installed on the run end of the tee.

   b. The lining shall be an amine-cured novalac epoxy containing at least 20 percent by volume of ceramic quartz pigment. The lining material shall be Protecto 401 Ceramic Epoxy as manufactured by Induron Protective Coatings, Inc. The lining shall be applied by a competent pipe lining specialty firm with a successful history of applying linings to the interior of ductile iron pipe and fittings.

2.06 DRIVE UNIT

A. Motors (Note: Maximum motor frame size is 326T open drip-proof.):

1. Pump motors shall be ___ HP, horizontal ODP, 1,800 RPM, NEMA design B with cast iron frame with copper windings, induction type, with class F insulation and 1.15 Service Factor for normal starting torque and low starting current characteristics, suitable for continuous service. The motors shall not overload at the design condition or at any head in the operating range as specified. Motors shall be suitable for operation using the utility power available specified in PART 1 - GENERAL of this Section.

2. Motors shall be tested in accordance with provisions of ANSI/IEEE Std. 112, Method B.

B. Drive Transmission:

1. Power to pumps shall be transmitted by V-belt drive assemblies. The sheave/belt combination shall provide the speed ratio needed to achieve the specified pump operating conditions.

C. Each drive assembly shall use at least two V-belts providing minimum a combined safety factor of 1.5. Single belt drives or systems with a safety factor of less than 1.5 are not acceptable. Computation of safety factors shall be based on performance data published by the drive manufacturer.

1. Precise alignment tolerances of the drive assemblies shall be achieved by means of a belt/sheave laser alignment system resulting in the reduction of vibration, accelerated wear, and premature failure.

2. The pump manufacturer shall submit power transmission calculations which document the following:

a. Ratio of pump/motor speed.
b. Pitch diameter of driver and driven sheaves.
c. Number of belts required per drive.
d. Theoretical horsepower transmitted per belt, based on vendor's data.
e. Center distance between pump and motor shafts.
f. Arc-length correction factor applied to theoretical horsepower transmitted.
g. Service factor applied to established design horsepower.

h. Safety factor ratio of power transmitted/brake horsepower required.

3. Pump drives to be enclosed on all sides by a guard constructed of fabricated steel or combination of materials including expanded, perforated, or solid sheet metal. No opening to a rotating member shall exceed 1/2 inch.

a. Guards must be completely removable without interference from any unit component, and shall be securely fastened and braced to the unit base with stainless steel fasteners.

b. Metal to be free from burrs and sharp edges. Structural joints shall be continuously welded. Rivet spacing on panels shall not exceed 5 inches. Tack welds shall not exceed 4-inch spacing.

c. The guard shall be finished with one coat of gray W.R. non-lift primer and one coat of orange acrylic alkyd W.R. enamel in accordance with section 3, Color Definitions of ANSI 253.1; Safety Color Code for Marking Physical Hazards.

2.07 FINISH

A. Pumps, piping, and exposed steel framework shall be cleaned before painting. Exposed surfaces shall be coated with one coat of gray W.R. non-lift primer and one coat of white acrylic alkyd W.R. enamel. Paint shall be low-VOC, alkyd-based, high-solids, semi-gloss white enamel for optimum illumination enhancement, incorporating rust inhibitive additives. The total coating thickness including primer, intermediate, and finish coats shall be 6.0 to 10.0 mils dry film thickness (minimum), resistant to oil mist exposure, solvent contact, and salt spray. The factory finish shall allow for over-coating and touch up after final installation.

2.08 ELECTRICAL CONTROL COMPONENTS

A. The pump station control panel will be tested as an integral unit by the pump station manufacturer. The control panel shall also be tested with the pump station as a complete working system at the pump station manufacturer's facility.

B. Panel Enclosure:

1. Electrical control equipment shall be mounted within a common NEMA 1 stainless steel, dead front type control enclosure. Doors shall be hinged and sealed with a neoprene gasket and equipped with captive closing

hardware. Control components shall be mounted on removable steel back panels secured to enclosure with collar studs.

2. All control devices and instruments shall be secured to the sub-plate with machine screws and lockwashers. Mounting holes shall be drilled and tapped; self-tapping screws shall not be used to mount any component. All control devices shall be clearly labeled to indicate function.

3. Control panel shall be provided with a dome light on the interior of the panel. The door shall be supplied with a switch to automatically turn on the light upon opening.

C. Branch Components:

1. All motor branch and power circuit components shall be of highest industrial quality. The short-circuit current rating of all power circuit devices shall be a tested combination or evaluated per the National Electrical Code Article 409. The lowest-rated power circuit component shall be the overall control panel short circuit rating and shall not be less than the fault current available. The minimum control panel rating shall not be less than 10 kA, RMS symmetrical. Control assemblies operating at 120 volts nominal or less may be provided with transformers that limit the fault current and may be rated less than the minimum required short circuit rating.

2. Circuit Breakers and Operating Mechanisms:

   a. A properly sized heavy-duty circuit breaker shall be furnished for each pump motor. The circuit breakers must be sealed by the manufacturer after calibration to prevent tampering.

   b. An operating mechanism installed on each motor circuit breaker shall penetrate the control panel door. A lockable operator handle shall be secured on the exterior surface. Interlocks must prevent opening the door until circuit breakers are in the "OFF" position. An additional mechanism(s) shall be provided on the circuit breaker permitting the breaker to be operated and/or locked with the control panel door in the open position.

3. Motor Starters: An open frame, across-the-line, NEMA-rated magnetic starter with under-voltage release, and overload protection on all three phases, shall be furnished for each pump motor. Starters of NEMA 1 and above shall allow addition of at least two auxiliary contacts. Starters rated "O," "OO," or fractional sizes are not acceptable. Power contacts to be

double-break type made of cadmium oxide silver. Coils to be epoxy molded for protection from moisture and corrosive atmospheres. Contacts and coils shall be easily replaceable without removing the starter from its mounted position. Each starter shall have a metal mounting plate for durability.

4. Overload Relays:

   a. Overload relays shall be solid-state block type, having visual trip indication with trip-free operation. Electrically resetting the overload will cause one normally open and one normally closed isolated alarm/control contact to reset, thus re-establishing a control circuit. Trip setting shall be governed by solid-state circuitry and adjustable current setting. Trip classes shall be 10, 15, and 20. Additional features to include phase loss protection, selectable jam/stall protection, and selectable ground fault protection.

   b. A reset pushbutton, mounted through the control panel door, shall permit resetting the overload relays without opening the door.

5. Phase Monitor: The control panel shall be equipped to monitor the incoming power and shut down the pump motors when required to protect the motor(s) from damage caused by phase reversal, phase loss, voltage unbalance, high voltage, and low voltage. An adjustable time delay shall be provided to minimize nuisance trips. The motor(s) shall automatically restart, following an adjustable time delay, when power conditions return to normal.

6. Wiring:

   a. The pump station, as furnished by the manufacturer, shall be completely wired, except for power feed lines to the branch circuit breakers and final connections to remote alarm devices.

   b. All wiring, workmanship, and schematic wiring diagrams shall comply with applicable standards and specifications of the National Electric Code (NEC).

   c. All user serviceable wiring shall be type MTW or THW, 600 volts, color coded as follows:

      (1) Line and Load Circuits, AC or DC power: Black.
      (2) AC Control Circuit Less Than Line Voltage: Red.

(3) DC Control Circuit: Blue.
(4) Interlock Control Circuit, from External Source: Yellow.
(5) Equipment Grounding Conductor: Green.
(6) Current Carrying Ground: White.
(7) Hot With Circuit Breaker Open: Orange.

d. Control circuit wiring inside the panel, with exception of internal wiring of individual components, shall be 16-gauge minimum, type MTW or THW, 600 volts. Power wiring to be 14-gauge minimum. Motor branch wiring shall be 10-gauge minimum.

e. Motor branch and other power conductors shall not be loaded above the temperature rating of the connected termination. Wires must be clearly numbered at each end in conformance with applicable standards. All wire connectors in the control panel shall be ring tongue type with nylon insulated shanks. All wires on the sub-plate shall be bundled and tied. All wires extending from components mounted on door shall terminate at a terminal block mounted on the back panel. All wiring outside the panel shall be routed through conduit.

f. Control wires connected to door-mounted components shall be tied and bundled in accordance with good commercial practice. Bundles shall be made flexible at the hinged side of the enclosure. Adequate length and flex shall allow the door to swing full open without undue stress or abrasion. Bundles shall be held on each side of hinge by mechanical fastening devices.

7. Conduit: Factory-installed conduit shall conform to following requirements:

a. All conduit and fittings to be UL listed.
b. Liquid-tight flexible metal conduit to be constructed of smooth, flexible galvanized steel core with smooth abrasion resistant, liquid tight polyvinyl chloride cover.
c. Conduit to be supported in accordance with Articles 346, 347, and 350 of the NEC.
d. Conduit shall be sized according to the NEC.

8. Grounding:

a. Station manufacturer shall ground all electrical equipment inside the pump station to the control panel back plate. All paint shall be

removed from the grounding mounting surface before making final connection.

b. The Contractor shall provide an earth-driven ground connection to the pump station at the main grounding lug in accordance with the NEC.

9. Equipment Marking:

a. Permanent corrosion-resistant name plate(s) shall be attached to the control and include the following information:

(1) Equipment serial number.
(2) Control panel short circuit rating.
(3) Supply voltage, phase, and frequency.
(4) Current rating of the minimum main conductor.
(5) Electrical wiring diagram number.
(6) Motor horsepower and full load current.
(7) Motor overload heater element.
(8) Motor circuit breaker trip current rating.
(9) Name and location of equipment manufacturer.

b. Control components shall be permanently marked using the same identification keys shown on the electrical diagram. Labels shall be mounted adjacent to device being identified.

c. Switches, indicators, and instruments mounted through the control panel door shall be labeled to indicate function, position, etc. Labels shall be mounted adjacent to, or above the device.

2.09 LIQUID LEVEL CONTROL (PRIMARY)

A. The level control system shall start and stop the pump motors in response to changes in wet well level, as set forth herein.

B. The level control system shall consist of the Multi-Smart Pump Station Manager controller, as manufactured by Xylem, and the FailSafe probe. No other control system is acceptable.

C. The level control system shall use alternation to first select one pump, then the second pump, to run as lead pump for a pumping cycle. Alternation shall occur at the end of a pumping cycle.

D. The level control system shall use a level-indicating transducer (submersible pressure sensing type) in accordance with Section 19, Wastewater Pump Controller/Remote Terminal Unit (RTU). This transducer shall continuously monitor the wet well level, permitting the operator to read wet well level at any time. Upon operator selection of automatic operation, the electronic pressure switch shall start the motor for one pump when the liquid level in the wet well rises to the "lead pump start level." When the liquid is lowered to the "lead pump stop level," the electronic pressure switch shall stop this pump. These actions shall constitute one pumping cycle. If the wet well level continues to rise, the electronic pressure switch shall start the motor of the second pump when the liquid reaches the "lag pump start level" or “standby pump start level” so that all pumps are operating.

E. The pump controller shall provide user ready automatic control of pumps with an intuitive HMI interface. The pump controller shall contain pre-designed operational parameters that are selected and configured via the user interface (HMI). The minimum features available in the pump controller shall include:

1. Pump control of up to six pumps, including pump grouping and pump alternation.

2. Intelligent Hand-Off-Auto Control:

    a. Hand mode (semi-automatic, non-maintained manual mode), the pump switches off at the deactivation set point and then resets to Auto mode for the next pump run cycle.
    b. Hand mode (fully manual, maintained mode). To pump beyond the off (deactivation) set point, the Hand-Off-Auto button must be held down by the user for failsafe control.

3. Level set point adjustment for pump activation, deactivation, and station level alarms.

4. Level device input capability shall include 4-20mA analog signal, conductive probe, or floats.

5. Redundant level device input capability with automatic input fault control (input device switching).

6. Selectable charge (fill) or discharge (empty) modes.

7. Pre-configured station optimization features:

    a. Maximum pump off time.
    b. Maximum pumps to run.
    c. Maximum starts per hour.
    d. Inter-pump start and stop time delays.
    e. Maximum pump run time.
    f. Blocked pump detection.
    g. Well washer control capability.
    h. Well clean out control capability.
    i. Pump operation control (profile programming) capability.

8. "Locked level" alarm function to indicate a level device fault.

9. Pump alternation modes:

    a. Fixed lead pump assignment.
    b. Normal alternation.
    c. User defined alternation using N:1 ratio.
    d. Run most efficient pump using N:1 ratio.
    e. Alternation by the number of hours run or the number of starts within a specified period.

10. Up to six unique user-defined profiles of set points shall be available to control pumps during specific site conditions or events. Features shall include:

    a. Automatic profile change based on date and time.
    b. Profile selection option from SCADA (remote control), digital input, logic tag or local display HMI.

11. Datalogger for user-defined faults and events:

    a. 50,000 events to internal flash memory.
    b. 10,000,000 events by writing directly to an SD card or USB.

12. Three-phase supply voltage monitoring and supply fault management for the following conditions:

    a. Under-voltage.
    b. Over-voltage.
    c. Phase fail.
    d. Phase rotation.

13. Monitoring of DC power supply, battery voltage, and internal controller temperature.

14. Energy, power and pump efficiency monitoring:

    a. kW, kVA, power factor, kWHr, KVAH calculation for each pump.
    b. Pump efficiency calculation (liters or gallons per KWHr) for each pump.

15. Motor protection features:

    a. Three-phase current monitoring for each pump.
    b. Over- and under-current trip.
    c. Ground/earth fault.
    d. Current phase imbalance fault.
    e. Insulation resistance testing for motor windings.

16. Flow measurement: Calculated flow via liquid level draw down data.

17. VFD speed-control capability.

18. Fault module capability as follows:

    a. Pump hold-out function.
    b. Automatic restart function after fault condition is no longer present.
    c. Manual reset of fault required (if user intervention of fault reset is selected).

19. Remote control via remote telemetry monitoring to include the following:

    a. Changing the mode of pumps (hand/off/auto).
    b. Reset of pump faults and station faults.
    c. Changing pump and alarm setpoints.
    d. Changing operational profiles.

20. Security:

    a. User-defined password management for access to programming areas in the controller.
    b. Automatic data logging of personnel who have entered the programming areas.
    c. Automatic logging of all unsuccessful login attempts with a date and time stamp.

d. Digital input option for controlled access to programming areas.

21. SD/USB ports shall be available for the following operations:

a. Firmware upgrades.
b. Save and load pump controller configuration.
c. Download data logs.
d. Export or import Modbus and DNP3 points list.

F. The pump controller shall include a graphical user interface (HMI) display for configuration settings, control operations, and advanced programming. The following display characteristics shall be provided:

1. Status Indication: The following parameters shall be displayed on the main screen:

a. Liquid level in percentage, meters, feet or other custom-defined units.
b. Set points for pump control and alarms.
c. Pump status (running or stopped).
d. Pump availability.
e. Pump fault indication.
f. Three-phase voltage supply values.
g. Date and time indication.
h. User-configurable options to display pump information and station status.

2. Information Screens: The following parameters shall be available via a user key press from the main screen.

a. Hours-run accumulators for each pump and the pump station with the following information:

(1) Minutes run for last pump cycle.
(2) Total minutes (hourly).
(3) Total hours today and total hours yesterday.
(4) Total hours this week and total hours last week.
(5) Total accumulated hours.

b. Pump-Start accumulators for each pump and the station with the following comparisons:

(1) Pump starts this hour and pump starts last hour.
(2) Pump starts today and pump starts yesterday.

(3) Pump starts this week and pump starts last week.
(4) Total accumulated pump starts.

c. Flow Values:

(1) Station inflow rate.
(2) Pump flow rate.
(3) Total station volume.
(4) Overflow data (including overflow start time, duration, estimated volume).

d. Power and Efficiency:

(1) Pump efficiency in gallons or liters per KWHr - or KVAh.
(2) Power in kW, KVA.
(3) Power factor.
(4) Energy accumulators per pump in KWHr and KVAH.

e. Insulation resistance value for each pump motor in (Ohms)

f. I/O Status:

(1) Digital I/O status and accumulated values.
(2) Analog I/O status and values in (mA) or scaled values.
(3) Three-phase voltage, current, frequency, phase angle, power factor.

g. Database viewer to review all statistics, data information, and available tags in real time.

h. Communications information and statistics.

3. Control Functions: The pump controller display interface shall be capable of performing the following control operations:

a. Pump control mode for each pump (Hand-Off-Auto).
b. Pump fault reset.
c. Level alarm reset.

4. Fault Screens:

a. The main screen shall include a Fault button that takes the user to a Fault screen and allows them to check all current and unacknowledged alarms.

b. The fault screen shall provide fault details along with a date and time stamp for each fault occurrence.
c. A fault reset option shall be presented to the user when alarms can be acknowledged or reset.

5. History Screen: The main screen shall include a History button that takes the user to a History screen that allows them to view the following information:

a. Viewing of all faults and events.
b. Information filtering capability.

6. Configuration screens: The user configuration screens shall provide capability to change pump control settings as follows:

a. Setup Wizard function to configure the pump controller settings by user input to specific questions.

b. Set point programming of alarms and pump activation/ deactivation.

c. Enable or disable alarms.

d. Set alternation mode for pumps.

e. Configure I/O as follows:

(1) Assign primary/backup level to any input, e.g., 4-20mA or conductive probe.
(2) Assign pre-defined or user-defined faults to any digital input.
(3) Zero and span analog inputs.
(4) Configure digital output source.
(5) Configure analog output source.

f. Configure faults as follows:

(1) Display the fault to the local screen only.
(2) Manual reset (local) or remote reset operation before pump becomes available.
(3) Auto-restart (after fault condition clears) with configurable restart time.

(4) Auto-restart user-selectable number of times within time window before locking out.
(5) Customized text for fault and event name.

g. Configure station optimization parameters.

h. Configure supply protection:

(1) Under- and over-voltage alarm points.
(2) Volts phase imbalance and volts phase rotation set points.
(3) DC supply alarm set point.

i. Configure motor protection:

(1) Under current set points.
(2) Over current set points.
(3) Ground/earth fault set points.
(4) Phase failure set points.

G. An alarm silence pushbutton and relay shall be provided to permit maintenance personnel to de-energize the audible alarm device while corrective actions are under way. After silencing the alarm device, manual reset of the alarm condition shall clear the alarm silence relay automatically. The pushbutton shall be oil-tight design with contacts rated NEMA A300 minimum.

2.10 LIQUID LEVEL CONTROL (FLOAT SWITCH TYPE - BACKUP)

A. Float switches shall be installed separately as backup with one switch for the high-level alarm all pumps on and one switch for the low level all pumps off.

B. Float switches shall be Roto-Float Type S manufactured by Anchor Scientific. Each float shall have sufficient cord length to reach the junction box with no splices. A stainless steel cable holder with a minimum of six hooks attached to the wet well shall suspend the floats in the wet well.

C. An explosion-proof junction box shall be installed as shown on the Drawings. Junction box shall be NEMA 7, non-corrosive type incorporating terminal blocks match-marked to terminals in the control panel. All cables leaving the wet well shall land in the junction box through conduit prior to being connected in the control panel. Seal-offs shall be provided on the conduits leaving the junction box.

2.11 ALARM

A. Alarm Light (External): Station manufacturer will supply one 115-VAC alarm light fixture with vapor-tight shatter-resistant red globe, conduit box, and mounting base. The design must prevent rainwater from collecting in the gasketed area of the fixture, between the base and globe. The alarm light will be mounted at the factory on top of the enclosure.

B. Alarm Horn (External): Station manufacturer will supply one 115-VAC weatherproof alarm horn with projector, conduit box, and mounting base. The design must prevent rainwater from collecting in any part of the horn. The alarm horn will be mounted at the factory on top of the enclosure.

2.12 PRODUCTS INSIDE THE CONTROL PANEL

A. All products inside the control panel, i.e., motor starters, breakers, relays, contactors, etc., shall by manufacturer listed in Appendix A, Approved Manufacturer List of the Town CSM.

2.13 PILOT LIGHTS

A. All pilot/alarm lights shall be push-to-test type.

1. Running lights shall be green.
2. Alarm lights shall be red.

2.14 NAMEPLATES

A. Nameplates shall be a laser screened Mylar laminated two-part system using black letters on a yellow background. Nameplates shall be adhered to the dead front panel and control panel to indicate relay, breakers, fuses, etc. according to the naming convention used on the as-builts and O&M manual.

2.15 GENERATOR RECEPTACLE

A. Receptacle for small motor Hp stations shall be Pyle National JRL10036 with reverse contacts.

B. Receptacle for large motor HP stations shall be Russell Stoll JRSB2044FR with reverse contacts.

C. Receptacle shall be mounted on the side of the control panel inside the enclosure and shall have a spring-mounted cap with gasket. The receptacle breaker and main breaker shall be mechanically interlocked.

2.16 WET WELL

A. Precast wet well sections shall consist of one monolithically cast base section and a 12-inch-long (at a minimum) base slab extension for counter flotation. The wet well floor shall have stainless steel anchor bolts for mounting of pump bases. Wet well bases, sections and miscellaneous structures shall conform to the requirements of ASTM C478 (specification for precast concrete manhole sections and structures) except as modified herein. Cement shall meet the requirements of ASTM C150 (specification for Portland cement, Type II).

B. Minimum wet well size shall be 8-foot diameter. A 12-foot-diameter wet well (minimum) shall be used in cases where the pump discharge piping (in the wet well) is 10-inch diameter or larger.

C. Wall thickness shall be as specified on the Contract Drawings and in accordance the Town's Construction Specification Manual. If no wall thickness is specified, then the minimum wall thickness shall be 1/12 the inside diameter in inches plus 1 inch. Rings shall be custom-made with openings to meet indicated pipe alignment conditions and invert elevations. Both top slab and bottom slab shall be 12 inches thick (at a minimum).

D. For concrete base and risers, the reinforcing steel shall be designed, signed, and sealed by a Florida-registered Structural Engineer and shall be submitted with the shop drawings. All openings in wet well sections shall be cast-in with the exception of the influent pipe opening which shall be cored in the wall.

E. Joint contact surfaces shall be formed with machined castings and shall be exactly parallel and specifically designed by a professional engineer. Wet well diameter and height shall be as shown on the Contract Drawings and in accordance with the Town's Standard Details.

F. The wet well shall be HDPE lined with an Agru Sure Grip Liner, Green Monster Liner or approved equal, with a minimum thickness of 2 mm, mechanically anchored to the concrete and with all joints extrusion welded by certified welders. The Contractor shall submit shop drawings consisting of manufacturer's standard details of various sections, for approval, before placing an order for structures.

G. Joints shall be sealed with 'RAM-NEK' joint sealer over the entire joint surface, with joints pre-primed. Joints shall be watertight. Upon completion of installation, excess joint sealer shall be trimmed flush with inside and outside surface of structure. All exterior joints of precast concrete wet wells shall be sealed with one 12-inch-wide exterior joint sealant membrane centered on joint. The tape shall be capable of sealing joints against groundwater infiltration. The installation of the

membrane shall be in conformance with the recommendations of the manufacturer. Surface must be smooth, clean, dry, and free of voids, loose aggregate, dirt or other matter that will hinder the adhesion of the membrane. A primer shall be used in accordance with the recommendations of the membrane manufacturer. If recommended by the manufacturer, heat shall be applied to all areas being sealed. Each joint shall be wiped inside the manhole with cement mortar after assembly.

H. Pipe penetration through wet well wall: Flexible sleeve-integrally cast the sleeve(s) in a precast concrete section(s). Fasten pipe in sleeve with stainless steel clamp(s). Coat stainless steel clamp(s) with bituminous material to protect from corrosion. Flexible sleeve shall be Lock Joint Flexible Manhole Sleeve, Kor-N-Seal connector, or equal. Connector shall meet the requirements of ASTM C923.

I. The wet well shall be design to prevent it from becoming buoyant under flooding and 100% soil saturation conditions.

2.17 WET WELL ACCESS COVER

A. The access cover shall have clear opening of 36-inch-x-48-inch access as manufactured by Halliday products or approved equal. Access frame and cover shall have a 1/4-inch-thick, one-piece, mill finish, extruded aluminum frame, incorporating a continuous concrete anchor. Door panel(s) shall be 1/4-inch aluminum diamond plate, reinforced to withstand a live load of 300 PSI. Door(s) shall open to 90 degrees and automatically lock with stainless steel hold open arms with aluminum release handles. Door(s) shall close flush with the frame. Unit shall lock with a noncorrosive locking bar. All access frame, cover, hardware, and fasteners shall be constructed of Schedule 316 stainless steel. All surfaces in contact with concrete shall have a shop coat of zinc chromatic primer, approved alkali resistant paint or approved protective coating. Double door access covers shall have removable center bar support. Cover must be compatible with enclosed equipment. Padlocks for access covers shall be Master No 4 brass padlock, keyed alike, furnished with two keys per lock. Bolts in locking device shall be stainless steel.

2.18 WET WELL VENT/ODOR CONTROL

A. The vent shall be a 4-inch flanged, cast 356-T6 aluminum with an epoxy powder coated finish. It shall be vertically mounted with an integral rain shield. A 4-inch Schedule 80 PVC pipe coupling shall be cast in the concrete wet well top. A 4-inch Schedule 80 PVC pipe shall extend 24 inches above the wet well top and shall have a solvent weld flange installed to mate to the vent apparatus. The valve body may be easily disassembled with two quick-release lockable metal latches.

B. The interior of the body shall contain a canister filled with odor-reducing media. Pellets shall be non-toxic and landfill disposable. The media shall contain blue indicator pellets that turn white when the media is spent.

C. Vent shall be as manufactured by Robert H. Wager Co., Inc., Rural Hall, NC.

2.19 BRACKETS, SUPPORTS, AND MISCELLANEOUS METAL

A. Brackets, supports, and miscellaneous metal parts shall be stainless steel and provided as needed to support piping, floats, controls, and their equipment for a complete installation. Anchor bolts shall be 300 series stainless steel and shall be provided. All metal shall be stainless steel. There shall be extra heavy duty 3/8-inch rod hooks for attaching control floats, and other wet well accessories (six hooks minimum) and be located on the side of the wet well hatch opening except for the side where the discharge piping is located.

2.20 CONCRETE

A. Concrete shall be Type II meeting ASTM C150, having a Tri-Calcium Aluminate (3CaOAL203) content of 8%. Coarse aggregate shall be sound, crushed, angular granitic stone only. Smooth or rounded stone is not acceptable. Fine aggregate and coarse aggregate shall meet the requirements of ASTM C33. Calcium Chloride or admixtures containing Calcium Chloride shall not be used in the concrete mix. Reinforcing shall meet or exceed the minimums described in ASTM C478.

2.21 POWER-POLE AND SUPPLY

A. The Contractor shall confirm service arrangements with the power company before commencing work. The Contractor shall run underground wiring to nearest transformer or hand hole. If no power pole is available, the Contractor shall provide a power pole and shall connect to Local Power Company at pole's weatherhead. The pole shall have the following mounted on it:

1. 250-watt mercury vapor lighting fixture, 120-volt with photo cell and 2-foot mounting arm.
2. A lightning arrestor.
3. A volt surge capacitor.
4. The meter base box, by Local Power Company.
5. A fusible 304 stainless steel disconnect switch.

B. All stations shall be provided with a control power transformer, single-phase primary, to 120 volts/1 ph/60 hertz secondary. Transformer shall be rated for the

loads of the lights, alarms, and control power. Power service for the pump motor circuits shall be as indicated on the pump data sheets.

2.22 SCADA CONTROL PANEL

A. The SCADA Control Panel and appurtenances shall be furnished and installed in accordance with Section 19, Wastewater Pump Controller/Remote Terminal Unit (RTU).

2.23 DESIGN STANDARDS AND OTHER PUMP STATION STANDARDS

A. The applicable pump station design standards and other pump station standards not covered in this Specification Section shall be in accordance with Section 17, Wastewater Lift Stations, unless otherwise specified or shown in the Town Standard Details.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install, level, align, and lubricate pump station as indicated on the Drawings. Installation must be in accordance with written instructions supplied by the manufacturer at time of delivery.

B. Suction pipe connections are vacuum tight. Fasteners at all pipe connections shall be tight. Install pipe with supports and thrust blocks to prevent strain and vibration on pump station piping. Install and secure all service lines (level control, air release valve or pump drain lines) as required in wet well.

C. Check motor and control data plates for compatibility to site voltage. Install and test the station ground prior to connecting line voltage to station control panel.

D. Before applying electrical power to any motors or control equipment, check all wiring for tight connection. Verify that protective devices (fuses and circuit breakers) conform to project design documents. Manually operate circuit breakers and switches to ensure operation without binding. Open all circuit breakers and disconnects before connecting utility power. Verify line voltage, phase sequence, and ground before actual start-up.

E. After all anchor bolts, piping, and control connections are installed, completely fill the grout dam in the pump station base with non-shrink grout in a manner to channel the flow and settled solids into the invert of the pump suction pipe.

3.02 CLEANING

A. Before acceptance, inspect interior and exterior of pump station for dirt, splashed material, or damaged paint. Clean or repair accordingly. Remove from the job site all tools, surplus materials, scrap, and debris.

3.03 PROTECTION

A. The pump station should be placed into service immediately. If operation is delayed, drain water from pumps and piping. Open motor circuit breakers and protect station controls and interior equipment from cold and moisture. The station is to be stored and maintained according to the manufacturer's written instructions.

3.04 PUMP DATA SHEET

A. The pump data sheet submitted to the Town by the Contractor before pump purchase shall contain the following:

1. Pump Station No.: ____.
2. Description – Service: Solids Handling Pump Station.
3. GPM: ____.
4. Total Head - Feet: ____.
5. Fluid: Domestic Wastewater.
6. Hp: ____.
7. Temperature Degree F.: Ambient.
8. pH: 5 to 8.
9. Specific Gravity: 1.0.
10. Minimum Sphere Diameter: 3 inches.
11. Power Service:_____.
12. Maximum Speed: ____.
13. Number Required: ____.
14. Electrical Cable Required/Pump:_____.
15. Electrical Circuit Breaker Rating: Supplier to furnish
16. Maximum Full Load Amps: Supplier to furnish
17. Maximum Starter Amps: Supplier to furnish
18. Maximum Locked Rotor KVA: Supplier to furnish
19. NEC Code Letter: Supplier to furnish
20. Remarks:_____.

3.05 FIELD QUALITY CONTROL

A. Manufacturer's Start-up Services:

1. Coordinate station start-up with manufacturer's technical representative. The representative or factory service technician will inspect the completed installation, calibrate and adjust instrumentation, correct or supervise correction of defects or malfunctions, and instruct operating personnel in proper operation and maintenance procedures.

2. The alignment tolerances of the drive assemblies shall be achieved by means of a belt/sheave laser alignment system and shall be checked at startup before starting the station.

B. Field Acceptance Testing:

1. Pre-Final Inspection: Prior to final inspection, the Contractor shall conduct a pre-final site inspection (including energizing each pump) in the presence of a Town representative. Any deficiencies noted at this time shall be corrected prior to scheduling of the final inspection.

2. Final Inspection: The Contractor shall be responsible for conducting the following field acceptance tests and start-up procedures in the presence of a Town Representative. The Contractor shall notify the Town, the Engineer, and the pump manufacturer's representative 48 hours before start-up. The time and date of this final inspection shall be scheduled by the Town. The Contractor shall furnish all labor, piping, equipment, water, and materials required to perform the acceptance testing. The Contractor shall ensure the force main is full of water prior to the pump test.

3. Wet well shall be tested for exfiltration by filling up with water to a level 2 feet below the top of the flat slab and measuring the amount of drop over one hour. Exfiltration shall be 0 gallons per foot diameter per foot depth per day.

4. The Contractor shall demonstrate that the pump mounting and guide rail systems are fully operational. The Contractor shall remove and reinstall the pumps in the presence of the Town Representative before conducting the performance test.

5. Pump Performance: Before acceptance, as part of the final inspection, and prior to placing the station in operation, the Contractor shall conduct a pump performance test. Pumps shall operate according to the operating conditions indicated on the Drawings without excessive vibration or

overheating. Testing shall be performed using clean water. The Contractor shall supply water at its own expense to perform the required testing. Pumping rates shall be determined by pumping a calculated volume of water in a specified time interval. Head and flow conditions shall be measured and recorded. Water levels during testing shall fall within the pump control levels shown on the drawings. Amperage draws shall be monitored to determine effectiveness and efficiency of equipment. The test shall be repeated until satisfactory results are obtained. The test results shall be recorded on the Pump Test Report sheet included at the end of this section. If the Contractor is unable to demonstrate to the Town that the pumping unit performs satisfactorily, the unit shall be rejected. The Contractor shall then remove and replace the defective unit at its own expense. Satisfactory performance includes, but is not limited to, the following:

a. Pumps: Pumps shall deliver rated GPM at rated TDH.
b. Motors: Running amperage shall be noted and recorded on each leg of power cord while pump is operating under full load.
c. All self-test trip relays shall demonstrate ability to simulate a fault condition. All test results shall be recorded on the pump test report and be submitted to the Engineer.
d. Pumps shall operate within 5% of the approved, certified, head-capacity curve.
e. Following performance testing, pumps shall be meggered for pump-moisture intrusion.
f. Pump spare parts shall be according to the manufacturer's recommendations.
g. For dry-pit submersible pumps, the closed-loop cooling system shall provide adequate cooling, in accordance with pump manufacturer's recommendation throughout the pumping range.

6. SCADA Inspections: A Town representative shall be present to verify that the pump sensors and controls perform control sequences satisfactorily including but not limited to correct start and stop elevations and proper high-level alarm functions. Town SCADA equipment representative is Xylem (Multitrode ™).

END OF SECTION

PUMP TEST REPORT

PROJECT: _____ DATE: _____
LOCATION: _____
GPS COORDINATES: _____
LONGITUDE / LATITUDE: _____
WATER METER NO: _____
ELECTRIC METER NO: _____

PUMP DATA

Manufacturer: _____
Model / Impeller Size: _____
Motor HP: _____ RPM: _____
Wetwell Diameter: _____ Gals / V. Ft _____
Pump Design Point: _____ GPM @ _____ Feet T.D.H. _____

TEST DATA

Pump No: _____
Serial No: _____
Start Time: _____
Stop Time: _____
Elapsed Time (min.): _____
Water Elevation Start (HWL) (ft.): _____
Water Elevation Stop (MWL) (ft.): _____
Net Draw down (ft.) _____
(Subtract water El. Stop from water El. start)
Total Gallons: _____
Gallons / Minute: _____
(Divide total gallons by minutes)
Pressure Gauge Reading (ft.) _____
Gauge Elevation to MWL (ft.) _____
Height to Gauge (ft.) _____
Total Head @ Pump (ft.) _____
Ampmeter Reading (amps) _____
Guide Rail Operation Checked _____

Contractor Representative: _____

Town's Inspection Representative: _____

Town's Maintenance Representative: _____

Pump Manufacturer's Representative: _____

Engineering of Record Representative: _____

SECTION 19
WASTEWATER PUMP CONTROLLER/
REMOTE TERMINAL UNIT (RTU)

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This section does not stand alone and is incorporated as part of Town Construction Specification Manual (CSM). The CSM shall be used for other requirements that may not be covered in this Section.

B. All piping and equipment of the same type shall be from one manufacturer, unless authorized in writing by the Town or the Town's representative.

C. The Contractor shall provide all design, labor, tools, materials, equipment, transportation, services, supervision and testing necessary for the construction of a Wastewater Pump Station Control System with Remote Terminal Unit (RTU) as described in this Section.

D. The Contractor shall furnish, install and place into operation a stainless steel pump control panel housing the pump controller, RTU, and other electrical/controls equipment necessary for the control and monitoring of the Town's wastewater collection system, as described in this Section. The stainless steel control panel is to be completely factory assembled, wired, and tested before shipment.

E. The contractor shall modify existing Master Telemetry Unit (MTU)/Computer Human Machine Interface (HMI) package located at the Town's treatment facility. The RTU at the lift station shall monitor and transmit the lift station status to the existing MTU controller/transceiver for monitoring.

F. All equipment, materials, programming, and services, in this Section shall be supplied by the Contractor who shall coordinate and have responsibility for interconnecting with equipment now existing and/or equipment being installed under this contract.

G. The system described in this Section is a micro controller based Radio Telemetry and Control system. This system shall communicate directly with the Town WWTP. The site shall acquire data from the remotes, report status and provide data logging capability. The remote station shall monitor and transmit status on request.

H. The Contractor shall furnish and install all hardware, software, supplies and services necessary for the construction of the control system including radios, antennas, modems, radio frequency acquisition, FCC license (if necessary), system training, and documentation.

1. All components shall be the products of companies normally engaged in the manufacture of such equipment and shall be furnished and installed by a single vendor. The equipment vendor, or its representative, shall perform all system Engineer of Record certifications and assume full responsibility for successful functional operations of the equipment in accordance with the performance requirements set forth in these specifications. The Contractor shall further be responsible for providing the complete verbal and written operating and programming procedures and instructions to Town-designated operating personnel.

2. At a minimum, the scope of work shall include the following major components:

   a. Complete Pump Station Control System with RTU for remote monitoring and control.
   b. All configuration, testing, startup, and training services.
   c. Configuration, programming, and development of existing Supervisory Control and Data Acquisition (SCADA)/MTU system.

3. All wiring between the control panel equipment and sensing devices shall be furnished and installed by the Contractor in accordance with national and local electrical codes, and these specifications.

1.02 SUBMITTALS

A. All submittals shall be submitted in accordance with the shop drawing submittal requirements as specified in Section 1, General Provisions.

B. All panels, equipment, and instrumentation require a complete shop drawing submittal, as detailed in this specification for the Town's review and approval.

1. At a minimum, the Drawings shall show the fabrication design, internal equipment arrangement, internal wiring, and external wiring connections.

2. Product List: Provide a list of equipment and components on each Drawing with each product identified by legend reference. Include product name, manufacturer, and model number.

1.03 SYSTEM CONFIGURATION

A. The Contractor shall furnish and install, but not be limited to, the following:

1. One RTU including service port, power supply, batteries, function modules and antenna per lift station that is to be provided or retrofitted. Work shall include all labor and materials to completely furnish and install the RTU. Discrete instrumentation and control devices shall be furnished as described in this Section and/or shown on the Drawings.

2. Function modules shall have 25% of input/output points reserved for future use.

1.04 RELATED WORK

A. The provisions of all other technical sections of these specifications are fully applicable to this Section as if incorporated in this Section.

1.05 PERMITS, FEES AND LICENSES

A. The Contractor shall obtain all necessary permits, licenses, and inspections required for the work of this section and pay all fees and charges incidental thereto. The Contractor shall deliver to the Town all licenses and certificates of inspection issued by authorities having jurisdiction.

B. If necessary, the RTU Supplier shall obtain the necessary FCC license for the Town to operate the system; pay for all fees; perform a radio survey and submit all the necessary forms to obtain the license for the Town. A new licensed frequency, if required, shall be isolated from the nearest user on the same frequency by a minimum of 75 miles for 900 MHZ, 100 miles for UHF, and 150 miles for VHF. Written proof of the frequency isolation is required. The Contractor shall guarantee that the new frequency obtained is free from interference, and will provide 98% or greater path reliability, for a period of two years. Should the frequency have interference or communications problems during this warranty period, the Contractor shall, at no cost to the Town.

C. Obtain a new license for a frequency without the interference or communications problems.

1. Reprogram and/or replace the radios to operate on the new frequency.

2. Replace the antennas if the new frequency is in another band.

3. Pay all fees and other costs incurred in modifying the existing frequency or obtaining a new frequency.

D. The Contractor shall perform a radio path analysis for the RTU. The path analysis shall provide a minimum of 15 decibels (dB) of fade margin for all proposed radio systems. The 15-dB fade margin shall be demonstrated by inserting a 15-dB pad into the Central Site coax cable and thereafter establishing reliable communications with each remote site.

1.06 SUBMITTALS

A. Material and Equipment: The Contractor shall submit a complete list of equipment and materials, to be incorporated in the work.

1. The list shall include catalog numbers, cut sheets, diagrams and other descriptive data required to demonstrate conformance to the specifications. Partial lists will not be acceptable.

2. The basis of acceptance shall be the Manufacturer's published ratings for the equipment. Manufacturer shall be regularly engaged in manufacture of products specified.

B. Submittals shall include data for the following items:

1. Control Panel and Components
2. RTUs
3. Antennas
4. Mast
5. HMI Graphic Screen Templates
6. HMI Report Templates
7. Spare Parts List
8. Warranty
9. Services Outline

C. Submittals shall include manufacturer's literature, cut sheets, wiring diagrams, schematics, and details of construction including dimensions, materials, finish, accessories, trim and ratings for all equipment.

1.07 OPERATIONS AND MAINTENANCE MANUALS

A. Before final acceptance of this project, an operations and maintenance manual shall be submitted to the Engineer of Record. The manual shall include manufacturer's literature as outlined in Article 1.06 above, Drawings corrected per submittal review comments and modifications, and lists of suppliers and/or

service shops that can provide parts and accessories and equipment repair for the items of equipment listed above. These lists shall include a contact name, telephone number, and address.

1.08 POSTED OPERATING INSTRUCTIONS

A. Operating instructions approved by the Town shall be provided for each principal piece of equipment for the use of operation and maintenance personnel. The operating instructions shall include wiring and control diagrams showing the schematic layout of the system. Operating instructions shall be printed or engraved and shall be framed under glass or in approved laminated plastic and posted where directed by the Town. Operating instructions shall be attached to or posted adjacent to each principal piece of equipment and shall include such instructions as startup, proper adjustment, operation, shutdown, safety precautions, procedure in the event of equipment failure, and any other necessary items of instruction as recommended by the manufacturer of the equipment.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Delivery

1. After completion of shop assembly, factory test, and approval, all equipment, cabinets, panels, consoles shall be packed in protective crates and enclosed in heavy-duty polyethylene envelopes or secured sheeting to provide complete protection from damage, dust, and moisture. Dehumidifiers shall be placed inside the polyethylene coverings. The equipment shall then be skid-mounted for final transport. Lifting rings shall be provided for moving without removing protective covering. Boxed weights shall be shown on shipping tags together with instructions for unloading, transporting, storing and handling at job site.

2. Special instructions for the correct field handing, storage, and installation required by manufacturer for protection of equipment and personal shall be securely attached to each piece of equipment before packaging and shipment.

B. Identification

1. Each component shall be tagged to identify its location and function in the system. Identification shall be prominently displayed on the outside of the package.

C. Storage

1. Equipment shall not be stored outdoors. Equipment shall be stored in dry permanent shelters, and shall be adequately protected against physical damage. If any apparatus has been damaged, such damage shall be repaired by the Contractor at no cost to the Town. If any apparatus has been subject to damage by water, it shall be replaced or put through such tests as directed by the Engineer of Record. The Engineer of Record maintains sole responsibility for acceptance of test results. This shall be at the cost and expense of the Contractor.

1.10 WARRANTY

A. The System Supplier shall warrant all hardware and software provided under this contract against all defects in material and workmanship for a period of 2 years from date of final acceptance. The System Supplier shall warrant the telemetry software to be free of defects and provide free software updates for the system for 2 years. Included with the Contractor's quote shall be maintenance and training services to be performed during the 2-year warranty period.

PART 2 PRODUCTS

2.01 MANUFACTURER QUALIFICATIONS

A. All products offered shall be supported by descriptive literature and/or diagrams.

B. All equipment shall be the Manufacturer's latest and proven design.

C. Acceptable RTU model: As approved by the Public Services Director or his Designee.

2.02 GENERAL REQUIREMENTS

A. UL Approval: All pump control system equipment shall be constructed in compliance with Underwriters Laboratories Industrial Control Panels, utilizing UL listed and recognized components where applicable.

B. Incoming Service:

1. The incoming service for the stainless steel pump control panel shall be 120 volts, single phase, two wires, 60 Hertz.

2. An EDCO HSP-121 lightning arrestor shall be supplied in each stainless steel pump station control panel and shall be connected to each line of the

incoming side of the power input terminals. The arrestor shall protect the pump control system against damage as the result of transient voltage surges caused by lightning interference, switching loads, and power line interferences.

3. Each pump control system circuit shall be supplied with a properly sized control power circuit breaker. The main breaker shall provide protection for all power and control wiring within the enclosure.

4. Transient protection shall be provided for all analog signals inside the enclosure.

C. Wiring

1. All power wiring shall be minimum 600-volt UL type MTW or AWM and have a current-carrying capacity of not less than 125% of the full load current. The conductors shall be #14AWG minimum and shall conform to the national electric code, state, local and NEMA electrical standards. For ease of servicing and maintenance, all wiring shall be color coded and numbered. The wire color code and number shall be clearly shown on the drawings, with each wire's color and number indicated.

2. All control wiring shall be contained within wiring duct with covers by manufacturers in accordance with the Appendix A, Approved Manufacturer List of the Town CSM. Where dimensional constraints prevent the use of wiring duct, wires shall be trained to panel components in groupings. The wire groupings shall be bundled and tied not less than every three inches with nylon self-locking cable ties. Every other cable tie shall be fastened to the enclosure door or inner device panel with a cable tie mounting plate with pressure tape. Where wiring crosses hinged areas such as when trained from the inner device panel to the enclosure door, spiral wrap shall be used.

3. Cable markings shall be imprinted on each cable at 12-inch intervals for the entire cable length inside the enclosures.

D. Signal Transient Protection

1. Transient protection shall be integrally provided for all equipment to protect all instrumentation and telemetry devices either receiving or sending signals. This means all signals shall be protected on the transmitting and receiving ends. The transient protectors shall be a three-stage surge suppression device, which shall effectively arrest most transients encountered in an instrumentation environment. Transient

protectors utilizing single or dual stage suppression devices shall not be acceptable.

2. The first stage of the transient protector shall consist of a gas tube arrestor connected across the signal wires and to ground. This stage shall be designed to suppress transients greater than 150 to 300 volts.

3. The second stage of the transient protector shall consist of two varistors each connected between a signal line and ground. This stage shall suppress any transients less than 150 to 300 volts and clamps them to 56 volts.

4. The third stage of the transient protector shall consist of two special purposes high-speed zener diodes that suppress any remaining transients to 51 volts. Connect 50-ohm, 5-watt resistors between the stages to dissipate the potential energy of the transients. Transient protector manufacturer shall be in accordance with Appendix A, Approved Manufacturer List of the Town CSM..

E. Condensation Protection: A 120-VAC condensation-protective heater and high-temperature cutout thermo switch shall be provided in each new stainless steel control panel enclosure.

2.03 COMPONENT REQUIREMENTS

A. Remote Terminal Unit

1. The field hardware shall be of a modular design and incorporate the following features:

   a. Pre-programmed control functionality for pump station application.
   b. Operator interface (graphical LCD with soft keys) with view of level, pump mode, fault status, pump controls, fault reset, etc.
   c. Set point adjustment.
   d. Grouping and alternation.
   e. Level device selection and redundancy.
   f. Station optimization functions to include:

      (1) Max run time (efficiency function).
      (2) Max off time (odor reduction).
      (3) Max starts/hr (pump protection).
      (4) Inter-pump start/stop delays.

   g. Well washer controls.

h. Fault handling (delays, critical/non-critical selection).
i. Built-in functionality for advanced pump control of up to 6 pumps including grouping and alternation.
j. Multiple profiles of set points for spill management, energy management, etc.
k. Dedicated I/O for pump seal, thermal, PT100, and conductive level probe.
l. 3-phase voltage and DC supply monitoring.
m. Expandable I/O capabilities.
n. 10Mbit/s Ethernet communications.
o. 115kBit/s RS232 serial communications.
p. DNP3 (level 2) communication protocol.
q. On-board datalogger.
r. Motor efficiency module including insulation resistance testing for motor windings.

2. The system shall support the following communication networks:

a. Licensed radio (VHF & UHF).
b. Wireless LAN (unlicensed spread spectrum).
c. Cellular (CDMA or GPRS).

3. The communications protocol shall include:

a. Change of state reporting.
b. Native date/time and quality stamp for each data point.
c. Event buffering for non-critical data.

4. The RTU shall be mounted in the enclosure on the back plane. The controller shall be provided with a Class II UL listed transformer/ power supply. Voltage regulation and battery charging circuitry shall be integral to the controller.

B. Antenna Subsystem

1. The RTU antennas shall be the Cushcraft, Model PLC4510-N with a gain of 11.5 Dbd. The RTU antenna must be connected to the polyphaser surge protector using the DB products. Vapor Bloch VB-8 coaxial cable. The cables must be terminated with silver plated/Teflon RF N connectors. The antenna must be mounted to a bonded mast. The antenna must be aligned to maximize the signal of the Sub Master station (the fire station) using a spectrum analyzer. All outside connections must be sealed with Decibel Products. Vapor Wrap and Alpha FIT321-1-0 sealant shrink tubing. The coaxial cables must be secured to the antennas support structure with

100% stainless steel clamps, Band-it, AE112 cable ties in such a way as not to crush the coaxial cable. The antenna mast and associated hardware must be hot dipped galvanized or stainless steel. If necessary the Rohn 25G towers is an approved material, if there is supporting documentation that this mast will satisfy the requirements of the following: The antenna support structure must follow all Florida Building Code Requirements for constant wind loading without damage. Engineering drawings sealed by a Florida Registered Professional Engineer shall be required.

C. Instrumentation

1. Level Indicating Transducer (Submersible pressure sensing type) - required.

2. The liquid level of the wet well shall be sensed by a Consolidated Electric Company Bulletin A1000 Model 157G Submersible Level Transducer. The Transducer shall be a 3-wire type to operate from a supply voltage of 10.5 to 24 VDC and produce a 1-5 VDC instrumentation signal in direct proportion to the measured level excursion over a factory-calibrated range.

3. The Transducer shall be of the solid-state head-pressure sensing type, suitable for continuous submergence and operation and shall be installed in accordance with manufacturer's instructions. The bottom diaphragm face of the sensor shall be installed approximately six inches above the reservoir floor. The sensor shall be mounted using a stainless steel cable system. The Contractor shall install the cable in the lift station wet well.

4. The transducer housing shall be fabricated of type 316 stainless steel with a bottom diaphragm 2-5/8" diameter of heavy-duty, limp, foul-free, molded Teflon (TM) bonded to a synthetic rubber back/seal. A hydraulic fill liquid behind the diaphragm shall transmit the sensed pressure to a solid-state variable-capacitance transducer element to convert the sensed pressure to a corresponding electrical value. The sensed media shall exert its pressure against the diaphragm, which flexes minutely so as to vary the proximity between an internal ceramic diaphragm and a ceramic substrate to vary the capacitance of an electrical field created between the two surfaces. A stable, hybrid, operational amplifier assembly shall be incorporated in the transducer to excite and demodulate the sensing mechanism. The transducer shall incorporate laser-trimmed, temperature compensated, high quality components and construction to provide a precise, reliable, stable output signal directly proportional to the sensed pressure over a factory-calibrated range.

5. The transducer element shall incorporate high over-pressure protection and be designed to withstand intermittent overpressures five times the full-scale range being sensed. Metallic diaphragms shall not be acceptable in that they are subject to damage or distortion. Sensing principles employing LVDTs, resistive or pneumatic elements shall not be acceptable.

6. The transducer/transmitter shall include easily accessible offset and span adjustments in the upper assembly. Span shall be adjustable from 100% down to 15% of the sensor range. Fine and coarse adjustments for both span and offset shall be provided, using 25-turn potentiometers. Offset and span adjustments shall be non-interactive, for ease of calibration.

7. The internal pressure of the lower transducer assembly shall be relieved to atmospheric pressure through a heavy-duty urethane jacketed hose/cable assembly and a slack PVC bellows mounted in the NEMA 4X vented fiberglass upper assembly. The sealed breather system shall compensate for variations in barometric pressure and expansion and contraction of air due to temperature changes and altitude as well as prevent fouling from moisture and other corrosive elements.

8. The transducer assembly shall be installed in the wet well and directly wired to the RTU and placed in successful operation. It shall be provided with external input power and output signal transient protection, associated control elements as specified in this Section and in accordance with manufacturer's instructions.

D. Spare Parts: The Contractor shall provide the spares need for the system per the manufacturer’s recommendation on application basis.

PART 3 EXECUTION

3.01 LAYOUT OF WORK

A. The Contractor shall lay out the work and shall be responsible for all necessary lines, levels, elevations and measurements. The Contractor shall become familiar with work of other trades engaged in the construction. Exact routing of raceways and locations of equipment may be governed by structural conditions and obstructions. The Contractor shall coordinate with the equipment shop drawings for connections to equipment furnished by others.

3.02 INSTALLATION

A. Instrumentation and accessory equipment shall be installed in accordance with the manufacturer’s instructions. The locations of equipment, transmitters, alarms, and

similar devices shown on the Drawings are approximate only. Exact locations shall be as approved by the Engineer of Record during construction. Perform site visit to obtain all information relevant to the placing of process control work, and in case of any interference with other work, proceed as directed by the Engineer of Record and furnish all labor and materials necessary to complete the work in an approved manner.

B. The Contractor shall furnish all labor, materials, equipment, and incidentals required to remove any existing equipment, as required installing any new equipment provided under this Contract.

C. The Contractor shall also furnish all labor, materials, equipment, and incidentals required to modify existing equipment or install new equipment provided under this Contract.

D. The Contractor shall make all necessary mechanical changes to install new instrumentation equipment provided under this Contract. This work includes all fittings and fabrications. All work shall be done in a workmanlike manner in full accordance with all applicable codes and standards.

E. The Drawings indicate an overview of the requirements for the equipment specified. The Contractor shall prepare detailed wiring interconnect diagrams.

F. All work shall be executed in full accordance with codes and local rulings. Should any work be performed contrary to said rulings, ordinances, and regulations, the Contractor shall bear full responsibility for such violations and assume all costs arising there from.

G. Field instruments requiring power supplies shall be provided with local electrical shut-offs and fuses.

H. Brackets and hangers required for equipment mounting shall be provided. They shall be installed in a workmanlike manner and not interfere with any other equipment.

I. The System Supplier shall investigate the lift station and include in the bid the actual routing of all conduits to reach their final location. If necessary, the System Supplier shall provide additional starter contacts or overloads as required for system operation. The System Supplier shall also investigate, and make any field modifications to existing lift station controls, enclosures, and panels to ensure proper System operation.

J. The shield on each process instrumentation cable shall be continuous from source to destination and shall be grounded in the RTU or as directed by the

manufacturer of the instrumentation equipment but in no case shall more than one ground point be employed for each shield.

K. Lifting rings from cabinets/assemblies shall be removed after equipment installation. Hole plugs shall be provided for the holes of the same color as the cabinet.

L. The Contractor shall coordinate the installation, placing, and location of system components, their connections to the process equipment panels, cabinets and devices, subject to the Engineer of Record's approval. He shall be responsible to insure that all field wiring for power and signal circuits are correctly done in accordance with best industry practice and provide for all necessary system grounding to insure a satisfactory functioning installation.

M. General: Comply with NEC, NESC, local codes, and rules and regulations of local agencies having jurisdiction. Size of conductors, circuit breakers, and protective devices shall meet all requirements of the NEC.

1. Determine rating and type of all electrical equipment furnished. Provide electrical equipment and conductors of correct size to serve equipment.

N. Grounding: A ground shall be established which will electrically connect the metal structural materials, equipment enclosures, conduits, outlet boxes, cabinets, etc., to obtain a potential common to all of these. The ground shall be properly bonded and sized in accordance with NEC. Solidly ground all non-current-conducting metal parts. A green insulated grounding conductor shall be carried with each circuit.

1. Provide a copper-clad steel ground rod connected to the equipment by bare copper conductor. Resistance to remote earth shall be 10 ohms or less before connection to the system.

3.03 SERVICES

A. The System Supplier shall provide the following services:

1. Process start-up services.

2. The services of factory personnel shall be provided to inspect the completed installation and make all adjustments necessary to place the system in trouble-free operation. This representative shall be capable of modifying the RTU software and Town's HMI screens.

3. Provide a minimum of 2 working days per lift station site (on site) start-up assistance.

3.04 MTU PROGRAMMING SERVICES

A. The Contractor shall provide development, programming, startup, commissioning, and training services to incorporate any new lift station control systems into the Town's existing MTU/SCADA software package to mimic monitoring and control functionality of existing lift station sites.

B. Configure historian to store lift station values on change of event with date/time stamp of when the event took place.

C. Configure historian to make data available to the HMI software system and to other trending and reporting software clients using OPC-HAD and ODBC/JDBC interfaces.

D. HMI Screens for the lift station shall include:

1. Station Overview including Station Name and Station ID.
2. Summary alarms such as: level alarm, device faults, communication faults, power supply fault.
3. Communications statistics.
4. 3-phase voltage.
5. Wet well level.
6. Pump Status: Hand/Off/Auto/Fault.
7. Thermal overload alarm.
8. Seal fail alarm.
9. Delay fail alarm.
10. Critical pump station fault alarm.
11. Non-critical pump station alert.
12. Phase currents.
13. Phase voltages.
14. Pump station KW and KWH accumulator.
15. Pump under-current.
16. Pump over-current.
17. Power Phase fail.
18. Ground fault.
19. Detailed pump data.
20. Pump station flow.
21. Pump mode control: Hand/Off /Auto/Fault Reset.
22. Pump station configuration screen for manipulation of set points and pump profile settings.

E. Pump Station Operation Reports:

1. Daily hours run and starts report.
2. Daily exception reports.
3. Daily site report.
4. Daily fault report.

3.05 SYSTEM SERVICE CONTRACT

A. The supplier of the standby power system must provide a copy of and make available to the Town the standard service contract which, at the Town's option, may be accepted or refused. This contract will accompany documents, drawings, catalog cuts, specification sheets, and wiring or outline drawings, etc., submitted for approval to the Director of Environmental Services. The contract shall be for the complete services rendered over 1 year.

3.06 TRAINING

A. The Contractor shall conduct the following minimum training:

1. One full (8-hour) day at the Town's facility during the time of system startup and before final acceptance of the system.

2. One full (8-hour) day 2 to 3 weeks after system start-up.

B. This training shall be supplied to at least two members of the operating crew. This training shall consist of start-up, general maintenance instruction, and troubleshooting procedures. It shall include a review of material presented at the last formal training school for factory and dealer service personnel.

3.07 TESTING

A. System Test and Acceptance

1. A formal system test shall be performed by the Supplier and witnessed by the Engineer of Record and/or Town's representative after installation. The equipment shall include the entire Data Acquisition and Process Control System. The purpose of the factory test shall be to verify the functionability, performance, and stability of the hardware and software.

2. Implicit in the scheduling of the test is the assumption that the Supplier has determined through the tests and quality assurance programs that the equipment is ready for shipment. Supplier's internal test procedures for hardware shall be equal to or exceed the requirements set forth in ANSI

Standard RP55.1, "Recommended Practice – Hardware Testing of Digital Process Computer," insofar as they apply.

3. Where hardware items are of standard manufacture and in current production, the Manufacturer shall certify that applicable tests have been performed and met, in accordance with said Standard and be prepared to supply copies of data to Engineer of Record upon request. Such statements shall accompany the equipment submittals called for in Submittals of this Section. Any assemblage of devices together with operating programs shall be tested together as provided in this Section.

4. The various tests performed during the Engineer of Record- and/or Town-witnessed site test shall be designed to demonstrate that hardware and software fulfill all requirements of the Specifications.

5. Tests to be performed shall include, but not be limited to, the following:

    a. Building and loading the System database.
    b. Conduct on-line modifications to the database.
    c. Demonstrate operability of the interfaces (hardware and software).
    d. Demonstrate operability of the data communication network.
    e. Demonstrate all system software functions specified.
    f. Verify the displays and interactive capabilities of the operator's console.
    g. Simulate selected operating conditions to verify the performance of the monitoring and control functions.
    h. Generate reports using test data.

6. During the test, the Engineer of Record and/or Town's representative shall have unrestricted access to the system, and all faults identified during this period shall be corrected and retested before completion of factory test. All test data and procedures followed during testing shall be logged, and certified copies of all logs shall be provided to the Engineer of Record and Town. The Supplier shall notify the Engineer of Record and Town a minimum of 30 days in advance of the proposed starting data for the Engineer of Record and/or Town-witnessed factory test. At the time of notification, the System Supplier shall submit a detailed test procedure for approval by the Engineer of Record.

7. After the equipment has been delivered and installed at the Town's site, the services of a factory-trained, qualified service representative of the system manufacturer shall be provided to inspect and complete equipment installation to insure that it is installed in accordance with the manufacturer's recommendations. The service representative shall make

all adjustments necessary to place the system in trouble-free operation and instruct the operating personnel in the proper care and operation of the equipment furnished.

B. Field Tests and Observation

1. The Contractor shall furnish the services of the System Supplier's servicemen, all special tools, calibration equipment, and labor to perform the tests. Certified copies of the tests shall be furnished in duplicate to the Engineer of Record.

2. General: Do not enclose or cover any work until it has been observed, tested and accepted.

3. Provide all personnel, equipment and instruments required for observation and testing.

4. Show, by demonstration, that all circuits and devices are in operating condition.

5. Verify that electrical and mechanical facilities and supervisory control systems are compatible.

6. Verify that instrumentation and supervisory control systems are compatible.

7. Verify installation was in accordance with manufacturer’s instructions.

8. The field inspector shall be a representative of the Manufacturer or Supplier. The representative shall have a minimum of 3 years’ experience on similar projects and shall be factory trained. The representative shall supervise installation, start-up, and make all predetermined settings and equipment adjustments to ensure proper operation of the system.

9. The manufacturer’s representative shall certify the installation in writing.

C. The manufacturer’s representative shall instruct the Town’s personnel in the proper operating and maintenance procedures.

END OF SECTION

SECTION 20
STANDBY POWER GENERATOR – DIESEL

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section does not stand alone and is incorporated as part of the Town Construction Specification Manual (CSM). The CSM shall be used for other requirements that may not be covered in this Section.

B. The Contractor shall furnish, install, and test a complete, self-contained, automatic standby power generator set complete with generator circuit breaker, control panel, annunciator, jacket water heaters, exhaust system, vibration isolators, batteries, battery charger, liquid level gauge, fuel tank and piping, automatic transfer switch, weatherproof enclosure, generator and fuel tank foundation. The Contractor shall furnish all labor, materials, equipment, and incidentals necessary for installing and testing a complete and operable system required by the Town of Howey-in-the-Hills as shown on the Drawings and specified in this Section.

C. The standby power generation facility shall be designed for automatic operation using an automatic transfer switch, which, upon interruption of normal power, will send a signal to the standby generator to start and will disconnect the load from the normal power supply and connect the load to the standby generator.

D. The Contractor shall coordinate the work of this Section with others involved in the construction of the project.

E. These Specifications are intended to give a general description of what is required, but do not cover all details which will vary in accordance with the application. It is, however, intended to cover the furnishing, shop testing, delivery complete installation and field testing, of all materials, equipment and appurtenances for the complete units as specified in this Section, whether specifically mentioned in these specifications or not.

F. The Contractor shall install and furnish all necessary equipment and auxiliaries whether specifically mentioned in these Specifications or not. This installation shall incorporate the highest standards for the type of service shown on the Drawings. The Contractor is responsible for field testing of the entire installation and instruction of the regular operating personnel in the care, operation and maintenance of all equipment.

G. All standby generator sets to be used in the Town of Howey-in-the-Hills' utility system shall conform to these specifications and shall be subject to approval by the Environmental Services Department.

H. All equipment of the same type shall be from one manufacturer, unless authorized in writing by the Town or the Town's representative.

1.02 SUBMITTALS

A. All submittals shall be submitted in accordance with the shop drawing submittal requirements as specified in Section 1, General Provisions.

B. The Contractor shall submit a complete list of materials and equipment to be provided. Partial lists shall not be acceptable.

C. The list shall include catalog numbers, cut sheets, diagrams, drawings, and other descriptive literature as related. A listing of standards and/or publications (i.e., ASME, NEMA, NFPA, IEEE, etc.), which apply to the material submitted shall be included.

D. The basis of acceptance will be the manufacturer's published ratings. Manufacturer literature shall include an outline and assembly drawings, engineering data, and wiring diagrams. Guide for troubleshooting, description and recommended installation instruction, adjustment, and calibration instructions.

E. Ladder-type schematic control diagrams and wiring diagrams for all equipment provided. Diagrams shall show and identify remote mounted devices including those supplied with the equipment and with/or as part of other equipment. Diagrams shall indicate color coding and labeling of wiring and include a complete symbol legend and abbreviation list as used for all devices of diagrams.

F. Submittal shall include prototype test certification and specification sheets showing all standard and optional accessories to be supplied, assembly diagram, schematic wiring diagrams, dimensional drawings, and interconnection diagrams identifying by terminal number each required for interconnection between the generator set, the transfer switch, and the switchgear panels included elsewhere in these specifications.

G. In the event that it is impossible to conform to certain details of the specifications due to different manufacturing techniques, describe completely all nonconforming aspects.

H. The submittal data for each engine/generator set and weatherproof enclosure shall include, but not necessarily be limited to, the following:

I. Installation drawings showing plan and elevations of the complete generator unit foundation plan; exhaust silencer; starting battery; battery charger; weatherproof enclosure, and base-mounted fuel tank.

1. Engine Data:

a. Manufacturer.
b. Model.
c. Number of cylinders.
d. RPM.
e. Bore x stroke.
f. BMEP at full rated load.
g. Piston speed, FPM.
h. Make and model and descriptive literature of electric governor (where required).
i. Fuel consumption rate curves at various loads.
j. Engine continuous pump drive duty rating (without fan) HP.
k. Gross engine horsepower to produce generator standby rating (including fan and all parasitic loads) HP.

2. Generator Data:

a. Manufacture.
b. Model.
c. Rated KVA.
d. Rated SKVA.
e. Rated kW.
f. Voltage.
g. Temperature rise above 40ºC ambient:
    (1) Stator by thermometer.
    (2) Field by resistance.
    (3) Class of insulation.
h. Generator efficiency including excitation losses and at 80 percent.
i. Power factor:
    (1) Full load.
    (2) 3/4 load.
    (3) 1/2 load.

3. Generator Unit Control Data:

   a. Actual electrical diagrams including schematic diagrams, and interconnection wiring diagrams for all equipment to be provided. Standard preprinted sheets are not acceptable.

   b. Legends for all devices on all diagrams.

   c. Sequence of operation explanations for all portions of all schematic wiring diagrams.

4. Engine/Generator Unit and Weatherproof Enclosure: Dimensional data shall be given for the Engine/Generator set and for the weatherproof enclosure.

   a. Weight of skid-mounted unit.
   b. Overall length.
   c. Overall width.
   d. Overall height.
   e. Exhaust pipe size.
   f. CFM of air required for combustion and ventilation.
   g. Heat rejected to jacket water and lubricating oil BTU/hr.
   h. Heat rejected to room by engine and generator BTU/hr.
   i. Weatherproof enclosure details and certification of manufacturing method per specifications.
   j. Base fuel tank, venting, fuel connection points and fill cap location.
   k. Data on all miscellaneous items supplied.

5. Optional System Service Contract:

   a. Equipment Supplier.
      Company Name.
      Address City/State.
      Phone Number.
   b. Attach the number of copies required of System Service Contract to submittal.

6. Furnish the number of copies required of the manufacturer's certified shop test record of the complete engine-driven generator unit.

J. The Developer shall submit the following to the Director of Environmental Services:

1. Complete sets of installation drawings, schematics, and wiring diagrams which shall show details of installation and connections to the work of other Sections, including foundation drawings showing location and size of foundation bolts for the spring-type vibration isolators and brochures covering each item of equipment.

2. The operating and maintenance data.

3. The equipment manufacturer's Certificate of Installation, Testing, and Instruction.

4. The written warranty as required in this Section.

1.03 PERMITS AND FEES

A. The Contractor shall obtain all necessary permits and inspections required for the work of this Section and shall pay all charges incidental to obtaining these permits and inspections.

B. The Contractor shall deliver to the Town of Howey-in-the-Hills all certificates of inspection issued by authorities having jurisdiction.

C. The Contractor shall complete and submit, on behalf of the Town, Storage Tank Registration Form 17-761.900(2), where applicable, and shall provide at least 24 hours' notice to the Florida Department of Environmental Protection (FDEP) before installation. The Contractor shall comply with all FDEP requirements relative to submittal and shall respond to FDEP comments as necessary to secure tank registration. The Contractor shall deliver the tank registration to the Engineer of Record.

1.04 REFERENCES

The work shall conform to the latest edition or revisions of the applicable provisions of the following standards except as modified in this Section:

A. American Society for Testing and Materials (ASTM)

1. ASTM A53/A53M – Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. ASTM D396 – Fuel Oils.

B. American Society of Mechanical Engineers (ASME)

1. ASME B16.3 – Malleable Iron Screwed Fittings, Classes 150 and 300.

C. Federal Specifications and Standards (FES)

1. W-C-375B/GEN (1) – Circuit Breakers, Molded Case; Branch Circuit and Service.
2. W-P-115C – Panel, Power Distribution.

D. National Electrical Manufacturers Association (NEMA)

1. ICS-2 – Controllers, Contactors, and Overload Relays Rated 600V.
2. MG-1 – Motors and Generators.

E. National Fire Protection Association (NFPA)

1. NFPA 30 – Flammable and Combustible Liquids Code.
2. NFPA 37 – Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines.
3. NFPA 70 – National Electrical Code (NEC).
4. NFPA 110 – Standard for Emergency and Standby Power Systems.

F. Underwriter's Laboratories (UL)

1. UL142 –Aboveground Flammable Liquid Tanks.
2. UL1008/1008A –Transfer Switch Equipment/Equipment over 1,000 Volts.UL2200 – Standard for Stationary Engine Generator Assemblies.

1.05 OPERATION AND MAINTENANCE MANUAL

A. Before final acceptance of this project, the Contractor shall submit an operation and maintenance manual to the Town. The manual shall include the manufacturer's literature as outlined in this specifications Section and drawings corrected according to submittals review comments and modifications, and lists of suppliers and/or service shops that can provide parts and accessories and equipment repair for the items of equipment listed in submittal article outlined in this Section. These lists shall include a contact name, telephone number, and address.

1.06 POSTED OPERATING INSTRUCTIONS

A. Operating instructions approved by the Town shall be provided for each principal piece of equipment for the use of operation and maintenance personnel. The

operating instructions shall include wiring and control diagrams showing the schematic layout of the system. Operating instructions shall be printed or engraved and shall be framed under glass or in approved laminated plastic and posted where directed by the Town. Operating instructions shall be attached to or posted adjacent to each principal piece of equipment and shall include such instructions as startup, proper adjustment, operating, shutdown, safety precautions, procedure in the event of equipment failure, and any other necessary items of instruction as recommended by the manufacturer of the equipment.

1.07 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall deliver materials and equipment with the manufacturer's tags and labels and UL labels intact. Deliver packaged material in the manufacturer's original, unopened containers bearing manufacturer's name, brand, and UL label. Contractor shall store material and equipment in a dry, clean location to avoid damage. Remove items delivered in broken, damaged, rusted, or unlabeled condition from the project site immediately.

B. The Contractor shall provide suitable protection of materials and equipment from dust and moisture. The Contractor shall be responsible for the condition of materials and equipment until acceptance by the Town.

C. All items shall be cleaned, touched up, or replaced as necessary to ensure first-class condition.

D. The engine generator set and associated equipment shall be shop primed and finish coated in accordance with the Manufacturer's standard practice before shipment. An adequate supply of touch-up paint shall be supplied by the manufacturer.

1.08 WARRANTY

A. All equipment and materials supplied shall be guaranteed against defective design, materials and workmanship under terms of the manufacturer and dealer's warranty, but in no event, shall it be for a period of less than 5 years (comprehensive) from final acceptance by the Town. Running hours shall not be a limiting factor for the system warranty either by the manufacturer or the supplying dealer.

B. The warranty shall cover replacement and/or repair including labor, travel time and miscellaneous expenses at no cost to the Town for the full warranty period.

C. The responsibility for performance, warranty and parts and service to the generating system in its entirety shall be assumed solely by the generator set

manufacturer/supplier and shall not be split among individual suppliers or components comprising the system.

D. The Contractor shall submit the manufacturer's written warranty with the shop drawings and include an approved warranty in the Operations and Maintenance Manual. Submittal data received without written warranties as specified will be rejected in their entirety.

PART 2 PRODUCTS

2.01 MANUFACTURER'S QUALIFICATIONS

A. The standby power generator set(s) shall be the product of a firm regularly engaged in the manufacture of generator sets and shall be a standard model in production at the manufacturer's place of business. The generator set(s) shall be assembled in the U.S. with 50% of the all major items of equipment such as the engine, generator, auxiliary equipment shall be manufactured in the U.S. by manufacturer currently engaged in the production of such equipment. The generator set shall be tested and shipped by an authorized distributor of the generator set manufacturer to establish a single source responsibility. The distributor shall be authorized to perform warranty work on all units and shall have factory-trained personnel in his direct employment. The distributor shall have a minimum of 10 years' experience in the field of power generation.

B. The engine-generator set shall be a UL2200 listed standard product, as modified by these specifications, the unit to be furnished shall be of proven ability and shall be designed, constructed, and installed in accordance with best practices and methods. To qualify as a manufacturer, the engine must be the principal item manufactured on the completed engine generator set.

C. It is the intent of this specification to secure an emergency generator system that has been prototype tested, factory built, production tested, site tested and of the latest commercial design, together with all accessories necessary for a complete installation as shown on the Drawings and specifications in this Section. The equipment supplied and installed shall meet the requirements of the latest NEC, along with all applicable local codes and regulations. All equipment shall be new, of current production of a national firm, which manufactures the engine/generator, and controls, transfer switch and switchgear, and assembles the emergency generator system as a matched unit so that there is one-source responsibility for warranty, parts, and service through a local representative with factory-trained service personal.

D. The unit must be of such physical dimensions as to make a good installation in the opinion of the Director of Environmental Services, in the space provided as indicated on the Drawings.

E. The unit shall be shipped to the jobsite by an authorized engine dealer having a parts and service facility within a 100-mile radius of the jobsite. In addition, and in order not to penalize the Town for unnecessary or prolonged periods of time for service or repairs to the emergency system, the bidding generator set supplier must have no less than 80% of all engine replacement parts locally available at all times. Certified proof of this requirement shall be furnished to the Town upon submittal of Drawings.

F. All materials and parts comprising the units shall be new and unused, of current manufacture, and of the highest grade, free from all defects or imperfections. Workmanship shall conform to the best modern practices. Only new and current models will be considered. The units offered under these specifications shall be the product of a firm regularly engaged in the production of engine-generator equipment and shall meet the requirements of the specifications set forth in this Section. Major exceptions to these specifications will be considered sufficient cause for rejection of the machines.

G. The engine/generator unit manufacturer shall be as listed in Appendix A, Approved Manufacturer List of the Town CSM.

2.02 GENERAL REQUIREMENTS

A. All materials and equipment shall be new and unused, of current manufacture, and approved and labeled, where required, by UL.

B. The generator set shall consist of a diesel engine directly connected to a brushless alternating current generator with brushless exciter and integrally mounted generator circuit breaker and control panel. Automatic controls shall be furnished to start the unit upon signal from a remote start contact upon failure of the normal source of Power. The unit controls shall provide for automatic exercising on a weekly basis.

1. The installation shall meet all applicable requirements of the NFPA standards, as listed in this specification, and state and local regulations.

C. The generator set shall be mounted, as shown on the Drawings, on a common structural steel, skid-type base designed to maintain proper alignment of components. Suitable spring-type vibration isolators shall be furnished which, when installed between the engine generator skid and mounting surface, will

permit only 5% of the unit's vibration to be transmitted. The vibration isolators shall be securely attached to the mounting surface.

1. The generator shall be set on an elevated pad of sufficient height (minimum 6 inches) above the surrounding floor or grade to allow the oil to be drained. A permanent, portable container shall be supplied with the generator set, to catch the oil being drained, and shall have a formed spout for pouring the oil into a waste oil collection tank or disposable container.

2.03 RATING REQUIREMENTS

A. The standby rating of the generator set shall not exceed the manufacturer's published prime rating by more than 10%. The gross engine horsepower required to produce the standby rating shall not exceed the manufacturer's published continuous duty rating by more than 150 percent. Continuous duty rating shall be as defined in BS649 or DIN6270 but in no case shall it exceed the manufacturer's published continuous duty rating for the engine as used in continuous-rated pump-drive applications. The gross engine horsepower required for the generator set standby rating described above shall include all parasitic demands such as generator inefficiencies, fuel pumps, water pumps, radiator fan (for fan cooled models), and all accessories necessary to the unit's proper operation while operating at rated load and at a rotative speed not to exceed 1,800 revolutions per minute (rpm).

B. The diesel-engine-driven generator set shall be capable of producing the specified standby kW rating for continuous electrical service during interruption of the normal utility source and shall be certified to this effect by the manufacturer for the actual unit supplied.

C. The Diesel Engine/Generator Unit shall be rated for 277/480 volts, 3-Phase, 60 Hertz at 0.8 power factor with fan. The engine/generator set shall be sized to allow starting two submersible pump motors across the line sequentially with 5 KVA of miscellaneous load on line. Manufacturer shall certify this in writing. Obtaining a motor starting KVA for each pump motor is the responsibility of the Engineer.

D. The instantaneous voltage dip shall not exceed 20 percent of rated voltage when full load, at rated power factor, is suddenly applied. Recovery of stable operation shall occur within 5 seconds. Steady-state modulation shall not exceed +1/2 percent.

2.04 TESTING

A. To ensure that the equipment has been designed and built to the highest reliability and quality standards, the manufacturer and local representative shall be responsible for three separate tests: design prototype tests, final production tests, and site tests. The requirements of these tests are described in detail in Article 3.06.G of this Section.

2.05 SYSTEM COMPONENTS

A. Engine

1. The engine shall be full-compression ignition, four cycles, single acting, solid injection engines, either vertical or "V" type. Speed shall not exceed 1,800 rpm at normal full-load operation. Multi block engines are not allowed. The engine governor shall be electronic type with a +/- 0.5 percent accuracy. The frequency at any constant load, including no load, shall remain within a steady-state band width of 0.25% of rated frequency. The governor shall not permit frequency modulation (defined as the number of times per second that the frequency varies from the average frequency in cyclic manner) to exceed one cycle per second. The governor shall be a mechanical or electronic type. Governor shall be by Cummins EFC, Woodward, or Barber Coleman.

2. The engine shall be capable of satisfactory performance on No. 2 fuel oil (ASTM D396). Diesel engines requiring a premium fuel will not be considered.

3. The engine shall be capable of operating at light loads for extended periods of time and shall provide a means to reduce carbonization. Periodic cleaning of exhaust ports shall not be required.

4. The engine shall be equipped with fuel filters, lube oil filters, intake air filters, lube oil cooler, fuel transfer pump, fuel priming pump, service meter, engine-driven water pump, and unit-mounted instruments. Unit-mounted instruments shall include a fuel pressure gauge, water temperature gauge, and lubrication oil pressure gauge. The engine shall be provided with low oil pressure, high water temperature, and low coolant level, and overspeed safety shutdowns of the manual reset type. Additional instruments and safety shutdowns shall be provided as noted in this Section.

5. Injection pumps and injection valves shall be a type not requiring adjustment in service and shall be of a design allowing quick replacement

by ordinary mechanics without special diesel experience. The engines shall have an individual mechanical injection pump and injection valve for each cylinder, any one of which may be removed and replaced from parts stock. Fuel injection pumps shall be positive action, constant-stroke pumps, activated by a cam driven by gears from the engine crankshaft. Fuel lines between injection pumps and valves shall be of heavy seamless tubing.

6. The fuel system shall be equipped with fuel filters having replaceable elements. Filter elements shall be easily removable from their housing for replacing without breaking any fuel line connections, or disturbing the fuel pump, or any other part of the engine. All fuel filters shall be conveniently located in one accessible housing, ahead of the injection pumps so that the fuel will have been thoroughly filtered before it reaches the pump. No screens or filters requiring cleaning or replacement shall be used in the injection pump or injection valve assemblies. The engines shall be equipped with a built-in gear-type, engine-driven fuel transfer pump, capable of supplying fuel through the filters to the injection pump at constant pressure.

7. In addition to the standard fuel filters provided by the engine manufacturer, there shall also be installed a primary fuel filter and a water separator in the fuel inlet line to the engine.

8. The engine shall be provided with removable wet-type cylinder liners of close grained alloy iron, heat treated for proper hardness as required for maximum liner life. The cylinder block shall be a one-piece stress-relieved gray iron casting.

9. The engine shall have a gear-type lubricating oil pump for supplying oil under pressure to main bearings, crank pin bearings, pistons, piston pins, timing gears, camshaft bearings, valve rocker mechanism, and governor. Effective lubricating oil filters shall be provided and so located and connected that all oil being circulated is continuously filtered and cleaned. Filters shall be accessible, easily removed and cleaned and shall be equipped with a spring-loaded by-pass valve as an insurance against stopping of lubricating oil circulation in the event the filters become clogged. The engine shall have a suitable water cooled lubricating oil cooler.

10. The engine shall be provided with one or more engine mounted dry type air cleaners of sufficient capacity to protect effectively the working parts of the engine from dust and grit.

11. During each initial start of the engine, a system shall be provided to pre-lube at low idle speed. When the internal oil pressure reaches a predetermined safe value, the engine will then increase to generator set operation speed.

12. The generator set supplier shall furnish the Engineer of Record certified curves, certified by the engine generator manufacturer, that the engine and generator of the model and series to be furnished will produce no less than the kW rating as specified. Manufacturer's literature indicating the BHP rating, overall generator efficiency, required auxiliaries, guarantee of fuel consumption, governor performance, and torsional vibration shall be submitted. Certified curves shall be furnished to the Engineer of Record before ordering the equipment.

13. Engine protective systems shall be provided to cause engine shut-down on low lubricating oil pressure, high water temperature, overcrank, and overspeed. The fuel supply to the engine shall automatically close on a fault condition. Pilot lights shall be provided to visually indicate the cause of engine shutdown. Engine protective systems shall be provided with pre-alarm for pending engine shut-down, for low lubricating oil pressure and high water temperature.

B. Cooling System

1. The engine shall be equipped with a water cooling system adequate to maintain the engine at the recommended temperature level when the generating plant is delivering full-rated load in an ambient temperature of 122°F.

2. The engine shall be furnished with a unit-mounted radiator-type cooling system having sufficient capacity for cooling the engine when the diesel generator set is delivering full rated load in an ambient temperature not to exceed 122ºF. The engine shall be provided with a thermostatic valve placed in the jacket water outlet between the engine and the cooling source. This valve shall maintain the proper jacket water temperature under all load conditions. Total air restriction from the radiator shall not exceed 0.5 inch of water at both inlet and outlet. A flexible connecting section shall be provided between the radiator and discharge louver frame. All cooling hoses shall be silicone. A coolant level sight glass shall be mounted on the top of the radiator tank assembly.

3. Closed circuit jacket water systems shall be treated with a rust inhibitor as recommended by the engine manufacturer.

4. Provide one or two unit-mounted thermal circulation-type water heaters incorporating a thermostatic switch shall be furnished to maintain engine jacket water at minimum of 70ºF. The heaters shall be 120-volt, single-phase, 60-Hertz size as required to achieve above-noted ambient temperature.

5. The expansion tank of the radiator shall be fitted with a low water level switch and wired into the safety shutdown system of the unit.

6. All fuel piping shall be installed in containment piping.

7. The cooling system shall be designed and engineered to be a functional unit capable of operating with a 50% ethylene glycol and 50% water solution. The cooling system shall be winterized for operating in temperatures to 0°F.

C. DC Electric Starting System

1. Batteries: - The generator set shall be equipped with a 24-volt DC electric starting system. Heavy-duty, lead-acid storage batteries rated no less than 225 ampere hours and have sufficient capacity for cranking the engine for at least 4 minutes at firing speed in an ambient temperature of 40°F shall be provided complete with battery rack, clamps, and cables.

   a. The cranking period shall be controlled by a speed sensor that disengages the starting motor when the engine has started. Battery charging alternator or generator voltage may not be used for this signal. The cranking period shall be limited to 30 seconds. At the end of the cranking period the starter shall disengage and the overcrank alarm shall be activated.

   b. The starting system shall be designed for restarting in the event of a false engine start by permitting the engine to completely stop and then re-engage the starter.

2. Battery Tray: A battery tray shall be provided for the batteries and shall conform to NEC 480-7(b). It shall be constructed of fiberglass and so treated as to be resistant to deterioration by battery electrolyte. Further, construction shall be such that any spillage or boil-over of battery electrolyte shall be contained within the tray to prevent a direct path to ground.

3. Battery Charger: A current-limiting, automatic 24-volt DC charger shall be furnished to automatically recharge batteries. Charger shall float at

2.17 volts per cell and equalize at 2.33 volts per cell. It shall include overload protection, silicon diode full wave rectifiers, voltage surge suppressor, DC ammeter, DC voltmeter, and fused AC input. AC input voltage shall be 120 volts, single phase. Amperage output shall be no less than 10 amperes. Charger shall be wall-mounting type in NEMA 1 enclosure, and UL listed as an industrial control panel. The charger shall be as manufactured by LaMarche per NFPA 110 and UL 508. The charger shall be mounted and wired within the enclosure for the generator set by enclosure manufacturer.

D. Generator

1. The generator shall be a type specially designed for induction motor starting. It shall be capable with its prime mover of starting the connected loads and running continuously for the duration of a normal power outage. The voltage drop under starting conditions specified shall be such as to maintain, without impairment, all plant operation functions.

2. The generator and exciter shall be drip proof, with split sleeve, or ball race bearings. A shaft-mounted brushless exciter shall be a part of the assembly. The stator core shall be built up of high-grade silicon steel laminations precision punched, and individually insulated. Armature lamination followers and frame ribs shall be welded integral with the frames for support of the stator core. A directional blower shall be mounted on the unit to draw cooling air from the exciter and over the rotor poles and through louvered openings on the opposite end.

3. The exciter shall be a fast-response type, with a rotating three-phase full-wave bridge. The exciter shall have a low time constant and large capacity to minimize voltage transients under severe load changes.

4. Generator stator and exciter stator windings shall be a full Class H insulated system vacuum impregnated with epoxy resin which after curing shall have additional treatment of epoxy for resistance to an environment of moisture and salt air. Generator coils shall be random or machine wound, and precision made, with turn-to-turn and ground insulation of glass yard and mica materials. The average di-electric strength for the form wound coils of the ground and end turn insulation shall not be less than 400 volts per mil. Spacers shall be tightly secured between end turns, and the end turn assembly securely lashed to the support rings.

5. Generator rotor poles shall be built up of individually insulated silicon steel punching. Poles shall be wound and bonded with high strength epoxy resin. Cage connections to the amortisseur rings shall be braze for strong construction and permanent electrical characteristics. Each pole shall be securely bolted to the rotor shaft with bolts sized for the centrifugal forces on the rotor. Generator windings shall be braced for full line to ground fault currents, with solidly grounded neutral system.

6. Accessories and Attachments:

   a. Low-Voltage Terminal Boxes: The generator shall have separate AC and DC low-voltage terminal boxes with suitably numbered terminal strip for required connections.

   b. All required PTs, CTs, and protective relays shall be supplied by the engine-generator manufacturer as required.

   c. Space Heaters: Space heaters shall be installed on the generator frame to maintain temperature of the entire generator above the dew point while not in use. Power supply shall be 120 volts single phase. Heaters will be automatically disconnected when engine starts. The magnetic starter for the heaters shall be mounted in the terminal box. Furnishing and installation of control and starter to be by engine/generator supplier.

7. Generator Associated Controls:

   a. Voltage Regulator:

      (1) The generator manufacturer shall furnish a hermetically sealed, silicon controlled rectifier type voltage regulator employing a zener reference with a +1 percent regulation for the generator. The regulator shall include three-phase voltage sensing, automatic short circuit protection and shall include automatic under frequency protection to allow the generator to operate at no load at less than synchronous speed for engine start-up and shutdown procedures. Switches and/or fuses shall not be used to provide this protection. An over-voltage sensing module with manual reset shall be furnished with the regulator. A volt-per-Hz sensing module shall be provided as part of the regulation system.

(2) A voltage adjustment rheostat for 5% voltage adjustment on the unit shall be provided.

(3) High-voltage step-down potential transformers shall be provided for the voltage regulator power input and sensing circuits if required.

b. Sustained Short Circuit: A permanent magnetic exciter shall be provided on the unit for sustaining a current of 300% during a short circuit, permitting the generator breaker to trip on overload. To prevent possible overheating of the armature windings, appropriate relaying shall be supplied to limit the fault to ten seconds. All current transformers required shall be supplied by the switchgear manufacturer.

E. Controls

1. Engine/Generator Control Panel: The generator set shall be provided with a microprocessor-based control system that is designed to provide automatic starting, monitoring, and control functions for the generator set. The control system shall also be designed to allow local monitoring and control of the generator set, and remote monitoring and control as described in this specification. The control shall be mounted on the generator set. The control shall be vibration isolated and prototype tested to verify the durability of all components in the system under the vibration conditions encountered. The generator set mounted control shall include the following features and functions:

2. Control Switches:

a. Mode Select Switch. The mode select switch shall initiate the following control modes. When in the RUN or Manual position the generator set shall start, and accelerate to rated speed and voltage as directed by the operator. In the OFF position the generator set shall immediately stop, bypassing all time delays. In the AUTO position the generator set shall be ready to accept a signal from a remote device to start and accelerate to rated speed and voltage.

b. EMERGENCY STOP switch. Switch shall be Red "mushroom-head" push-button Depressing the emergency stop switch shall cause the generator set to immediately shut down, and be locked out from automatic restarting.

c. RESET switch. The RESET switch shall be used to clear a fault and allow restarting the generator set after it has shut down for any fault condition.

(1) PANEL LAMP switch. Depressing the panel lamp switch shall cause the entire panel to be lighted with DC control power. The panel lamps shall automatically be switched off 10 minutes after the switch is depressed, or after the switch is depressed a second time.

3. Generator Set AC Output Metering: The generator set shall be provided with a metering set including the following features and functions:

a. Digital metering set, 0.5% accuracy, to indicate generator RMS voltage and current, frequency, output current, output kW, kW-hours, and power factor. Generator output voltage shall be available in line-to-line and line-to-neutral voltages and shall display all three-phase voltages (line to neutral or line to line) simultaneously.

b. The control system shall monitor the total load on the generator set, and maintain data logs of total operating hours at specific load levels ranging from 0 to 110% of rated load, in 10% increments. The control shall display hours of operation at less than 30% load and total hours of operation at more than 90% of rated load.

c. The control system shall log total number of operating hours, total kWH, and total control on hours, as well as total values since reset.

4. Generator Set Alarm and Status Display:

a. The generator set control shall include LED alarm and status indication lamps. The lamps shall be high-intensity LED type. The lamp condition shall be clearly apparent under bright room lighting conditions. Functions indicated by the lamps shall include:

(1) The control shall include five configurable alarm-indicating lamps. The lamps shall be field adjustable for function, color, and control action (status, warning, or shutdown).

(2) The control shall include green lamps to indicate that the generator set is running at rated frequency and voltage, and that a remote start signal has been received at the generator set. The running signal shall be based on actual sensed

voltage and frequency on the output terminals of the generator set.

(3) The control shall include a flashing red lamp to indicate that the control is not in automatic state, and red common shutdown lamp.

(4) The control shall include an amber common warning indication lamp.

b. The generator set control shall indicate the existence of the following alarm and shutdown conditions on an alphanumeric digital display panel:

(1) Low oil pressure (alarm).
(2) Low oil pressure (shutdown).
(3) Oil pressure sender failure (alarm).
(4) Low coolant temperature (alarm).
(5) High coolant temperature (alarm).
(6) High coolant temperature (shutdown).
(7) High oil temperature (warning).
(8) Engine temperature sender failure (alarm).
(9) Low coolant level (alarm or shutdown – selectable).
(10) Fail to crank (shutdown).
(11) Fail to start/overcrank (shutdown).
(12) Overspeed (shutdown).
(13) Low DC voltage (alarm).
(14) High DC voltage (alarm).
(15) Weak battery (alarm).
(16) Low fuel-daytank (alarm).
(17) High AC voltage (shutdown).
(18) Low AC voltage (shutdown).
(19) Under frequency (shutdown).
(20) Over current (warning).
(21) Over current (shutdown).
(22) Short circuit (shutdown).
(23) Over load (alarm).
(24) Emergency stop (shutdown).

c. Provisions shall be made for indication of four customer-specified alarm or shutdown conditions. Labeling of the customer-specified alarm or shutdown conditions shall be of the same type and quality as the above specified conditions. The non-automatic indicating lamp shall be red, and shall flash to indicate that the generator set is not able to automatically respond to a command to start from a remote location.

d. The control shutdown fault conditions shall be configurable for fault bypass.

5. Engine Status Monitoring:

a. The following information shall be available from a digital status panel on the generator set control:

(1) Engine oil pressure (psi or kPA).
(2) Engine coolant temperature (degrees F or C).
(3) Engine oil temperature (degrees F or C).
(4) Engine speed (rpm).
(5) Number of hours of operation (hours).
(6) Number of start attempts.
(7) Battery voltage (DC volts).
(8) The control system shall also incorporate a data logging and display provision to allow logging of the last 10 warning or shutdown indications on the generator set, as well as total time of operation at various loads, as a percent of the standby rating of the generator set.

6. Engine Control Functions:

a. The control system provided shall include a cycle cranking system, which allows for user selected crank time, rest time, and number of cycles. Initial settings shall be for 3 cranking periods of 15 seconds each, with 15-second rest period between cranking periods.

b. The control system shall include an idle mode control, which allows the engine to run in idle mode in the RUN position only. In this mode, the alternator excitation system shall be disabled.

7. The control system shall include an engine governor control, which functions to provide steady state frequency regulation as noted elsewhere in this specification. The governor control shall include adjustments for gain, damping, and a ramping function to control engine speed and limit exhaust smoke while the unit is starting.

a. The control system shall include time delay start (adjustable from 0 to 300 seconds) and time delay stop (adjustable from 0 to 600 seconds) functions.

b. The control system shall include sender failure monitoring logic for speed sensing, oil pressure, and engine temperature which is capable of discriminating between failed sender or wiring components, and an actual failure conditions.

8. Alternator Control Functions:

a. The generator set shall include an automatic digital voltage regulation system that is matched and prototype tested by the engine manufacturer with the governing system provided. It shall be immune from misoperation due to load-induced voltage waveform distortion and provide a pulse width modulated output to the alternator exciter. The voltage regulation system shall be equipped with three-phase RMS sensing and shall control buildup of AC generator voltage to provide a linear rise and limit overshoot. The system shall include a torque-matching characteristic, which shall reduce output voltage in proportion to frequency below an adjustable frequency threshold. Torque matching characteristic shall be adjustable for roll-off frequency and rate, and be capable of being curve-matched to the engine torque curve with adjustments in the field. The voltage regulator shall include adjustments for gain, damping, and frequency roll-off. Adjustments shall be broad range, and made via digital raise-lower switches, with an alphanumeric LED readout to indicate setting level. Controls shall be provided to monitor the output current of the generator set and initiate an alarm (over current warning) when load current exceeds 110% of the rated current of the generator set on any phase for more than 60 seconds. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (over current shutdown). The protective functions provided shall be in compliance to the requirements of NFPA 70 Article 445.

b. Controls shall be provided to individually monitor all three phases of the output current for short circuit conditions. The control/protection system shall monitor the current level and voltage. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (short circuit shutdown). The protective functions provided shall be in compliance to the requirements of NFPA 70 Article 445.

c. Controls shall be provided to monitor the kW load on the generator set, and initiate an alarm condition (over load) when total load on the generator set exceeds the generator set rating for in excess of 5 seconds. Controls shall include a load shed control, to operate a set of dry contacts (for use in shedding customer load devices) when the generator set is overloaded.

9. An AC over/under voltage monitoring system that responds only to true RMS voltage conditions shall be provided. The system shall initiate shutdown of the generator set when alternator output voltage exceeds 110% of the operator-set voltage level for more than 10 seconds, or with no intentional delay when voltage exceeds 130%. Under voltage shutdown shall occur when the output voltage of the alternator is less than 85% for more than 10 seconds.

10. Other Control Functions:

a. The generator set shall be provided with a network communication module to allow LonMark compliant communication with the generator set control by remote devices. The control shall communicate all engine and alternator data, and allow starting and stopping of the generator set via the network.

b. A battery monitoring system shall be provided which initiates alarms when the DC control and starting voltage is less than 25 VDC or more than 32 VDC. During engine cranking (starter engaged), the low voltage limit shall be disabled, and DC voltage shall be monitored as load is applied to the battery, to detect impending battery failure or deteriorated battery condition.

11. Control Interfaces for Remote Monitoring:

a. The control system shall provide four programmable output relays. These relay outputs shall be configurable for any alarm, shutdown, or status condition monitored by the control. The relays shall be configured to indicate:

(1) Generator set operating at rated voltage and frequency.
(2) Common warning.
(3) Common shutdown.
(4) Load shed command.

b. A fused 10 amp switched 24 VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit whenever the generator set is running.

c. A fused 10 amp 24 VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit at all times from the engine starting/control batteries.

d. The control shall be provided with a direct serial communication link for the LonWorks communication network interface as described elsewhere in this specification and shown on the Drawings.

F. Generator Circuit Breaker

1. Type: Main line, molded case, circuit breaker mounted upon and sized to the output of the generator shall be installed as a load circuit interrupting and protection device. It shall operate both manually for normal switching functions and automatically during overload and short circuit conditions.

2. The breaker shall include ground fault sensing that will trip the breaker on ground fault conditions.

3. The trip unit for each pole shall have elements providing inverse time delay during overload conditions and instantaneous magnetic tripping for short circuit protection. The circuit breaker shall meet standards established by Underwriters Laboratories, National Electric Manufacturers Association, and National Electrical Code.

4. Generator exciter field circuit breakers do not meet the above electrical standards and are unacceptable for line protection.

5. Circuit breaker shall have battery voltage operated shunt trip wired to safety shutdowns to open the breaker in the event of engine failure.

6. Each circuit breaker shall be equipped with an auxiliary contact for remote annunciation of breaker position.

7. The rating of each circuit breaker shall allow the starting of full generator SKVA.

8. The circuit breaker enclosure, together with all specified circuit breakers, shall be designed for the specific generator set specified and be equipped

with an isolated neutral conductor bus, rear copper stabs, or load cable lugs and finish painted to match the generator set.

G. Exhaust and Muffler System

1. The Contractor shall furnish and install, according to manufacturer's recommendations, silencers, wall thimbles, stainless steel flexible corrugated exhaust connections, flanges, hangers and supports, pipe and fittings, and insulation as specified in this Section or as indicated on the Drawings to provide a complete and operable exhaust system.

   a. Exhaust Silencer: A critical type, side inlet, end outlet, Nelson, Maxim M-51, or Silex JB silencer and a flexible stainless steel exhaust fitting properly sized shall be furnished and installed according to the manufacturer's recommendation. Mounting shall be provided by the Contractor as required. The silencer shall be mounted so that its weight is not supported by the engine nor will exhaust system growth due to thermal expansion be imposed on the engine. Exhaust pipe size shall be sufficient to ensure that exhaust back pressure does not exceed the maximum limitations specified by the engine manufacturer. So called "spiral" or truck mufflers are disallowed and will not be considered as equal to the industrial quality silencers specified above.

   b. The silencer shall be fitted with a tail pipe extension terminating at a 45° angle to prevent the entrance of rainwater. It shall also be fitted with an expanded metal bird screen.

   c. Rain Skirt: At the point where the exhaust pipe flexible tubing penetrates the roof of the enclosure, a suitable "rain skirt" and collar shall be provided by the manufacturer. It shall be designed to prevent the entrance of rain and allow for expansion and vibration of the exhaust piping without chafing or stress to the exhaust system. This detail must appear on the Drawings submitted for approval.

H. Fuel System

1. The Contractor shall provide a diesel fuel system consisting of sub-base fuel storage piping, fuel oil level gauges and miscellaneous appurtenances necessary for complete and working installation as specified in this Section.

2. Base and Mounting: The generator set and enclosure shall be mounted and shipped to the jobsite on the formed steel sub-base provided by generator supplier. Provisions for crane unloading of the complete package shall be designed into the base of the unit.

3. The fuel tank base dimensions shall be full size of the generator base and be formed from steel of a minimum metal thickness of 0.25-inch (1/4-inch) and shall be fitted with low fuel level and inner wall leak alarm contact for local and remote annunciation. The fuel tank height shall not exceed 30 inches.

4. Filter/Separator: In addition to the standard fuel filters provided by the engine manufacturer, there shall also be installed a primary fuel filter/water separator in the fuel inlet line to the engine. The filter shall be a Fleetguard, Racor, simplex or duplex Model 1000, as required for proper fuel flow. It shall be supplied and installed by the enclosure supplier.

5. The base and enclosure assembly allow room within the package to mount and maintain the specified battery charger, engine starting batteries, racks, and cables, main line circuit breaker, and engine-generator control panel, and other items as specified or as shown on the Drawings.

6. The weight of the entire unit consisting of generator set, base, enclosure, and all other specified items including all liquids (i.e., fuel oil, lube oil, and cooling water) shall be calculated by the manufacturer. The base of the unit shall be designed and manufactured as a heavy-duty, formed-steel construction with four-point lifting provision to support the calculated weight. Details and manufacturer's certification of the base construction shall be included with the drawings submitted for approval as well as all weight calculations.

7. Base Tank (UL142): The unit shall be equipped with a double-wall in-base fuel tank and shall be supplied with a lockable, exterior located fill cap. The capacity (gallon) of the base tank shall permit operation of the generator for 3 days at 75%t load. All necessary fuel and vent lines for proper engine performance shall be provided as well as a means to readily detect the fuel level in the tank without the use of a measuring stick.

8. Platforms and Stairs: Working platforms and stairs, complete with hand railings, shall be provided if necessary to allow for safe maintenance of the generator set without the use of ladders. Working platforms and stairs shall be made of aluminum, and shall be manufactured to be non-slip. Working platforms, stairs and hand railings shall be in compliance with OSHA standards

I. Sound Attenuated Weatherproof Enclosure

1. The intent of this Specification is to provide the Town with a weatherproof sound-attenuated generator set enclosure complete in every detail and requiring no additional in-field modifications or assembly, except where specifically allowed by these Specifications. The enclosure is to be accurately dimensioned so as to be in compliance with the National Electrical Code (NEC), and the National Fire Protection Association (NFPA) for clearance of all specified items included therein, and all applicable fire codes for a structure and application of this type.

2. Construction drawings, engineering blueprints, or other bid documents accompanying these Specifications which show switchgear, transfer switch(es), motor controllers(s), and/or other service or distribution equipment within the generator set enclosure must be considered complimentary to and not in lieu of this written Specification. Drawings submitted for approval shall reflect this fact clearly and any contradiction or omission shall be brought to the attention of the Director of Environmental Services.

3. The enclosure shall be of sheet metal or aluminum construction as designed and manufactured by the generator supplier. The design and construction shall be modular in that the side panels, doors, and louvers shall not exceed 36 inches in width and shall be a minimum thickness of 14 gauges for all component parts. The roof of the enclosure shall meet or exceed the minimum gauge requirements specified but, in addition, shall be strengthened in such a manner as to support the largest commercially available exhaust silencer recommended by the manufacturer for this application.

    a. Construction: All sheet metal used in the construction shall be primed and painted. This sequence of metal forming, and final assembly of the enclosure must be noted on the drawings submitted for approval and a factory certification of this manufacturing process shall accompany the "as-built" drawings provided to the Owner. Walls and roof shall be constructed of 14-gauge steel.

    b. Attenuation: The enclosure will be designed to provide a noise emission rating of 76 decibels at a distance of 23 feet from any point on the generator. Utilize plenum if necessary to meet this requirement.

c. Doors: All doors on the enclosure shall be strategically located in areas as to allow ease of maintenance on the generator set and allow good access to and visibility of instruments, controls, engine gauges, etc. The doors shall be fitted with bolt-on stainless steel hinges constructed with stainless steel hinge pins of a diameter not less than 0.25-inch. Each door shall be fitted with flush-mounted, adjustable, key-lock latches. Enclosure shall be rated for 110 MPH constant wind. Certified calculations shall be provided to the Engineer of Record.

d. Louvers: All louvers fixed and drainable with bird screen and shall be designed to the total engine/generator cooling air requirements used in this application. Maximum air velocity shall be 700 CFM. Manufacturer shall submit air flow calculations to the Engineer of Record for review.

e. Components: All components of the enclosure shall be assembled utilizing 0.375-inch minimum stainless steel bolts, nuts, and lock washers. In addition, watertight neoprene flat washers shall be used on all roof bolts.

f. The manufacturer of the enclosure shall provide mounting brackets for the exhaust silencer specified. In addition, a tail pipe extension terminating in a horizontal plane and cut at a 45-degree angle to prevent the stainless steel, seamless flexible exhaust tube and all necessary bolts, flanges, and gaskets to mate with the engine and the exhaust silencer shall be provided. The length of the flexible tubing shall be such that additional solid metal nipples or sections shall not be required to be provided as spacers between the engine exhaust port and the exhaust silencer.

g. All wiring to the switchgear from the generator shall be in conduits made from Rigid Metal, IMC, or liquid-tight material specifically manufactured for electrical use. All connections at the generator set shall be flexible, and all shall be provided and installed by enclosure manufacturer.

h. Oil and Water Drains: All necessary fittings, hoses, shut-off valves, etc., shall be provided by the manufacturer of the enclosure to facilitate lube oil and water drain at the exterior of the enclosure. In addition engines equipped with crank-case breather tubes shall have this tube terminate at the exterior of the enclosure directly under the radiator air discharge louver.

i. Enclosure: The enclosure shall be skintight construction to meet specific project requirements.

j. Under no circumstances shall the floor area or any of its parts be considered for cooling air intake or discharge requirements of the generator set or its associated equipment, nor shall its properties as a "heat-sink" or heat dissipating medium be utilized in any manner whatsoever in this application.

k. All items specified in this Section shall be supplied and rewired and/or pre-installed.

l. Rain dress for exhaust pipe and tail pipe extension. Rain dress shall prevent the entrance of rain and allow for the expansion and vibration of the exhaust piping without stress to the exhaust system. Rain dress shall be stainless steel and provided by the enclosure supplier.

m. Coordination between Contractor and Manufacturer is mandatory and the equipment Supplier's instructions will be adhered to without exception.

J. Spare Parts

1. The manufacturer shall furnish two complete spare replacement sets of all filter elements required for the generator unit.

2.06 AUTOMATIC TRANSFER SWITCH

A. The rating of the automatic transfer switch (ATS) shall be sized to the station main breaker rating. The ATS shall be service entrance rated if required by NEC.

B. The automatic transfer switch shall be mechanically held on both the emergency and the normal side, and rated for continuous duty in an unventilated enclosure.

C. The switch shall be solid-state, electronically controlled, double throw, actuated by a single electrical operator momentarily energized. The transfer switch shall be capable of transferring successfully in either direction. Power for the transfer shall be derived from the supply being transferred to.

D. The normal and standby contacts shall be positively interlocked mechanically (mounted on a common steel bar) and electrically to prevent simultaneous closing. Contacts shall be mechanically locked in position in both the normal and emergency 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. Main and arcing contacts shall be fully visible without major disassembly to facilitate inspection and maintenance. All maintenance required shall be accomplished by front access only without major disassembly. Switch shall be designed for inductive loads and shall be equipped with magnetic blowouts and arc barriers on all poles.

E. The transfer switch shall be equipped with a manual operator to prevent injury to the operating personnel if the electrical operator should suddenly become energized during manual transfer and to enable one hand manual operation which, when utilized, can provide a neutral position for servicing operations. The manual operator shall provide the same contact-to-contact transfer speed as the electrical operator to prevent flashover when switching the main contacts.

F. The automatic transfer switch shall be a single motor operated circuit breaker type with interpole barriers and arc chutes. So-called linear actuated or solenoid operated switches are approved only when manufactured by the Generator manufacturer. All elements of the drive system must be replaceable from the front of the switch, and the power switching devices must be replaceable without removal of the connecting cables.

G. Accessories: The automatic load transfer switch specified shall include the following accessories:

1. Full three-phase protection. Solid-state phase monitor shall be field adjustable, close differential type, with 85 to 100% pick-up and 75 to 98% drop-out. A single adjustment shall set all phases.

2. Solid-state voltage and frequency monitor on generator output to prevent transfer before proper output parameters, adjustable 85 to 100% of generator rated voltage and frequency, with adjustable drop-out of 75 to 85% of pick- up setting.

3. Adjustable, solid-state, from 0.5 to 6 seconds time delay on engine starting to override momentary outages and nuisance voltage dips.

4. Adjustable, solid-state, from 2 to 30 minutes time delay on retransfer of load to normal.

5. Adjustable, solid-state, from 2 to 30 minutes cool-down timer wherein the generator set runs unloaded after retransfer to normal source.

6. Motor load decay time delay, pneumatic type, adjustable for 1.5 to 15 seconds and operating on transfer to either source.

7. Adjustable, solid-state, from 0.5 second to 5 minutes time delay on transfer to emergency source after verification of emergency source voltage and frequency.

8. Test switch to simulate normal power failure, heavy duty, oil tight, pushbutton type with momentary contacts and override circuitry to revert to normal power if emergency source should fail during test.

9. Motor circuit disconnect switch.

10. Three pilot lights, to indicate the normal and emergency position of the transfer switch, and mode selector switch in "off" position.

11. Engine starting contacts to provide for generator starting from each unit independent of the other.

12. One (1) auxiliary SPDT contact on emergency breaker and one SPDT auxiliary contact on normal breaker.

13. Plant exerciser to start and run the generator set with or without load (in-field switchable) each 168 hours for a 30-minute interval.

14. Four position-mode selector switches marked "test", "auto", "off", and "engine start".

15. Equipment grounding lug.

16. Cable connection lugs, cu/al type for all conductors.

17. The ATS shall be either solid neutral or switched neutral design as required by the Town.

H. The transfer switch shall be listed under UL 1008, in NEMA 4X stainless steel enclosure, manufacturer shall be in accordance with Appendix A, Approved Manufacturer List of the Town CSM.

PART 3 EXECUTION

3.01 LAYOUT OF WORK

A. The Contractor shall lay out the work and shall be responsible for all necessary lines, levels, elevations, and measurements. The Drawings indicate the extent and general arrangement of the components. The Contractor shall become familiar with work of other trades engaged in the construction. Exact routing of raceways, piping and locations of equipment may be governed by structural conditions and

obstructions. The Contractor shall coordinate with the equipment shop drawings for locations of equipment to be connected as furnished by others. This is not to be construed to permit redesigning systems.

3.02 INSTALLATION

A. Comply with Referenced Standards, National Electrical Code (NEC), National Electrical Safety Code, and local codes and rules and regulations of local agencies having jurisdiction. The size of conductors, circuit breakers, motor controllers and protective devices indicated or specified shall meet all requirements of the NEC.

B. A standby generator shall be installed on and secured to a reinforced concrete pad as indicated on the Drawings or as recommended by the manufacturer per Town's approval. The concrete pad shall be designed to accommodate the standby generator, enclosure, and housed equipment.

C. Fuel storage tank shall be installed on, and secured to, a reinforced concrete pad as indicated on the Drawings or as recommended by the manufacturer per Town's approval.

3.03 SYSTEM OPERATION

A. Automatic Operation: The generator set shall automatically start upon a signal from the automatic transfer switch and after the transfer switch has transferred back to normal, the generating plant shall be allowed to operate at no load for an adjustable period of 2 to 30 minutes to allow it to cool before shutdown.

1. The generating plant shall start if any phase of the normal source drops below an adjustable set point of 75 to 98% of rated system voltage, after an adjustable time delay of 0 to 6 seconds, to allow for momentary dips. The transfer switch shall transfer to the standby source after an adjustable time delay 0 seconds to 5 minutes when the frequency and voltage output have reached an adjustable set point of 85 to 100% of rating.

2. Upon restoration of frequency and voltage to an adjustable set point on all phases of the normal power ratings, the transfer switch shall retransfer to the normal power source after an adjustable time delay period of 0 to 30 minutes. If the standby power source should fail during the time delay period, the time delay shall be by-passed and the switch shall return immediately to the normal source.

3. There shall be a delay in transfer to stand-by power or retransfer to commercial power (delayed up to 10 seconds) to prevent excessive switching transients due to non-synchronization of two power supplies.

This may be accomplished by the use of an in-phase monitor, load disconnect/reset controls, neutral position delay or other methods with previous approval. If the load disconnect/reset method is chosen, coordinate and provide required conduit and wire between transfer switch and motor starters.

B. Emergency Stop: An emergency stop pushbutton shall be installed on the exterior of the generator room or on the weatherproof enclosure. When the pushbutton is activated, the engine-generator set shall be shut down.

1. The pushbutton shall be red in color, 2-1/2 inches minimum diameter, and shall have cover or release device to prevent accidental operation.

2. An engraved nameplate with the words *Generator Emergency Stop*, in 1/2-inch-high letters, shall be mounted on the wall above the pushbutton.

3.04 SERVICE

A. Furnish the services of a competent and experienced manufacturer's field service technician who has complete knowledge of proper operation and maintenance of the equipment for a period of not less than 2 days in two separate visits to inspect the installed equipment, supervise the initial test run, and to provide instructions to the plant personnel. The first visit will be for checking and inspecting the equipment after it is installed.

B. At least 1 of the 2 days shall be allocated solely to the instruction of plant personnel in operation and maintenance of the equipment. This instruction period shall be scheduled at least 10 days in advance with the Town and shall take place during plant start-up and acceptance by the Town.

C. One final hard copy and one final electronic copy on CD/DVD final copies of operation and maintenance manuals specified must be delivered to the Owner before scheduling the instruction period.

3.05 SYSTEM SERVICE CONTRACT

A. The supplier of the standby power system must provide a copy of and make available to the Town the standard service contract which, at the Town's option, may be accepted or refused. This contract will accompany documents, drawings, catalog cuts, specification sheets, and wiring or outline drawings, etc., submitted for approval to the Director of Environmental Services. The contract shall be for the complete services rendered over a period of 1 year.

3.06 TESTING

A. The engine-generator set shall be given the manufacturer's standard factory load test before shipment.

B. Before final acceptance of the generator set, all equipment furnished under this Section shall be field tested per NFPA 110 to show it is free of any defects and the generator set can operate satisfactorily under full load test using resistance type load banks (brine tanks not acceptable). Test shall be for 4 continuous hours.

1. Load bank testing shall be done in the presence of the Town's appointed representative after the unit is permanently installed in accordance with Drawings and Specifications.

2. Before acceptance, any defects that become evident during this test shall be corrected at no expense to the Town.

C. An all-in-place static alignment check of all rotating components shall be made before first start-up, after unit is secured in place and all final connections are made.

D. The services of a factory-trained service engineer who is specifically trained on the type of equipment in this Section specified shall be provided to fully inspect the installation, calibrate the equipment and supervise testing.

E. Upon completion of testing, the services of the service engineer shall be provided for instruction of the Town's operating and maintenance personnel. The instructions shall include operating and maintenance procedures specifically written for the equipment installed and not generally written to cover all options available. Once completely satisfied with the instructions, the Town will consider the services completed.

F. The transfer switch shall be operationally tested as part of the complete system to verify satisfactory operation under the worst-case conditions to be provided by the electrical system.

G. To ensure that the equipment has been designed and built to the highest reliability and quality standards, the manufacturer and local representative shall be responsible for three separate tests: design prototype tests, final production tests, and site tests.

1. Design Prototype Tests: Components of the emergency system such as the engine/generator set, transfer switch, and accessories shall not be subjected to prototype tests since the tests are potentially damaging.

Rather, similar design prototypes and preproduction models, which will not be sold, shall have been used for the following tests. Prototype test programs shall include the requirements of NFPA 110 and the following:

a. Maximum power (KW).
b. Maximum motor starting (KVA) instantaneous voltage dip.
c. Alternator temperature rise by embedded thermocouple and by resistance method per NEMA MG1-2240 and 16.40.
d. Governor speed regulation under steady-state and transient conditions.
e. Voltage regulation and generator transient response.
f. Fuel consumption at 1/4, 1/2, 3/4, and full load.
g. Harmonic analysis, voltage waveform deviation, and telephone influence factor.

(1) Three-phase short circuit tests.
(2) Alternator cooling air flow.
(3) Tensional analysis testing to verify that the generator set is free of harmful tensional stresses.
(4) Endurance testing.

2. Final Production Tests: Each generator set shall be tested under varying loads with guards and exhaust system in place. Tests shall include:

a. Single-step load pickup.
b. Transient and steady-state governing.
c. Safety shutdown device testing.
d. Voltage regulation.
e. Rated power.
f. Maximum power.
g. Upon request, arrangements to either witness this test will be made or a certified test record will be sent before shipment.

3. Site Tests: An installation check, start-up and building load test shall be performed by the manufacturer's local representative. The Director of Environmental Services, regular operators, and the maintenance staff shall be notified of the time and date of the site test. The tests shall include:

a. Fuel, lubricating oil, and antifreeze shall be checked for conformity to the manufacturer's recommendations, under the environmental conditions present and expected.

b. Accessories that normally function while the set is standing by shall be checked before cranking the engine. These shall include:

block heaters, battery charger, generator strip heaters, remote annunciator, etc.

c. Start-up under test mode to check for exhaust leaks, path of exhaust gases outside the building, cooling air flow, movement during starting and stopping, vibration during running, normal and emergency line-to-line voltage, and phase rotation.

d. Automatic start-up shall be tested by means of simulated power outage to test remote/automatic.

H. Starting, Transfer of the Load, and Automatic Shutdown: Before this test, all transfer switch timers shall be adjusted for proper system coordination. Engine coolant temperature, oil pressure, and battery charge level along with generator voltage, amperes, and frequency shall be monitored throughout the test. An external load bank shall be connected to the system if sufficient building load is unavailable to load the generator to the nameplate kW rating.

I. After testing is complete, the Contractor shall fill all fuel storage tanks to Town's desired capacity with #2 diesel fuel.

END OF SECTION

SECTION 21
POLICIES FOR
FATS, OILS, AND GREASE

PART 1 PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Town of Howey-in-the-Hills recognizes the need to develop Best Management Practices (BMPs) to reduce the discharge of Fats, Oils, and Grease (FOG) into the Town's wastewater collection system. Reducing FOG is necessary to protect public health and the environment from the hazards caused by sanitary sewer overflows. In the sewer system, FOG coats the interior surface of the pipes. Over time, FOG accumulations restrict the flow of wastewater through the sewers and can clog sewer pipes, causing sewage to back up and spill on the ground and into waterways, homes, and buildings. This is called a sanitary sewer overflow and endangers public health and the environment.

B. Besides health and environmental concerns, excessive FOG discharges can also create unnecessary costs to the ratepayers by requiring Town staff to clean sewer lines more frequently and to provide additional maintenance on sewer lift stations and the wastewater treatment plant.

C. Traditionally, Food Service Establishments (FSEs) (typically restaurants) that prepare and serve food or beverages for sale and consumption discharge FOG. By working with food daily, all FSEs generate varying amounts of FOG. Although they are most commonly associated with fried foods, FOG are generated in significant quantities in all types of commercial food preparation.

D. The Town of Howey-in-the-Hills recognizes that BMPs are needed for all types of commercial facilities that discharge FOG—not just FSEs. Examples of non-food establishments that discharge FOG are grocery stores, hotels, hospitals, nursing homes, schools, factory kitchens, ice cream/yogurt/frozen custard shops, bars, caterers, car washes, auto dealerships and automotive-related facilities, laundries, slaughter houses, bottling plants, and multifamily dwellings (e.g., triplexes, quadraplexes, townhouses, condominiums, apartment buildings, and apartment complexes).

1.02 POLICY

A. The discharge of FOG impedes the proper conveyance and treatment of sanitary sewage. The Town of Howey-in-the-Hills, as the controlling authority, is required to regulate FOG discharges from commercial establishments. The Town of

Howey-in-the-Hills Pubilc Services Department's policy is to require existing and proposed commercial establishments discharging to the sanitary sewer system to abide by this policy and implement the BMPs in this document to minimize the amount of FOG entering the Town's sanitary sewer system. The BMPs outlined in this document require commercial establishments to use grease interceptors/traps and oil/water separators to address their FOG discharges into the Town's sanitary sewer system.

1.03 STATEMENT OF THE POLICY

The following outlines the Town's FOG policy:

A. All discharges must be in accordance with applicable state, local, and federal rules and regulations.

B. Unless otherwise approved by the Utilities Director or his/her designee, all commercial facilities that produce FOG must have a properly sized and operational grease interceptor (large external tank), grease trap (smaller "under the sink" fixture), or oil/water separator (large external tank).

C. Sizing and designing grease traps and interceptors must meet the criteria in the Florida Building Code, Chapter 10, Plumbing; the Florida Administrative Code; and other applicable state and local regulations and be approved by the Pubilc ServicesPublic Services Director or his/her designee before traps or interceptors are installed.

D. All FOG-bearing drains must be plumbed to the interceptor.

E. All grease interceptors and traps must be maintained by the owner/operator (User) of the commercial facility.

F. All non-residential establishments that have the potential to discharge wastes containing residual petroleum-based (Hydrocarbon) oil and grease, including but not limited to car washes, auto dealerships, and automotive-related facilities, shall have an approved oil/water separator.

G. Other Users may be required by the Public Services Director or his/her designee to install an approved grease interceptor/trap or an oil/water separator as appropriate to properly handle wastes potentially containing FOG.

H. The Public Services Director or his/her designee shall have the right to obtain grease trap and oil/water separator samples for testing, without prior notification to the user. Such testing shall be at the Public Services Director's sole discretion to ensure requirements of the FOG program are being adhered to by users.

1.04 SUBMITTALS

A. All submittals shall be submitted in accordance with the shop drawing submittal requirements as specified in Section 1, General Provisions.

1. Shop Drawings: The Contractor shall submit catalog cut sheets, manufacturer's descriptive literature, and other necessary information to the Public Services Director for approval before installation.

1.05 DESIGN REQUIREMENTS

A. Detailed drawings showing the grease trap/interceptor or oil/water separator facilities and operating procedures must be approved by the Public Services Director or his/her designee. The Town's review and approval shall in no way relieve the User from the responsibility of meeting effluent discharge limitations or properly maintaining the device. Information to be submitted shall include but may not be limited to size, capacity, shop drawings, schematics, plan details, performance data, materials of construction, installation instructions, and operation and maintenance manual. The following design requirements apply to any facility that discharges FOG to the Town's sanitary sewer system:

B. A User's discharge to the Town's sanitary sewer system of certain liquids or wastes may be prohibited or limited by the provisions of this Section.

C. Wastewater may be discharged to the sanitary sewer system in accordance with conditions in this Section.

D. Wastewater containing FOG derived from animal or vegetable products shall be conveyed through a separate building sewer line to a grease interceptor/trap before being discharged to the sewer system.

E. Wastewater containing FOG derived from petroleum-based products shall be conveyed through a separate building sewer line to the oil/water separator before being discharged to the sewer system.

F. Valve or piping bypass equipment that could prevent a facility's wastewater from entering the appropriate treatment equipment shall not be allowed.

G. The minimum removal efficiency for oil and grease interceptors for animal fats and vegetable oils shall be 80%. The minimum removal efficiency for oil/water separators for trace petroleum-based wastes shall be 90%.

H. Grease interceptors/traps and oil/water separators shall achieve an effluent oil and grease concentration of less than 100 milligrams per liter (mg/L). The Public Services Director or his/her designee may request that the User provide documentation on the design and expected performance of the grease interceptor/trap or oil/water separator.

I. The pH of the wastewater discharged from the grease trap/interceptor, oil/water separator, under-the-sink trap, or other approved unit shall not be less than 5 or greater than 10 standard units at any time. Water temperature shall not exceed 140°F.

J. Grease interceptors or automatic grease removal devices shall conform to PDI G101, ASME A112.14.3, Appendix A requirements, or ASME A112.14.4, and shall be installed in accordance with the manufacturer's instructions.

K. The following are the minimum design criteria for grease interceptors:

1. 9 inches of freeboard.

2. The inlet and outlet must have a T-pipe attached that extends at least 18 inches down. The influent side must expand 18 inches down and not exceed 33% of liquid depth. There should be a clearance of over 8 inches from the bottom of the T-pipe to the bottom of the interceptor on the effluent side (18 inches preferred).

3. 2-1/2-inch inlet and outlet differential.

4. At least two compartments with an interior baffle wall extending to the bottom of the interceptor. The baffle wall should extend above the water line of the tank but should allow an air gap at the top. There must be an opening in the baffle wall approximately mid-way from the bottom to the water line. The opening must be at least 18 inches from the bottom and at least 12 inches down from the water line.

5. 24-inch minimum access openings over both inlet and outlet tees brought up to at least finished grade and protected from surface water runoff. Access covers shall be cast iron or equivalent.

6. The design shall facilitate sampling of the interceptor's effluent, measurement of the grease layer, and cleanout pumping operations.

7. Joints should be properly sealed using mastic, butyl rubber, or other pliable sealant that is waterproof, corrosion-resistant, and approved for use in grease traps.

L. Hydromechanical grease interceptors shall be equipped with devices to control the rate of wastewater flow so that the wastewater flow does not exceed the rated flow. The flow-control device shall be vented and terminate no less than 6 inches above the flood rim level or be installed in accordance with the manufacturer's instructions.

M. The minimum grease retention capacity for interceptors shall be at least two times the flow-through rate.

N. No emulsifiers, grease cutters, or other chemicals that could cause grease to pass through the grease waste interceptor may be used to maintain a grease waste interceptor or its drain lines.

1. A FOG disposal system using a live bacterial product that does not contain any enzymes, surfactants, emulsifiers, or substances that act as solvents for fat and does not affect the wastewater collection system may be used to clean and maintain, if approved by the Public Services Director or his/her designee, based on formulation and demonstrated operational criteria including material safety data sheets.

O. A grease trap intended to serve as a fixture trap in accordance with the manufacturer's installation instructions shall be permitted to serve as the trap for a single fixture or a combination sink of not more than three compartments where the vertical distance from the fixture outlet to the inlet of the interceptor does not exceed 30 inches and the developed length of the waste pipe from the most upstream fixture outlet to the inlet of the interceptor does not exceed 60 inches.

P. All grease interceptors/traps and passive (non-mechanical oil/water separators) shall be equipped with a floatable sludge baffle and a solids sludge baffle.

Q. An adequate number of inspection and monitoring points, such as a control manhole or sample port, shall be provided.

R. The design of oil/water separators shall be based on peak flow and where applicable shall be capable of treating and removing emulsions. Oil/water separators shall be sized to allow efficient removal (retention) of petroleum-based oils and greases from the user’s discharge into the sewer collection system.

S. Sanitary facilities and other similar fixtures shall not be connected or discharged to the grease interceptor/trap or oil/water separator.

T. If garbage or food grinders are connected to the grease trap/interceptor, a solids removal device shall be installed before wastes are discharged into interceptor/trap.

U. Liquid wastes shall be discharged to the grease interceptor/trap or oil/water separator through the inlet pipe only and in accordance with the design/operating specifications of the device.

V. Grease interceptors/traps and oil/water separators shall be installed in a location that provides easy access at all times for inspections, sludge measurement, cleaning, and proper maintenance, including pumping. The Public Services Director or his/her designee shall approve the location of the grease interceptor/trap or oil/water separator before it is installed.

W. Grease interceptors/traps shall not be located in or near any part of a structure where food is handled unless the Public Services Director or his/her designee grants an exemption. Requests for exemptions must be submitted in writing to the Public Services Director. If an exemption is granted and an under-the-sink indoor trap is approved:

1. The Public Services Director or his/her designee shall approve the location and size of the grease trap before it is installed.

2. The trap shall be installed with flow control.

3. The User shall be required to inspect and clean the contents of the trap weekly.

4. An outdoor in-ground grease/interceptor of proper size shall be required if the trap is found to be in violation of these BMPs more than three times in 12 months.

X. Multifamily dwellings, such as triplexes, quadraplexes, townhouses, condominiums, apartment buildings, or apartment complexes that the Public Services Director or his/her designee finds to be contributing FOG in quantities sufficient to cause line stoppages in the collection system, lift station malfunctions, or increased maintenance on the collection system, shall be directed to cease discharging oil and grease to the sanitary sewer system and shall be required to install a grease interceptor/trap. The capacity of the grease interceptor/trap shall be determined on a case-by-case basis. For monitoring purposes, a control manhole or sample port shall be required and installed at the User's sole expense, as approved by the Public Services Director or his/her designee.

Y. Oil/water separators shall be sized on a case-by case basis using established design guidelines for the proposed facility. A control manhole or sample port shall be installed downstream.

Z. Proper operation, maintenance, and repair of grease interceptors/traps and oil/water separators shall be installed solely at the User's expense.

AA. Any requests for extensions and/or exemptions to program requirements, installation requirements, compliance schedules, permit fees, and/or deadlines must be made in writing to the Public Services Director at least 15 days before the deadline, if a deadline is established. The written request shall include the reasons for the User's failure or inability to comply with the compliance date set forth, the additional time needed to complete the remaining work, and the steps to be taken to avoid future delays.

BB. Alternative oil and grease-removal devices or technologies shall be subject to written approval by the Public Services Director or his/her designee and shall be based on proven removal efficiencies. Under-the-sink oil and grease traps are prohibited for new facilities.

1.06 SIZING AND CAPACITY

A. Grease interceptors/traps and oil/water separators shall be designed in accordance with applicable rules, regulations, and specifications including but not limited to the current Florida Building Code—Plumbing, the Florida Administrative Code, and other applicable state and local regulations.

B. The minimum capacity of a grease interceptor/trap shall be 750 gallons and requires approval of the Town. The maximum capacity of a single interceptor shall be 1,250 gallons. The formula below shall determine the capacity required for a facility. If more than a 1,250-gallon capacity is required using the Florida Building Code formulas below, the device may be chambered in isolated 1,250-gallon sections or two or more devices may be installed in series.

Food Service Establishment Sizing for Grease Traps/Interceptors
Formula:

$$S * GS * \frac{HR}{12} * LF = \text{Effective capacity of grease inceptor in gallons}$$

S = Number of seats in dining area.
GS = Gallons of waste per seat. (Use 25 gallons for restaurants with china dishes and/or automatic dishwasher. Use 10 gallons for restaurants with paper or baskets and no dishwasher.)
HR = Number of hours the restaurant is open.

LF = Loading factor (use 2.00 interstate highway, 2.50 other freeways, 1.25 recreational area, 1.00 main highway, and 0.75 other highway).

Other Commercial Kitchen Sizing for Grease Traps/Interceptors

Formula:

$$M * GM * LF = \text{Effective capacity of grease inceptor in gallons}$$

M = Meals prepared per day.

GM = Gallons of waste per meal (use 5 gallons).

LF = Loading factor (use 1.00 with dishwasher and 0.75 without dishwasher).

Under-The-Sink Fixture Sizing for Grease Traps

Formula:

$$\frac{S * 0.75 / 231 \text{ cubic inches}}{2 \text{ minutes}} = \text{Gallons per minute for grease trap}$$

S = Sink(s) volume in cubic inches.

C. The minimum capacity of an oil/water separator shall be 750 gallons and requires approval of the Town. The maximum capacity of a single separator shall be 1,250 gallons. The formula below shall determine the capacity required for a facility. If more than a 1,250-gallon capacity is required using the formula below, two or more devices may be installed in series. Sizing shall be as follows.

Oil/Water Separator Sizing

Formula:

6 cubic feet for first 100 square feet of area to be drained + 1 cubic foot for each additional 100 square feet of area to be drained into separator (where 1 cubic foot = 7.48 gallons).

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 INSTALLATION

A. Proposed Facilities: On or after the effective date of this BMP, proposed facilities with the potential to discharge FOG to the Town's sewer system shall be required to install an approved grease interceptor/trap or oil/water separator. Grease interceptors/traps or oil/water separators shall be installed in accordance with this BMP before the opening of the facilities are open. A control manhole or sample port for monitoring shall be required and installed at the User's sole expense, as approved by the Public Services Director or his/her designee.

B. Existing Facilities: On or after the effective date of this BMP, existing facilities discharging FOG to the Town's sewer system shall be required to install an approved grease interceptor/trap or oil/water separator when any of the following conditions exist:

1. The Public Services Director or his/her designee finds the facility to be contributing FOG in quantities potentially sufficient to upset or interfere with the Town's sanitary collection systems or necessitate increased maintenance on the collection system.

2. The facility is remodeled or expanded to include or increase the potential for a FOG discharge. The Public Services Director or his/her designee shall determine the compliance date, not to exceed 30 days.

3.02 REQUIRED MAINTENANCE PRACTICES

A. To prevent introduction of FOG to the Town's sanitary sewer system, grease interceptor/traps, oil/water separators, and under-the-sink grease traps must be maintained as follows:

1. Grease Interceptor (750 gallons or over):

   a. A minimum of every 90 days or more often if grease and solids levels reach 25% of the tank volume.

2. Grease Interceptor (50 gallons to 750 gallons):

   a. A frequency not to exceed 30 days.

3. Grease Trap (less than 50 gallons):

   a. A frequency not to exceed 15 days.

4. Under-the-Sink Indoor Trap:

   a. The facility will be required to monitor all contents of the trap weekly. The contents shall be disposed of in a manner approved by the Public Services Director that is not harmful to the environment or wastewater system.

   b. A deep cleaning (scraping of the walls, baffle, inlet, and outlet) shall be required quarterly or monthly and shall be determined based on inspection(s).

c. Trap sludge contents shall not exceed 20% capacity.

d. Lid, seal, baffle, inlets, and outlets shall be approved by the Public Services Director and maintained in proper working condition.

5. Oil/Water Separators (all sizes):

a. Cleaning shall be performed when 25% of the retention capacity of the device has been reached. Oil/water separators shall be cleaned out completely at least once every 6 months or more frequently as needed to prevent carryover of petroleum-based products into the collection system.

B. The extracted material shall not be reintroduced into the sanitary sewer.

C. Grease interceptor/traps and oil/water separators must be inspected to ensure proper functionality during each pump-out event.

D. The User shall provide for all cleaning and maintenance of grease interceptors/traps, oil/water separators, and under-the sink traps. Cleaning shall include completely removing all contents—including floating materials, wastewater, sludge solids and debris—and removing materials from the tank walls, baffles, inlet tees, and outlet tees. Outdoor grease interceptors/traps shall be cleaned by a Florida Department of Environmental Protection (FDEP)-certified waste hauler.

E. Decanting, back-flushing, or discharging of removed wastes back into a grease interceptor/trap or oil/water separator is prohibited.

F. Grease interceptors/traps shall be deep cleaned annually. Pressure washing or scraping walls, baffles, inlet tees, and outlet tees are acceptable methods of deep cleaning and must be inspected by Public Services Director Designee before being introduced back on line.

G. Wastes removed from each grease interceptor/trap or oil/water separator shall be disposed of at a facility permitted to receive such wastes or at a location designated and permitted for such purposes, in accordance with FDEP requirements. Pumpage shall not be returned to any private or public portion of the collection system or the treatment plants without prior written approval from the Public Services Director or his/her designee.

H. Flushing the grease interceptor/trap or oil/water separator with water that is more than 140°F is prohibited.

I. Grease interceptors/traps and oil/water separators shall be maintained in proper working order. Inlet and outlet tees shall not be obstructed by sludge or debris or be capped. Both tees shall have vents that remain clear and visible above the water surface. Lids shall have a water- and gas-tight seal and be intact.

J. The User, at the User's sole expense, shall perform all maintenance and repairs of oil and grease management devices, including proper disposal of generated wastes.

3.03 WASTEWATER DISCHARGE PERMITS

A. It shall be unlawful for any commercial establishment producing wastewater containing FOG to discharge into the Town's collection system without authorization from the Public Services Director or his/her designee. Authorization shall be given in the form of a Wastewater Discharge Permit. Application for a permit shall be made to the Public Services Director or his/her designee. If after examining the Wastewater Discharge Permit application, the Public Services Director or his/her designee determines that the proposed facility does not conflict with the provisions of the BMP, a permit shall be issued to allow the discharge into the collection system. Each Wastewater Discharge Permit shall be issued for no longer than 5 years. The User shall apply for a permit reissuance a minimum of 90 days before the expiration of the User's existing permit. The terms and conditions of the permit may be subject to modification by the Pubilc Services Department during the term of the permit as limitations or requirements as identified in this BMP are modified or for other just causes. The User shall be informed of any proposed changes in the issued permit at least 60 days before the effective date of the change(s). Any changes or new conditions in the permit shall include a reasonable schedule for compliance.

B. As a condition of the granting of a Wastewater Discharge Permit, the User shall agree to hold harmless the Town and the Town's employees from any liabilities arising from the User's operations under this permit.

C. The Town shall set fees for issuance and annual renewal of Wastewater Discharge Permits.

3.04 REPORTING REQUIREMENTS

A. The User shall keep a log that confirms pumping, hauling, and disposal of waste to track pumped wastes from grease interceptors/traps and oil/water separators. This manifest shall contain the following information:

<u>Generator Information</u>:
Facility Name

Contact Person
Address
Telephone Number
Date
Maintenance Performed

Transporter Information:
Company Name
Contact Person
Address
Telephone Number

Destination Information Disposal Site or Facility:
Company Name
Permit Number(s)
Contact Person
Address
Telephone Number

Pumping Information:
Date
Time
Volume Pumped
Transporter Name
Transporter Signature
Witness Name
Witness Signature

B. The User shall maintain a log of pumping activities onsite for the previous 12 months. Town personnel shall have immediate access to the current pumping log, which shall be readily available for FOG Program inspections.

C. The User shall maintain a maintenance log of all maintenance activities onsite for the previous 12 months. Town personnel shall have immediate access to the log, which shall include the following information:

Name of Establishment
Address
Phone
Location of Interceptor, Oil/Water Separator, or Under-the-Sink Trap
Date
Inspector's Name and Signature
Depth of fats, oils, grease, and waste within the grease trap/interceptor at time of inspection

Cleaning Method Used Grease Pumped: Yes or No

D. The User shall maintain a file of records and other documents pertaining to the facility's grease interceptor/trap or oil/water separator. The file contents shall include but are not limited to the record (as-built) drawings, record of inspections, log of pumping activities and receipts, log of maintenance activities, hauler information, disposal information, and monitoring data. The file shall be available at the Public Services Director’s or his/her designee’s request and must be kept for 5 years.

E. If a violation of this BMP is discovered during a scheduled inspection or if a problem such as line stoppages or increased maintenance on the collection system or the wastewater treatment plant system is determined to be a result of the discharge from a facility, additional inspections may be required. For each additional inspection, the Town shall charge the User a $100 Additional Inspection Fee. If there is no immediate threat of upset, interference, or potentially harmful discharge, additional inspections shall not be conducted within 1 week of the scheduled inspection.

F. The Public Services Director or his/her designee may require the User to provide, operate, and maintain at the User's expense appropriate monitoring facilities such as a control manhole that are safe and accessible at all times for observation, inspection, sludge measurement, sample collection, and flow measurement of the User's discharge. The Public Services Director or his/her designee may impose additional limitations and monitoring requirements for the discharge to the wastewater treatment plant in accordance with the provisions set forth in this BMP.

3.05 FOG PROGRAM INSPECTIONS

A. Pubilc Services Department personnel shall conduct an inspection on all facilities with grease interceptors/traps or oil/water separators with a 750-gallon capacity or greater annually.

B. Facilities with devices with a capacity between 100 and 750 gallons shall be inspected once per year.

C. Grease interceptors/traps with a capacity of less than 100 gallons shall be twice per year.

D. If an inspection by the Pubilc Services Department finds one or more of the requirements below are not being met, an Additional Inspection Fee may be charged for a follow-up inspection or a Notice of Violation may be issued to the facility:

1. The grease interceptor/trap or passive oil/water separator shall be readily accessible. Vented inlet and outlet tees shall break the water surface and extend to within 18 inches from the bottom of the floor between the influent and extend to within 8 inches from the bottom of the floor between the effluent. Baffle(s) shall be intact, and lid(s) shall have a good seal. Automatic oil/water separators shall be operating effectively.

2. The contents of the interceptor or separator shall not exceed 25% total capacity.

3. Concrete lids shall be replaced with either manhole lids for traffic-bearing areas or plastic lids or manhole lids for non-traffic bearing areas.

4. A pumping log shall be posted or be readily accessible for inspection. Information on this log shall include at minimum hauler (pumper) name, last pump date, volume pumped, and pumping frequency.

5. If a fryer is used, the used oil shall be recycled. A form of documentation shall be onsite. The storage container shall have a lid that remains closed at all times other than during use.

6. Corrosive chemicals shall not be stored near floor drains. If they are, they shall be secondarily contained to prevent spills and/or leaks.

3.06 VIOLATIONS AND NON-COMPLIANCE

A. The Public Services Director or his/her designee shall issue a Notice of Violation to a User for:

1. Failing to properly maintain (clean out or pump) the grease interceptor/trap or oil/water separator in accordance with the provisions of this BMP.

2. Contributing to a FOG-related sewer overflow or potential FOG-related sewer overflow if the facility's grease interceptor/trap or oil/water separator is out of compliance with this BMP when the incident is investigated.

3. Failing to provide access to the facility for inspections, pumping logs and records, or oil and grease management devices for sludge measurements and sampling by an authorized Town employee.

4. Failing to obtain or renew a Wastewater Discharge Permit in a timely manner.

5. Failing to pay program fees in a timely manner or to correct a previous violation by an established deadline.

B. If a User violates or continues to violate the provisions in this section or fails to initiate/complete corrective action within the specified period in response to a Notice of Violation or Notice of Significant Noncompliance, the Public Services Director or his/her designee may pursue one or more of the following options:

1. Charge the User $100 for each additional inspection conducted as a result of the violation.

2. Pump, maintain, and/or repair the grease interceptor/trap or oil/water separator, and place the fee for this service on the User's monthly sewer bill.

3. Impose an administrative fine or penalty in accordance with the rules and procedures set forth in this BMP.

4. Revoke the facility's Wastewater Discharge Permit.

5. Suspend or terminate water and sewer service.

6. Any combination of the enforcement actions above.

C. If water and/or sewer service is suspended or terminated, the User shall pay all outstanding fees, penalties, and other utility charges before water and sewer service is reinstated.

D. If the User shows good and timely correctable actions for a violation, the permit shall not be revoked nor shall service be terminated.

END OF SECTION

SECTION 22
RECLAIMED WATER SYSTEM

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section does not stand alone and is incorporated as part of the Town Construction Specification Manual (CSM). The CSM shall be used for other requirements that may not be covered in this Section.

B. This Section includes general technical criteria for the design and installation of a reclaimed water piping system. The relevant provisions of other Sections of this specification shall be applicable to this Section unless otherwise indicated herein or approved by the Town.

C. The Contractor shall provide all work necessary for the construction and testing of a reclaimed water piping system. This work shall include the installation of all reclaimed water lines, services, fittings, and appurtenances as may be required to complete the work as indicated in the Construction Drawings and as specified herein.

D. The work shall also include such connections, reconnections, temporary service, and all other provisions about existing sewer operations and modifications as is required to perform the new work. All references to Industry Standards (ASTM, ANSI, AWWA, etc.) shall be to the latest revision unless otherwise stated. Only those materials included in the Town CSM shall be installed. All materials shall be new unless specifically called for otherwise.

E. All piping and equipment of the same type shall be from one manufacturer, unless authorized in writing by the Town or the Town's representative.

1.02 SUBMITTALS

A. Submittals: All submittals shall be submitted in accordance with the shop drawing submittal requirements as specified in Section 1, General Provisions.

1. Shop Drawings: The Contractor shall submit catalog cut sheets, manufacturer's descriptive literature, and other necessary information to the Engineer for approval before installing pipe.

2. Certifications: The Contractor shall submit a certification from the pipe manufacturer that the pipe and fittings supplied are new, have been manufactured for this project, and have been inspected at the plant.

1.03 DESIGN

A. Before installation of any water distribution system, a hydraulic model of the reclaimed distribution system shall be performed and submitted to the Town for approval in accordance with Section 1, General Provisions.

B. Reclaimed water systems shall be designed to promote efficient reclaimed water usage. Reclaimed water mains shall be designed for the estimated ultimate irrigation demand, based on planned development build-out. The Engineer/Developer is responsible for sizing of the mains only for his project/development. Individual single-family homes are exempt from providing design calculations for irrigation system with one inch or smaller meters.

C. Weekly Flows and Peak Flows

1. The weekly reclaimed water flow shall be based on 300 gpd per Equivalent Irrigation Connection (EIC) in accordance with the Town of Howey-in-the-Hills Code of Ordinances. EIC is based on 1-inch per week. Application of the EIC basis is as follows:

a. Single-family lots consisting of 1/2 acre or less are equal to one EIC.

b. All other General Service connections are the greater of: one EIC; or the area in square feet subject to irrigation times 0.083 gpd/sf divided by 300 gpd/EIC and rounded up to the next higher number, or the requested amount of service in gpd divided by 300 gpd/EIC and rounded to the next higher number.

2. Peaking factor for peak flow calculations:

a. For commercial developments, the peak reclaimed water flow shall be determined by dividing the weekly flow by 2 days of irrigation per week and multiplying the result by a peak hourly factor of 6. Irrigation zones shall be provided to uniformly distribute flow so that the maximum peak hourly factor is not exceeded. Alternate irrigation system designs will be evaluated on a case-by-case basis.

b. For single-family residential developments, the peak reclaimed water flow shall be determined by dividing the weekly flow by

4 days of irrigation per week and multiplying the result by a peak hourly factor of 6.

D. No cross connection between the reclaimed water system and the potable water system shall be allowed.

E. All reclaimed water piping and appurtenances shall be clearly identified to inform the public and employees that the water is not intended for drinking.

F. The following features shall be included in the design of reclaimed water facilities:

1. All reclaimed water transmission and distribution piping shall be a minimum of 6 inches in diameter or larger.

2. All reclaimed water transmission and distribution piping shall be color coded purple. For high-density polypropylene (HDPE) mains, the color shall be an integral part of the pipe material. All ductile iron piping above ground (including bridge crossings) shall be color labeled "RECLAIMED WATER" stenciled in the center of each joint of pipe using oil-based paint. Stenciled lettering shall be 4-inch-high (minimum) lettering and be Pantone purple.

3. All aboveground valves, meters, and other devices, and other appurtenances shall be painted purple. The color standard for paint shall be Pantone color 522C. All valves shall be permanently stamped or tagged with stainless steel tags on the extension stem, labeled with "RECLAIMED WATER," valve type, and number of turns to open. In addition, the body of the valve shall be marked as reclaimed water and the tee head shall include "RW" or Town-approved equal that designates it as a reclaimed water valve.

4. All valve boxes shall be square with covers on the reclaimed water system painted purple. Covers shall be permanently embossed with the wording "Reclaimed Water, Do Not Drink" in English, and in Spanish "No Beber," and should have the International "Do Not Drink" symbol embossed on the cover. Valve box manufacturer shall be in accordance with Appendix A, Approved Manufacturer List of the Town CSM.

G. Tracer Wire and Warning Tape Installation

1. General: Wherever nonmetallic pipe is installed, #10 tracer wire and warning tape shall be installed to facilitate future location of reclaimed water main.

2. Tracer wires shall begin and terminate in the test boxes. Wire shall run continuously through test stations for the entire length of the pipeline and shall be strapped to the pipe at ten-foot intervals Test boxes shall be installed at each location as shown on the Construction Drawings, spaced at intervals not exceeding the service connection spacing. Test boxes shall not be installed in streets or driveways. Tracer wire between boxes shall be continuous, unbroken lengths. The tracer wire shall not be installed in tension, but neither shall there be "coils" in the wire. The ends of the tracer wires shall be installed in the test boxes. The length of each tracer wire in each box shall be long enough to extend no less than 1 foot and no greater than 2 feet above ground level. Breaks shall be repaired by splicing with a split-bolt clamp or pre-approved equal. Repairs by "twisting" the two ends together shall not be accepted.

3. Warning tape shall be buried in the backfill approximately 18 inches over the top of the polyvinyl chloride (PVC) reclaimed water main. Warning tape should be above all direct buried reclaimed water mains. Tape shall be laid in continuous lengths. Any breaks or tears shall be repaired before proceeding with the backfilling operations.

H. Reclaimed Water Service Connections

1. All reclaimed water services lines shall extend to the Town's right-of-way line and shall include meter, meter box, valves, fittings, adapters, and appurtenances necessary for a proper installation. In no case shall the Town's reclaimed water service extend onto private property.

2. It shall be the sole responsibility of the homeowner or business to connect to the reclaimed water service connection at the right-of-way line. The Town shall not be responsible for installation or maintenance of any reclaimed water service line beyond the Town's right-of-way line. The homeowner or business shall obtain a plumbing permit for connection to the Town's reclaimed water service connection.

3. All reclaimed water service lines 2 inches in diameter and smaller shall be constructed of polyethylene (PE) tubing, DR 9.

4. All service connections greater than 40 feet in length are known as “long-side” service connections and shall be cased as shown in the Contract Drawings. One electronically detectable 10-gauge stranded THWN copper tracer wire shall be installed with each long-side service. The service tubing and tracer wire for a long-side service shall be installed inside a casing sleeve, as shown in the Contract Drawings.

5. Polyethylene extrusion compound from which the PE pipe and tubing are extruded shall comply with the applicable requirements for the Type III, Grade P34, Class C, PE 3408, very high-molecular-weight polyethylene plastic material, as specified in ASTM D1248, a cell classification of 345434C, or 355434C as specified in ASTM D3350.

6. Polyethylene tubing shall be SDR 9-200 PSI type CTS (copper tubing size). The average outside diameter, minimum wall thickness, and respective tolerances for any cross-section shall be as specified in ASTM D2737. Manufacturer shall be in accordance with Appendix A, Approved Manufacturer List of the Town CSM.

7. Polyethylene reclaimed water service pipe or tubing shall be identified with solid pantone purple coloring. Manufacturer shall be in accordance with Appendix A, Approved Manufacturer List of the Town CSM.

I. Design Calculations: The Engineer/Developer shall submit signed, dated, and sealed calculations by a Florida-registered Professional Engineer licensed with the final Construction Drawings for all reclaimed water distribution system projects. Calculations shall show that the reclaimed water mains will have sufficient hydraulic capacity to transport peak hourly flows. All head losses and minor losses shall be included in the calculations.

PART 2 PRODUCTS

2.01 MATERIALS

A. The materials of construction shall comply with the specific applicable standards set forth under Section 6, Utility Excavation, Trenching, and Backfilling, Section 9, Boring, Jacking, and Tunneling , Section 11, Pipe, Fittings, Valves, and Appurtenances, and as indicated in this Specification.

B. Pipe material for Reclaimed Water Mains shall be as shown on the Construction Drawings. Pipe material shall be in accordance with the design requirements in this specification Section and specification Section 11, Pipe, Fittings, Valves, and Appurtenances, unless otherwise shown on the Contract Drawings. Pipe, fittings, valves, restrainers, and other appurtenances shall be as specified in Section 11,

Pipe, Fittings, Valves, and Appurtenances. Additional valves and appurtenances are specified below. To preclude possible domestic water tapping, all installed underground nonmetallic reclaimed water mains shall be Pantone purple or ductile iron pipe marked with a continuous Pantone purple stripe located within the top 90 degrees of the pipe.

C. Nonmetallic Marking Tape: Marking tape shall be "Extra-Stretch" marking tape for reclaimed water, colored pantone purple. Extra-Stretch marking tape shall consist of 6-ply copolymer film bonded together without the use of adhesives, specifically formulated for prolonged use underground. It shall be highly resistant to alkalis, acids, and other destructive agents found in the soil. Extra Stretch tape shall have a minimum thickness of 6 mils, minimum tensile strength of 80 pounds per 3-inch-wide strip, and a minimum elongation of 600%. Tape shall bear a continuous printed message repeated every 16 to 36 inches warning of the installation buried below. Installation instructions for the tape shall be printed with each message along the entire length. Manufacturer shall be in accordance with Appendix A, Approved Manufacturer List of the Town CSM.

D. Tracer wire shall have a Pantone purple, type TWH insulated PVC copper conductor, #10 solid strand copper wire that is strapped to the pipe at 10-foot intervals installed. Wire shall meet National Electric Codes and Underwriter Laboratories, Inc. requirements. Manufacturer shall be in accordance with Appendix A, Approved Manufacturer List of the Town CSM.

E. Air-release valves shall have with 316 stainless steel service saddle, 316 stainless steel piping, and 316 stainless steel ball valve. Air-release valve manufacturer shall be in accordance with Appendix A, Approved Manufacturer List of the Town CSM.

F. Combination air valves shall have a 316 stainless steel service saddle, 316 stainless steel piping, and 316 stainless steel ball valve. Combination air valve manufacturer shall be in accordance with Appendix A, Approved Manufacturer List of the Town CSM.

G. All material shall be free from defects impairing strength and durability, shall be of the best commercial quality for the purpose specified, and shall have structural properties sufficient to safely sustain or withstand strains and stresses to which it is normally subjected and be true to detail.

PART 3 EXECUTION

3.01 INSTALLATION

A. Pipe materials and appurtenances, installation and construction details, shall comply with the requirements of Section 11, Pipe, Fittings, Valves, and Appurtenances, in addition to the requirements specified in this Section.

B. The Contractor shall not install reclaimed water mains in the same trench with potable water mains. Wherever practical, reclaimed water mains shall be installed on the opposite side of the street from potable water mains. Underground water mains shall be laid to provide a horizontal distance of at least 6 feet, and preferably 10 feet between the outside of the water main and the outside of any existing or proposed gravity- or pressure-type sanitary sewer, wastewater force main, or pipeline conveying reclaimed water not regulated under Part III of Chapter 62-610, Florida Administrative Code (FAC).

C. Underground water mains crossing any existing or proposed pressure-type sanitary sewer, wastewater or stormwater force main, or pipeline conveying reclaimed water shall be laid so the outside of the water main is at least 12 inches above the outside of the other pipeline. Where 12 inches of vertical clearance cannot be maintained, the crossing shall be arranged so that the joints of the two pipes are equidistant from the point of crossing with no less than 10 feet between any two joints. Alternatively, the reclaimed water main may be placed in a casing to obtain the equivalent of the required 10-foot separation.

D. Where minimum horizontal and/or vertical separation between reclaimed water mains, potable water mains, sanitary sewers, and sanitary force mains cannot be maintained, watertight joints complying with public water supply design standards shall be used.

E. The Contractor shall provide and install fusing service saddles, tapping saddles, and valves for each service connection. After installing the sleeve and before making the tap, the Contractor shall ensure that the sleeve is providing a watertight joint by pressure testing with pressures in accordance with this Section. If leaks are present, the Contractor is required to repair them to satisfaction of the Engineer of Record or Town.

F. Connections to existing reclaimed water pipelines shall be made as shown on the Construction Drawings. Coordination between the Town and the Contractor shall be required to accomplish this task. The Contractor shall supply connection, procedure, and customer notification schedules to the Town and Engineer of Record, for approval, 2 weeks before the proposed connection date.

G. All connections to existing reclaimed water mains shall be made in the presence of the Engineer of Record and the Town. Valves on existing reclaimed water mains will be operated by Town personnel or under their direct supervision. Temporary plugs or caps shall be installed on new mains until the pressure and leakage tests are completed. Upon satisfactory completion of the tests, the caps or plugs shall be removed and the connections made to the existing reclaimed water mains.

H. A 'V' cut shall be carved in the curb closest/adjacent to a below grade valve. This 'V' cut shall be painted Pantone purple. Reclaimed water services serving vacant lots (service not in use), shall include an "R" cut in the curb (closest to the meter box), and painted Pantone purple.

I. Reclaimed water meter boxes or services shall be constructed similar to domestic water services, located inside the Town right-of-way line, and should be located away from each other, unless approved otherwise by the Town.

3.02 CROSS-CONNECTION/BACKFLOW

A. No cross connection between the reclaimed water system and the potable water system shall be allowed.

3.03 TESTING

A. Flushing of the reclaimed water system is required using either potable water or reclaimed water (when available).

B. Hydrostatic Testing:

1. All field tests shall be made in the presence of a representative of the Engineer of Record. Except as otherwise directed, all pipelines shall be tested. All piping to operate under liquid pressure shall be tested in sections of approved length, typically from valve to valve and in no case longer than 5,000 feet.

2. Hydrostatic testing shall consist of a combined pressure test and leakage test. The test pressure shall be as indicated in the piping schedule presented on the Drawings. The pressure shall be applied by a pump connected to the pipe in a manner satisfactory to the Engineer of Record. The pump, pipe connection, and all necessary apparatus shall be furnished by the Contractor and shall be subject to the satisfaction of the Engineer of Record and the Town.

3. The maximum duration for any test including initial pressurization, initial expansion, and time at test pressure must not exceed 8 hours. If the test is not completed due to leakage, equipment failure, etc., the Contractor shall depressurize the test section, and then allow the test section to "relax" for at least 8 hours before bringing the test section up to test pressure again.

4. Monitored Make-Up Water Test: The test procedure consists of initial expansion and test phases.

   a. During the initial expansion phase, the test section is filled with water. Once the line is filled, make-up water is added as required to maintain the test pressure for 3 hours.

   b. At the end of the 3-hour period, the addition of make-up water will cease. During the test phase, the pipe will not have any water added to it for the following 2 hours. The 2 hours will be the actual leakage test. At the end of the 2-hour period, measured make-up water will be added to the pipe to return it to the original test pressure.

   c. If the amount of make-up water added is greater than calculated using the numbers listed below, the section being tested will be considered to have a leak. The leak shall be found and fixed at the Contractor's expense and that section of line retested before continuing with subsequent leakage tests. Testing and repairs shall be repeated at the Contractor's expense until the amount of makeup water is less than the amount calculated using the numbers listed below.

Nominal Pipe Size (in)	Make-up Water Allowance (gal/100ft)
1.25	0.060
1.5	0.065
2	0.07
3	0.10
4	0.13
6	0.30
8	0.50
10	0.80
12	1.10
14	1.40
16	1.70
18	2.20
20	2.80

Nominal Pipe Size (in)	Make-up Water Allowance (gal/100ft)
24	4.50

C. The Contractor shall be required to perform a separate hydrostatic/leakage field test on each valve installed to insure it is bubble tight. The duration of this test shall be 15 minutes at 150 pounds per square inch (psi) and conform to AWWA C504. The method of performing this test shall be left up to Contractor with the Engineer of Record's approval. The failure of the valve to perform will result in its removal from the job site and replacement by the Contractor at the Contractor's expense.

END OF SECTION

SECTION 23
STORMWATER SYSTEM

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section covers the work necessary to provide for the construction of a stormwater system. This work shall include installing the pipe, catch basins, inlets, manholes, mitered end section, etc., as may be required to complete the work as indicated in the Drawings. All requirements set forth in this specification and as required in Chapter 14, Flood Plan Management, Chapter 15, Stormwater Regulations, and Division IX of Chapter 17, Utilities of the Town of Howey-in-the-Hills Code of Ordinances, shall be the responsibility of the Developer/Contractor.

B. The latest Florida Department of Transportation (FDOT) Standards apply if not specifically address in the Town's Construction Specification Manual (CSM) and Details.

C. The design standards and requirements specified herein are minimum requirements and other Federal, State, District, and local requirements and standards shall be applied, whichever is stricter.

1.02 SUBMITTALS

A. All submittals shall be submitted in accordance with the shop drawing submittal requirements as specified in Section 1, General Provisions.

1. Shop Drawings: The Contractor shall submit catalog cut sheets, manufacturer's descriptive literature, and other necessary information to the Public Services Director for approval before installation.

2. Certifications: The Contractor shall submit a notarized certification from the pipe manufacturer that the pipe and structures supplied are new have been inspected at the plant, and meet the requirements of these Specifications.

3. Submit information required in Chapter 14, Flood Plan Management, Chapter 15, Stormwater Regulations, and Division IX of Chapter 17, Utilities of the Town of Howey-in-the-Hills Code of Ordinances.

4. Manholes:

   a. Base sections, riser sections, eccentric and concentric conical top sections, flat slab tops, and grade rings with notarized certificate indicating compliance with ASTM C478.
   b. Location and elevation of all penetrations.
   c. Applicable lifting and installation details or instructions.
   d. Frames and covers with description literature and cut sheets and notarized certificate indicating compliance with specified standards (ASTM A48/A48M, Class 30; etc.).
   e. Method of repair for minor damage to precast concrete sections.
   f. Delivery, unloading, and receiving instructions.
   g. Buoyancy countermeasures.

5. Design drawings shall demonstrate that the applicable industry design standards listed in this Section have been met.

6. Precast Concrete Structures:

   a. Sectional Drawings and elevations showing dimensions and reinforcing steel placement.
   b. Structural calculations including assumptions.
   c. Concrete design mix.

1.03 DESIGN

A. Design Discharges: The determination of the design flows for a storm sewer system serving any classification of facility shall be in accordance with the methods and procedures of Chapter 14, Flood Plan Management, Chapter 15, Stormwater Regulations, and Division IX of Chapter 17, Utilities of the Town of Howey-in-the-Hills Code of Ordinances; FDOT Drainage Manual and FDOT Drainage Design Guide; and other applicable FDOT Standards, latest edition and SJRWMD permitting requirements.

B. Minimum Pipe Size: The minimum size pipe to be used in stormwater system shall be 15 inches in diameter. Designs shall be based upon 6-inch increments in sizes above 18-inches.

C. Maximum and Minimum Pipe Slopes: All storm sewers shall be designed and constructed to produce a minimum mean velocity of 3.0 feet per second (fps). No stormwater system or portion thereof will be designed to produce velocities in excess of 10 fps.

D. Maximum Lengths of Pipe: The following maximum runs of pipe shall be used when spacing access structures of any type.

Pipe Diameter*	Maximum Run
Less than 24" Inches	300 feet
24" Inches or Larger	400 feet

*(Or minimum dimension of elliptical pipe or box culvert.)

E. Time of Concentration: A minimum time of concentration to be used in storm sewer computations shall be 15 minutes for single-family and duplex-residential projects, and 10 minutes for all other developments.

F. Manhole Losses: The following manhole losses shall be used provided all structures are constructed with smooth flow channels to a depth equal to half the diameter of the largest pipe. This requirement is waived for structures having only one connecting pipe.

Use greater of:

1. 20% of the difference between the highest and lowest velocity heads.
2. 0.10 foot.

If no channelization is provided, the designer shall use the greater of:

1. 50% of the difference between the highest and lowest velocity heads.
2. 0.30 foot.

Manhole losses shall be applied only at surcharged structures.

G. Inlets

1. Inlets shall be installed at a minimum of all low points, road intersections, and at continuous intervals along constantly sloped grades so as to prevent ponding or intolerable spreading of water.

2. Acceptable tolerable limit is defined as one travel lane width while maintaining one inch of clearance between the top of curb and design water surface.

3. A maximum distance of 400 feet shall be allowed between inlets. A lesser distance may be required to maintain tolerable spreading limits.

4. All inlets at low points shall be capable of intercepting 100% of the design flow while maintaining tolerable spread. All other inlets shall be designed to intercept 80% of the approaching gutter flow.

H. Drainage structures shall be designed with buoyancy countermeasures to prevent floatation.

I. Stormwater configuration, design, and sizing shall be in accordance with the applicable Chapter 14, Flood Plan Management, Chapter 15, Stormwater Regulations, and Division IX of Chapter 17, Utilities of the Town of Howey-in-the-Hills Code of Ordinances; FDOT; and SJRWMD standards and requirements, latest editions.

1.04 REFERENCE STANDARDS

A. Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the time shop drawings are submitted. The following documents are incorporated as part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

1. The latest of the FDOT Standard Specifications for Road and Bridge Construction (Standard Specifications) and the most current edition of the Roadway and Traffic Design Standards shall be referred to for construction, workmanship, and quality control as specified in this Section with exceptions as noted. Note that any reference in the Standard Specifications to the terms “Department” or “District Materials Engineer” shall be replaced by the term “Town.”

PART 2 PRODUCTS

2.01 MATERIALS

A. The materials of construction shall comply with the specific applicable standards set forth under Section 6, Utility Excavation, Trenching, and Backfilling.

B. The Contractor shall provide all new materials free from defects impairing strength and durability and of the best commercial quality for the purpose specified. All materials shall have structural properties sufficient to safely sustain or withstand strains and stresses that they will be normally subjected to and be true to detail.

C. Pipe material and layout of drainage structures for stormwater shall be specified on the Construction Drawings and shall be in accordance with the design requirements in this specification Section.

D. Materials used shall be in accordance with applicable FDOT Standards, latest edition unless approved by the Town Public Services Director.

E. Materials and Installation

1. All stormwater piping materials shall comply with the FDOT Standard Specifications for Road and Bridge Construction (SSRBC), latest edition and FDOT Roadway and Traffic Design Standards, latest edition.

2. HDPE shall not be acceptable.

3. All pipe joints will be wrapped per FDOT Standard Manual Index No. 280.

F. Manufacturers used shall be in accordance with Appendix A, Approved Manufacturer List of the Town CSM.

G. All material shall be free from defects impairing strength and durability, shall be of the best commercial quality for the purpose specified, and shall have structural properties sufficient to safely sustain or withstand strains and stresses to which it is normally subjected and be true to detail.

2.02 PIPE CULVERTS

A. The following section of the FDOT Standard Specifications shall apply: Section 430.

B. The use of corrugated metal pipe (CMP) within the Town's right-of-way shall not be allowed.

2.03 INLETS, MANHOLES, AND JUNCTION BOXES

A. Inlets, manholes, and junction boxes shall be designed from reinforced concrete and shall include all necessary metal frames and gratings. Inlet design shall be in accordance with the FDOT Design Standards Manual and the requirements of Part 1.

B. The following section of the FDOT Standard Specifications shall apply: Section 425.

2.04 RUBBLE RIP RAP (BANK AND SHORE PROTECTION)

A. The following section of the FDOT Standard Specifications shall apply: Section 530.

2.05 BEDDING MATERIAL

A. The following section of the FDOT Standard Specifications shall apply: Section 125.

2.06 PRECAST CONCRETE DRAINAGE PRODUCTS

A. The following sections of the FDOT Standard Specifications shall apply:

1. Section 449-1, Description
2. Section 449-2, Materials
3. Section 449-3, Construction Requirements
4. Section 449-4, Concrete Pipe
5. Section 449-5, Requirement for Pipe Joints When Rubber Gaskets Are To Be Used

PART 3 EXECUTION

3.01 EXCAVATION FOR STRUCTURES AND PIPE

A. The following sections of the FDOT Standard Specifications shall apply:

1. Section 125-1, Description
2. Section 125-2, Classification
3. Section 125-3, Cofferdams
4. Section 125-4, Excavation
5. Section 125-8, Backfilling
6. Section 125-9, Acceptance Criteria
7. Section 125-11, Site Restoration
8. Section 125-12, Cleaning Up

3.02 PIPE CULVERTS

A. The following section of the FDOT Standard Specifications shall apply: Section 430.

3.03 BEDDING MATERIAL

A. The following section of the FDOT Standard Specifications shall apply: Section 125.

3.04 INLETS, MANHOLES, AND JUNCTION BOXES

A. The following section of the FDOT Standard Specifications shall apply: Section 425.

3.05 RUBBLE RIP RAP (BANK AND SHORE PROTECTION)

A. The following section of the FDOT Standard Specifications shall apply: Section 530.

END OF SECTION

SECTION 24
FENCING WITH PRIVACY SLATS

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope

1. Contractor shall provide all labor, materials, tools, equipment and incidentals as shown, specified and required to furnish and install all fencing.

2. Extent of fencing is shown on drawings.

3. Types of products required include the following:

a. Aluminum-coated, steel chain-link fabric.
b. Galvanized steel framework.
c. Polyvinylchloride fusion bonded finish.
d. Barbed wire.
e. Auxiliary system components, gates, accessories, fasteners and fittings.
f. Privacy slats.

1.02 REFERENCES

A. Standards referenced in this Section are listed below:

1. The Americans with Disabilities Act of 1990 (Public Law 101-336), Appendix A to Title 28 Code of Federal Regulations Part 36 (Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities - ADAAG).

2. American Society for Testing and Materials, (ASTM).

a. ASTM A 53, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
b. ASTM A 90, Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
c. ASTM A 123, Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
d. ASTM A 153, Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

e. ASTM A 428, Test Method for Weight of Coating on Aluminum-Coated Iron or Steel Articles.
f. ASTM A 491, Specification for Aluminum-Coated Steel Chain-Link Fence Fabric.
g. ASTM A 570, Specification for Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality.
h. ASTM A 585, Specification for Aluminum-Coated Steel Barbed Wire.
i. ASTM A 653, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
j. ASTM A 780, Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
k. ASTM A 817, Specification for Metallic-Coated Steel Wire for Chain-Link Fence Fabric.
l. ASTM A 824, Specification for Metallic-Coated Steel Marcelled Tension Wire for Use with Chain Link Fence.
m. ASTM B 6, Specification for Zinc.
n. ASTM D 412, Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension.
o. ASTM D 746, Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.
p. ASTM D 792, Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
q. ASTM D 1499, Practice for Operating Light- and Water-Exposure Apparatus (Carbon-Arc Type) for Exposure of Plastics.
r. ASTM D 2240, Test Method for Rubber Property - Durometer Hardness.
s. ASTM E 329, Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.
t. ASTM E 548, Guide for General Criteria Used for Evaluating Laboratory Competence.
u. ASTM F 552, Terminology Relating to Chain Link Fencing.
v. ASTM F 567, Practice for Installation of Chain-Link Fence.
w. ASTM F 626, Specification for Fence Fittings.
x. ASTM F 668, Specification for Poly(Vinyl Chloride) (PVC)-Coated Steel Chain-Link Fence Fabric.
y. ASTM F 900, Specification for Industrial and Commercial Swing Gates.
z. ASTM F 1043, Specification for Strength and Protective Coatings on Metal Industrial Chain Link Fence Framework.
aa. ASTM F 1083, Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.

bb. ASTM F 1184, Specification for Industrial and Commercial Horizontal Slide Gates.
cc. ASTM F 1664, Specification for Poly(Vinyl Chloride)(PVC)-Coated Steel Tension Wire Used With Chain-Link Fence.
dd. ASTM F 1665, Specification for Poly(Vinyl Chloride)(PVC)-Coated Steel Barbed Wire Used With Chain-Link Fence.
ee. ASTM G 23, Practice for Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials.

3. Chain Link Fence Manufacturer's Institute, (CLFMI).

a. CLF 2445 - Product Manual.

4. Institute of Electrical and Electronic Engineers, (IEEE).

a. Standard No. C2 - National Electrical Safety Code.
b. Standard No. 81 - Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System, Standard Guide for.

5. National Electrical Manufacturer's Association, (NEMA).

a. NEMA ICS 1, Industrial Control and Systems: General Requirements.
b. NEMA ICS 2, Industrial Control and Systems: Controllers, Contactors and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.
c. NEMA ICS 6, Industrial Control and Systems: Enclosures.
d. NEMA MG 1, Motors and Generators.

6. Underwriters' Laboratories, Incorporated, (UL).

a. Standards for Safety, UL Standard No. 467, Grounding and Bonding Equipment.

1.03 DEFINITIONS

A. Terminology used in this Section shall comply with CLF 2445, ASTM F 552 and the following:

1. The term "knuckling" shall be used to describe the type of selvage obtained by interlocking adjacent pairs of wire ends and then bending the wire ends back into a closed loop.

2. The term “gate operating cycle” shall mean one gate opening plus one gate closing.

3. The term “fencing” shall be used to describe an assembly of metal components, including wire chain-link fabric fastened to top, bottom and intermediate horizontal rails and to vertical line posts, corner posts and terminal posts. This assembly shall also include all auxiliary components, gates, fittings, fasteners and other accessories all with polymer coating and other specified protective coatings.

1.04 QUALITY ASSURANCE

A. Erector Qualifications:

1. Engage a single erector skilled, trained and with successful and documented experience in the installation of fencing, who is acceptable to the fencing manufacturer, and with specific skill and successful experience in the erection of the types of components required; and who agrees to employ only tradesmen with specific skill and successful experience in this type of Work. Submit names and qualifications to Engineer along with the following information on a minimum of three successful projects:

a. Names and telephone numbers of owners, architects or engineers responsible for projects.
b. Approximate contract cost of the fencing.
c. Amount of area installed.

B. Testing Agency Qualifications: To qualify for approval, an independent testing agency shall demonstrate to Engineer’s satisfaction, based on evaluation of criteria submitted by testing agency, that it has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work, in accordance with ASTM E 329 and as documented according to ASTM E 548.

C. Source Quality Control:

1. Provide fencing as a complete system with all gates, hardware, appurtenances and other components produced by a single manufacturer, including custom erection accessories, fittings, clamps and fastenings as may be necessary or required.

2. Provide fence fabric imprinted with manufacturer’s trade name, country of origin, core wire gauge, and finished outside diameter gauge.

3. Provide shipping list for materials used, endorsed with the manufacturer's voucher certifying that the material used in the fencing complies with these Specifications and with specific selections made on approved Shop Drawings.

4. Structural shapes of satisfactory sections and equal strengths may be substituted if approved by Engineer.

D. Performance Criteria:

1. Comply with the standards of the Chain Link Fence Manufacturer's Institute for product and installation requirements and the requirements of ASTM F 567. These standards shall represent a minimum level of quality when additional information is not shown or specified in the Contract Documents.

2. Where proposed fencing framework or other structural components varies from Contract Documents, the fabricator shall provide structural calculations for the design of the proposed fencing to Contractor for submittal to Engineer as part of Shop Drawing review. Structural analysis shall verify that all system components including, but not limited to, supports, gates, fasteners, fittings and connections meet the requirements of governing authorities having jurisdiction at the Site. Such modifications shall be incorporated into the Work only as acceptable to Engineer.

3. Verify size of framing members shown or specified, and submit with Shop Drawings. Member sizes, thicknesses and weights shown or specified shall be considered minimum. Where structural analysis indicates, provide additional members, or increased member size, thickness or weight.

4. Modifications may be made only as necessary to meet Site conditions to ensure proper fitting and support of the Work, and only upon submittal of Shop Drawings and receipt of approval by Engineer.

5. Furnish weights of zinc and aluminum coatings on wire and pipe fabrications, in compliance with CLF 2445.

6. Furnish thickness of polyvinyl chloride coating on wire and pipe fabrications, in compliance with CLF 2445.

E. Fabrication Tolerances

1. Fabric, posts, rails, and other supports shall be straight or uniformly curved to provide the profiles shown, to a dimensional tolerance of 1/16-inch in 10 feet - 0 inches without warp or rack in the finished installation.

1.05 SUBMITTALS

A. Qualifications Data: Submit qualifications data for the following:

1. Erector.
2. Test agency.

B. Shop Drawings: Submit the following:

1. Copies of manufacturer's technical product information, specifications and installation instructions for all fencing components, and auxiliary system components such as gate operators and motors.

2. All structural calculations verifying that all system components comply with the requirements of governing authorities having jurisdiction at the Site.

3. Drawings at a scale of 1/4-inch equals one foot of typical fence assembly, identifying all materials, dimensions, sizes, weights, and finishes of all rails, posts, braces, supports and other fencing components. Show fence heights, and locations of gates. Show gate swing, or other operation, hardware, and accessories. Include plans, elevations, sections, with required installation and operating clearances, and details of post anchorage, attachments and bracing.

4. A list of all hardware, fasteners and accessories.

C. Test Reports: Submit the following:

1. Physical properties of polyvinyl chloride protective coating in compliance with ASTM D 1499.
2. Weight of aluminum coating on wire fabrications in compliance with ASTM A 428.
3. Weight of zinc coating on pipe fabrications in compliance with ASTM A 90.

1.06 DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials

1. Packaging and marking shall comply with CLF 2445.

2. Deliver materials in manufacturer's original, unopened packaging with all factory-applied tags, labels and other identifying information intact, legible and accurately representing material approved on Shop Drawings by Engineer.

B. Storage of Materials

1. Store all materials under weatherproof cover, off the ground and away from other construction activities.

2. Do not store material in a manner that would create a humidity chamber. Provide for free movement of air under protective cover and between components of the fencing.

C. Handling of Materials

1. Handle material in a manner that is in compliance with product institute standards and that will prevent damaging coatings.

1.07 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by OWNER or others, unless permitted under the following conditions, and then only after arranging to provide temporary utility services according to requirements indicated.

1. Notify Engineer not less than 7 days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Engineer's written permission.

B. Site-Measurements: Take measurements at the Site and verify layout information and dimensions for fencing and gates in relation to property surveys and existing conditions.

C. Do not begin installation and erection of the fencing until final grading is completed.

1.08 WARRANTY

A. General Warranty: The special warranties specified in this Article shall not deprive Owner of other rights or remedies Owner may otherwise have under the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under the Contract Documents.

B. Special Warranties

1. Furnish manufacturer's written ten-year warranty against cracking and peeling of the vinyl coating, and against rusting or corrosion of the metal.

PART 2 PRODUCTS

2.01 MATERIALS

A. General:

1. Tube sizes specified are nominal outside dimension.

2. Roll-formed section sizes are the nominal outside dimensions.

3. Wire gauges shall conform to American Steel and Wire Company gage.

4. Heat-form all arcs and chords before protective coatings are applied to metal.

5. All sizes specified are given for uncoated metal. All protective coatings are in addition to specified metal dimensions, gages and sizes.

6. Provide weights of zinc and aluminum coatings on wire and pipe fabrications in accordance with CLFMI CLF 2445.

7. Provide thickness of vinyl coating on wire and pipe fabrications in accordance with CLFMI CLF 2445.

B. Chain-Link Fence Fabric:

1. One-piece fabric widths, for fencing 12 feet and less in height, complying with CLFMI CLF 2445.

2. Wire mesh shall be woven throughout in form of approximately-uniform square mesh with parallel sides and horizontal and vertical diagonals of approximately-uniform dimensions, of size and gage specified and in

compliance with ASTM A817, Type 1, cold-drawn carbon steel wire with minimum breaking strength of 2,170 pounds and coated with aluminized finish, as specified. Fabric shall be as recommended by CLFMI for heavy industrial usage.

3. Provide fence fabric imprinted with manufacturer's trade name, country of origin, core wire gage, and finished outside diameter gage.

4. Provide fabric knuckled to eliminate exposure of sharp edges.

5. Fabric Gage: Provide the following:

   a. No. 9-gage wires.

6. Mesh Size: Provide the following:

   a. Two-inch mesh.

2.02 FRAMEWORK

A. General: The following table is provided for the convenience of Contractor and provides actual OD and equivalent nominal NPS size and trade size of round members.

Actual OD	NPS Size	Trade Size
1.315	1	1-3/8
1.660	1-1/4	1-5/8
1.900	1-1/2	2
2.375	2	2-1/2
2.875	2-1/2	3
3.500	3	3-1/2
4.000	3-1/2	4
6.625	6	6-5/8
8.625	8	8-5/8

B. Pipe shall be commercial grade, plain end steel pipe with standard weight walls. Steel strip used in the manufacture of pipe shall be in compliance with ASTM F 1083, Schedule 40 pipe with minimum yield strength of 25,000 pounds per square inch and protected with zinc, as specified.

C. End, Corner, and Pull Posts: Provide end, corner, and pull posts of minimum sizes as follows:

1. Up to six feet fabric height:

a. 2.375-inches OD pipe weighing 3.65-pounds per linear foot.

D. Line Posts: Provide line posts of the minimum sizes and weights as follows:

1. Up to six feet fabric height:

a. 1.90 inches OD pipe weighing 2.72 pounds per linear foot.

E. Gate Posts: Furnish gate posts for supporting single gate leaf, or one leaf of a double gate installation, for nominal gate widths as follows:

1. Up to six feet wide:

a. 2.875-inches OD pipe weighing 5.79-pounds per linear foot.

2. Over six feet and up to 13 feet wide:

a. 4-inches OD pipe weighing 9.11-pounds per linear foot.

3. Over 13 feet and up to 18 feet wide:

a. 6.625-inches OD pipe weighing 18.97-pounds per linear foot.

4. Over 18 feet:

a. 8.625-inches OD pipe weighing 28.55-pounds per linear foot.

F. Top Rail: Provide top rails, unless otherwise shown, conforming to the following:

1. 1.900-inch OD pipe weighing 2.72 pounds per linear foot.

2. Provide in manufacturer's longest lengths, with expansion type coupling 0.051-inch-thick rail sleeves, approximately 7-inches long, for each joint.

3. Provide means for attaching the top rail securely to each gate, corner, pull, and end post.

G. Center Rails Between Line Posts: Provide center rails between line posts, where shown, consisting of 1.660-inch OD pipe weighing 2.27-pounds per linear foot.

H. Roll-Formed Steel: Provide rolled steel shapes produced from structural-quality steel conforming to ASTM A 570, Grade 45, with a minimum yield strength of 45,000 pounds per square inch. Protective coating system shall conform to ASTM F 1043, as specified.

2.03 GATES

A. Swing gates shall comply with ASTM F 900.

B. Gate hinges shall be of the double clamping offset type. To hold the gate in the open or closed positions, provide each gate frame with a keeper that automatically engages a gate shoe set in concrete. Gates shall have a drop latch with provision for a padlock.

1. Gate Hinges: Pressed or forged steel or malleable iron to suit gate size, non-lift-off type, 180 degree offset heavy-industrial hinges; 1-1/2 pair per leaf.
2. Latch: Forked-type or plunger-bar type to permit operation from either side of gate, with padlock eye as integral part of latch.
3. Keeper: Provide a gate keeper for vehicle gates that automatically engages gate leaf and holds it in the open position until manually released.

C. Padlocks: Provide each gate with a heavy-duty bronze padlock and shackle chain as follows:

1. Product and Manufacturer: Provide one of the following:

   a. No. 160DHM with 11/32-inch marine brass shackle by the Master Lock Company.
   b. Or equal.

2. Provide three keys for each padlock. Where more than one gate is required for the same enclosure, padlocks shall be keyed the same.

D. All gate frames shall have intermediate horizontal rails. Gate frames shall be of welded construction and shall be galvanized after fabrication. Single gates 6-feet wide or wider and double gates 12-feet wide or wider shall be provided with diagonal bracing in one direction, extending from top to bottom rail.

E. Gate Stops: Provide gate stops for double gates consisting of mushroom-type flush plate with anchors, set in concrete and designed to engage a center drop rod or plunger bar. Include locking device and padlock eyes as an integral part of the latch, using one padlock for locking both gate leaves.

F. Fabricate gate perimeter frames of tubular members. Provide additional horizontal and vertical members to ensure proper gate operation and for attachment of fabric, hardware and accessories. Space so that frame members are not more than eight feet apart. Fabricate as follows:

1. Up to six feet high, or leaf width eight feet or less:

   a. 1.660-inch OD pipe weighing 2.27-pounds per linear foot.

2. Over six feet high, or leaf width exceeding eight feet:

   a. 1.900-inch OD pipe weighing 2.72-pounds per linear foot.

G. Assemble gate frames by welding or with special malleable or pressed steel fittings and rivets for rigid connections. Use same fabric as for the fence. Install fabric with stretcher bars at vertical edges. Bars may also be used at top and bottom edges. Attach stretchers to gate frame at not more than 15-inches on center. Attach hardware with rivets or by other means, which will provide security against removal or breakage.

H. Install diagonal cross-bracing on gates consisting of 1/2-inch diameter adjustable length truss rods provided with turnbuckles to ensure frame rigidity without sag or twist.

I. Where barbed wire is shown or indicated above gates, extend end-members of gate frames one foot above top member and prepare to receive three strands of wire. Provide necessary clips for securing wire to extensions.

2.04 AUXILIARY FENCING MATERIALS AND ACCESSORIES

A. Wire Ties

1. For tying fabric to line posts, use 9-gage, aluminum alloy 1100-H4, polyvinyl chloride coated wire ties to match fence fabric, spaced 12 inches on center.
2. For tying fabric to rails and braces, use 9-gage, aluminum alloy 1100-H4, polyvinyl chloride coated wire ties to match fence fabric, spaced 24 inches on center.
3. For tying fabric to tension wire, use 11-gage, aluminum alloy 1100-H4, polyvinyl chloride coated wire hog ring ties to match fence fabric, spaced 24 inches on center.

B. Post Caps: Pressed steel, wrought iron, or cast aluminum alloy, designed as a weather tight closure cap, for tubular posts. Provide one cap for each post unless equal protection is afforded by combination post top cap and barbed wire supporting arm, where barbed wire is required.

1. Provide caps with openings to permit through passage of the top rail.
2. Provide cone-type caps for terminal posts and loop-type caps for line posts.

C. Stretcher Bars: One-piece lengths equal to full height of fabric, with a minimum cross-section of 3/16-inch by 3/4-inch. Provide one stretcher bar for each gate and end post, and two for each corner and pull post, except where fabric is integrally woven into the post.

D. Stretcher Bar Bands: Pressed steel, galvanized, 0.078-inches to 0.108-inches thick depending on post diameter, spaced not over 15 inches on center to secure stretcher bars to end, corner, pull, and gate posts.

1. Bands may also be used with special fittings for securing rails to end, corner, pull and gate posts.

E. Concrete

1. Cement: Domestic Portland cement complying with ASTM C150, Type II. Air entraining cements shall not be used. The brand of cement shall be subject to approval by the Engineer and one brand shall be used throughout the Work.
2. Water: Potable water conforming to ASTM C618.
3. Admixtures: Admixtures shall be free of chlorides and alkalis (except for those attributable to water). When it is required to use more than one admixture in a concrete mix, the admixtures shall be from the same manufacturer. Admixtures shall be compatible with the concrete mix, including other admixtures, and shall be suitable for use in contact with potable water after 30 days of concrete curing.
4. Fly Ash: ASTM C618, Class F except that the Loss on Ignition (LOI) shall be limited to 3% maximum.

F. Tension Wire: Furnish tension wire consisting of aluminized 7 gage coiled spring wire.

1. Locate at bottom of fabric only.

G. Barbed Wire Supporting Arms: Furnish pressed steel, wrought iron, or malleable iron barbed wire supporting arms, complete with provisions for anchorage to

posts attaching 3 rows of barbed wire to each arm. Supporting arms shall be integral with post top weather cap. Provide following type:

1. Single 45 degree arm, one for each post where shown.

H. Barbed Wire: 3 strand, 12.5 gage wire with 14 gage, 4-point aluminum barbs spaced 5 inches on center, as follows:

1. Galvanized per manufacturer's standards.

I. Privacy Slats: Provide plastic bottom-locking fencing slats manufactured from PVC or HDPE with UV inhibitors for a privacy factor of 75 to 90 percent. The manufacturer shall provide a 25-year limited warranty.

2.05 FINISHES

A. Chain-Link Fence Fabric

1. Aluminized finish with not less than 0.40-ounces aluminum per square foot, complying with ASTM A 491, Class II.

B. PVC Finish for All Fencing Components: Provide polyvinyl chloride (PVC) epoxy-modified plastic resin finish, fusion bonded to heated metal, minimum 10-mil thickness.

1. Provide the following physical properties for polyvinyl chloride coating:

a. Specific Gravity, ASTM D 792: 1.30 to 1.38, maximum.
b. Ultimate Tensile Strength, ASTM D 412: 2,600 pounds per square inch ±5 percent.
c. Hardness, ASTM D 2240: Durometer A (10 Second) 93 ±3.
d. Ultimate Elongation, ASTM D 412: 275 percent ±5 percent.
e. Compression Cut Resistance, Bell Laboratories: 2,000 pounds per square inch.
f. Low Temperature Brittleness, ASTM D 746: -20 degrees C.
g. Low Temperature Flexibility, (Mandrel Wrap): -40 degrees C.
h. Weatherometer Exposure, ASTM G 23, with no change: 1,000 hours.

2. Provide polyvinyl chloride (PVC) plastic resin finish over aluminized steel wire by the thermal extrusion method, in compliance with ASTM F 668, Class 2b.

3. Color:

a. As selected by Engineer from manufacturer's complete range of standard and custom colors.
b. Provide fencing with all components, including framework and accessories completely protected with color coating, in compliance with CLF 2445.

C. Welded Joints

1. Repair polymer-coated steel by applying an epoxy primer, intermediate coat and a urethane topcoat matching color and reflectivity of adjacent PVC finish.

PART 3 EXECUTION

3.01 INSPECTION

A. Contractor shall examine the conditions under which the fencing and gates are to be erected and notify Engineer, in writing, of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the Engineer.

3.02 ERECTION

A. Erect framework, fabric and accessories in accordance with ASTM F 567.

B. Excavation: Drill holes of diameters specified, for post footings in firm, undisturbed or compacted soil.

1. For posts set in cast-in-place concrete, provide hole diameters dug or drilled a minimum of four times the largest cross section of the post.

a. Unless otherwise indicated, excavate hole depths approximately 3 inches lower than the post bottom, with bottom of posts set not less than 24-inches below the surface of finished grade when in firm, undisturbed soil, plus an additional 3-inches for each foot increase in the fence height over four feet.

2. Spread soil from excavations uniformly adjacent to the fence line, or on adjacent areas of the Site, as directed by the Engineer.

3. When solid rock is encountered at the surface, drill into rock at least 12 inches for line posts and at least 18 inches for end, pull, corner, and gate posts. Drill hole at least 1-inch greater diameter than the largest dimension of the post to be placed.

   a. If solid rock is below soil overburden, drill to full depth required, except penetration into rock need not exceed the minimum depths specified above.

C. Setting Posts: Remove loose and foreign materials from sides and bottoms of holes, and moisten soil prior to placing concrete.

1. Center and align posts in holes 3-inches above bottom of excavation.

2. Posts shall be set in concrete footings, except as otherwise shown or specified. Place concrete around posts in a continuous pour, and vibrate or tamp for consolidation. Check each post for vertical and top alignment, and hold in position during placement and finishing operations.

3. Extend concrete to 2 inches above grade or to 2 inches below grade if a cover of sod, blacktop, or other material is shown to conceal concrete. Crown to shed water away from posts.

4. Extend footings for gate posts to the underside of bottom hinge. Set keeps, stops, sleeves and other accessories into concrete as required.

5. Keep exposed concrete surfaces moist for at least seven days after placement, or cure with membrane curing materials, or other acceptable curing method.

6. Grout posts set in sleeved holes, concrete constructions, or rock with grout.

D. Concrete Strength: Allow concrete to attain at least 75 percent of its minimum 28-day compressive strength, but in no case sooner than seven days after placement, before rails, tension wires, barbed wire, or chain-link fabric is installed.

1. Do not stretch and tension fabric and wires, and do not hang gates until the concrete has attained its full design strength.

E. Posts and Rails

1. Line Posts: Set posts in cast-in-place concrete footings as specified, spaced not more than ten feet on centers. Install caps on tops of all posts to exclude moisture and to receive the top rail, unless equal protection is afforded by combination post top cap and barbed wire supporting arm, where barbed wire is required.

2. Top Rails: Run rail continuously through post caps or extension arms, bending to radius for curved runs. Provide expansion couplings as recommended by fencing manufacturer to form a continuous rail between terminal posts.

3. Brace Assemblies: Install braces so posts are plumb when diagonal rod are under proper tension. Install brace assemblies at end posts and at both sides of corner and pull post panels. Panels adjacent to gates shall have intermediate horizontal rails and diagonal bracing. The diagonal bracing shall run from the center of the first line post to the bottom of the terminal post.

F. Chain-Link Fabric

1. Install fabric on security side of fence, and anchor to framework so that fabric remains in tension after pulling force is released. Fasten to terminal posts and gate posts with tension bars threaded through mesh and secured with tension bands at maximum intervals of 14-inches.

2. Tie to line posts, gate frames and top and bottom rails with tie wires spaced at maximum 12-inches on posts and 24-inches on rails.

3. Connect tension bars to posts and frames by means of adjustable bolts and bands spaced not more than 14-inches apart.

4. Leave approximately 2-inches between finish grade and bottom selvage, except where bottom of fabric extends into concrete.

5. Join roll of chain-link fabric by weaving a single picket into the ends of the roll to form a continuous mesh.

G. Tension Wire

1. Stretch tension wire taut and free of sag, from end to end of each stretch of fence and position at a height that will enable the wire to be fastened to the

chain-link fabric by securing within the top 12-inches of the chain-link fabric.

2. Fasten bottom tension wire within the bottom 6-inches of the chain-link fabric.

3. Tie tension wire to each post with not less than 6-gage galvanized wire.

H. Barbed Wire

1. Install three parallel wires on each extension arm; on security side of fence, unless otherwise shown or indicated.

2. Pull wire taut to remove sag and firmly install in slots of extension arms to prevent movement or displacement.

3. Secure wire to terminal posts utilizing terminal post band arms or brace bands.

4. Extend vertical members of gates to receive barbed wire.

I. Stretcher Bars: Thread through or clamp to fabric 4 inches on center, and secure to posts with metal bands spaced 15 inches on center.

J. Gates: Install gates plumb, level, and secure for full opening without interference. Install ground-set items in concrete for anchorage, as shown on approved Shop Drawings. Adjust hardware for smooth operation and lubricate where necessary.

K. Tie Wires: Use U-shaped wires conforming to diameter of pipe. Clasp pipe and fabric firmly with ends twisted at least two full turns. Bend ends of wire to minimize hazard to persons or clothing.

L. Fasteners: Install nuts for tension band and hardware bolts on side of fence opposite fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

3.03 ADJUSTMENT AND CLEANING

A. Repair coatings damaged in the shop or during erection on-Site by recoating with manufacturer's recommended repair compound, applied in accordance with manufacturer's directions.

B. Gate: Adjust gate to operate smoothly, easily, and quietly, free from binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or

malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

C. Lubricate operating equipment and clean exposed surfaces.

D. Repair and replace all broken or bent components.

END OF SECTION

SECTION 25

ROADWAY CONSTRUCTION STANDARDS

General

Unless otherwise indicated in these standards, all roadway construction shall comply with the latest edition of the Florida Department of Transportation Standard Specifications for Road and Bridge Construction. The City or Designee shall make the interpretation of these specifications in cases where they are unclear or where there is a conflict due to a difference in understanding of the intent of the specifications.

Clearing and Grubbing

All rights-of-way shall be completely cleared and grubbed for their entire width. Selective clearing and grubbing in order to preserve desirable, existing landscape may be allowed provided that the final determination of areas to be cleared and grubbed is made by the City or Designee.

Earthwork

In areas where unsuitable materials (muck, peat, clay, rock, etc.) are uncovered, the contractor shall over-excavate to a depth approved by the City and shall backfill with a suitable material in an approved manner as directed by the City or Designee. Fill areas shall be constructed in 6-inch lifts.

All unsuitable material that is removed shall be hauled off-site and properly disposed of by the contractor.

Any hauling equipment loaded beyond the legal road limit, is not permitted. The contractor shall restore any roads, public or private, damaged by his equipment, to its original condition. This requirement shall apply to all phases of construction.

Subgrade

The following are minimum standards for the stabilized subgrade:

Width : The subgrade shall extend twelve (12) inches behind the curb.

Depth : The subgrade shall have a minimum depth of 12-inches.

Compaction : The subgrade shall be compacted to 98% density having a minimum Limerock Bearing Ratio (LBR) of 40, (F.D.O.T. Type “B” Stabilization).

Care of Subgrade: Trucks will be allowed on finished subgrade to dump base course, but contractor will be required to level out ruts. In the event the trucks cause too much damage to the subgrade, the City or Designee may require dumping, spreading, and hauling on the base course.

Base Course

The following are minimum standards for the base course:

Material: Crushed limerock is the standard material type for the road base. Other materials

may be used if approved by the City or Designee. Soil cement or crushed concrete may be specified by the City or Designee as the road base material type if site conditions warrant.

Width: All bases shall match the width of the finished surface from face of curb to face of curb.

Depth: The base shall have a minimum depth of six inches. Heavy duty roads shall have a base with a minimum depth of eight inches placed in two lifts.

Compaction: Limerock base shall be compacted to a minimum 98% density as determined by ASSHTO T-180.

Strength: Soil cement base shall have a seven day design compressive strength of at least 300 PSI.

Forms: No form boards will be required unless, in the opinion of the City or Designee, the contractor is not taking precautions to obtain the full depth at the edges.

Grading: The base shall be graded and rolled to conform to the grade and cross-slope of the finished roadway.

Prime Coat: Prime coat shall be applied to all base courses, and sand sealed.

Pavement Surface

The following are minimum standards for pavement wearing surface:

Material: Type SP9.5 asphaltic concrete shall be used for the road wearing surface. Other asphalt types may be used if required by the City or Designee.

Depth: Roads shall have a minimum 1½ -inch depth of wearing surface. The minimum depth may be increased if required by the City or Designee.

Heavy Duty Roads: Heavy duty roads shall have a wearing surface consisting of minimum of two inches of SP12.5 asphaltic concrete overlaid with a one inch friction course. The type of material to be used for the friction course shall be determined by the City or Designee.

Grading: Road surfaces shall be graded with a minimum cross-slope of ¼ inch per foot.

Curb and Gutter

The City standard is for all roads to include curb and gutter. Non-guttered road designs must be approved by the City or Designee.

The width of curb and gutter shall be a minimum of twenty-four (24) inches and shall be FDOT Drop (Miami) curb type as the standard or FDOT type F curb and gutter, depending upon the stormwater flow to be handled. FDOT type A (mountable median curb) may be used around median dividers on the high side of pavement. Other types of curb may only be used with approval of the City or Designee. There shall be a stabilized subgrade beneath all curb and gutter.

No water valve boxes, meters, portions of manholes, or other appurtenances of any kind relating to any underground utilities shall be located in any portion of a curb and gutter

section.

The curb and gutter flow line grades shall run parallel to the road centerline grade. The minimum allowable flow line grade of curbs and gutters shall be 0.30%, except in intersections where flatter grades may be allowable.

Joints shall be sawed (unless an alternate method is used) at intervals of ten (10) feet, except where shorter intervals are required for closures, but, in no case, less than four (4) feet. Joints shall be cut on the same day that the curb and gutter is poured.

All cross-street valley gutters shall be constructed of concrete.

Pavement Marking and Signing

All pavement marking and traffic control signs shall be in place prior to final inspection. The installation of traffic control devices shall be at no cost to the City. All materials and installation shall conform to the specifications of the Manual of Uniform Traffic Control Devices, latest edition.

If, at any time prior to final acceptance, an unforeseen need becomes apparent for signing or pavement markings that were not shown on the approved plans, the City may require additional sign(s) or markings in the interest of public safety and as a condition of City acceptance.

All pavement markings shall be thermoplastic except for on bike paths and bike lanes which shall be standard paint for pavement marking.

All regulatory signs shall have “high intensity” facings or better.

Stop signs on local streets shall be 30” and 36” on all others and shall be placed on 2” square metal posts. A larger stop sign may be required at the direction of the City or Designee.

Road name signs shall be 9” high with a length of 24” minimum to 54” maximum.

Sidewalks

Sidewalks shall be constructed as follows:

Sidewalks shall be 4” thick, 3,000 PSI concrete with fiber reinforcement. The depth shall be 6” at driveways. Saw cut traverse joints shall be included to control cracking. Joints shall be cut on the same day as the pour and shall be spaced at length equal to the width of the sidewalk.

Driveways

Driveway aprons shall be constructed as follows:

Driveways shall be 6”thick, 3,000 PSI concrete with fiber reinforcement. Construct from the edge of the existing pavement to the property line.

Decorative Pavement

The use of decorative pavement shall be subject to the approval of the City or Designee. The City shall not assume the maintenance of decorative pavement sections. Maintenance shall

be the responsibility of a homeowners association or other acceptable entity. The City shall have the right to modify, alter, or remove any or all portions of the decorative pavement as necessary for roadway improvements or improvements for traffic safety.

Paving Bricks: The use of paving bricks shall be subject to the approval of the City. The developer shall submit to the City, for approval, manufacturer's literature and technical specifications regarding the structural strength, skid resistance and subgrade requirements.

Storm Sewer Pipes

The following is a list of minimum standards for storm sewer piping:

Material: Reinforced concrete (RCP) pipe or dual-wall, smooth-bore corrugated HDPE pipe. Only RCP shall be allowed under roads.

Minimum Size: Fifteen (15) inches or equal, unless otherwise approved by the City or Designee.

Minimum Cover: One and one-half (1½) inches below base.

Junctions: An inlet or manhole is required at each change of alignment, grade, size, or material. Maximum length between manholes shall be 300-feet for pipe diameter sizes less than 24" and 400-feet for 24" and above.

End Treatment: Inlet, manhole, headwall, or mitered end sections.

Inlets, Manholes and Mitered End Sections

Inlets, manholes, and mitered end sections shall be constructed in accordance with the Florida Department of Transportation Standard Specifications for Road and Bridge Construction.

Groundwater / Underdrain

Roads shall be designed such that the high groundwater elevation is at least 6" below the bottom of the subgrade. In cases where this is unattainable, road underdrains may be utilized with the approval of the City or Designee. Underdrain design shall be subject to the approval of the City or Designee.

If road underdrains are installed which discharge into the stormwater management system, the retention/detention system shall be designed to accommodate the additional flow and volume due to the groundwater discharge.

Pressurized Pipes

Pressurized PVC pipe laid under roadways, with the exception of local streets, shall be sleeved in a conduit. An acceptable alternative shall be the utilization of ductile iron pipe without a sleeve.

Sodding

Two strips of sod shall be placed along the back of curb on all roads. Roads which exceed a grade of 3% shall be sodded from edge of pavement to the edge of the right-of-way to prevent excessive erosion and sedimentation.

Any existing sodded areas that are disturbed by construction shall be resodded with like sod and restored to its original state.

The contractor shall be responsible for watering and maintaining the viability of the sod for a period of 30 days after installation. Any sod which dies within this period shall be replaced at no cost to the City. All grassed areas within existing City rights-of-way that are disturbed by construction shall be re-sodded.

Seeding and Mulching

All unpaved areas of the right-of-way that are not required to be sodded shall be seeded and mulched.

Seeding and mulching shall be distributed on a per acre basis. The mix for a one acre area shall include: 30 pounds of Bermuda (one-half hulled/one-half un-hulled); 80 pounds of Bahia; 550 pounds of fertilizer and from October 1 through March 31, 50 pounds of millet shall be included. Clean weed-free mulch shall be used.

Proper watering shall be included for 30 days from the completion of the seeding and mulching.

Testing

Testing shall be provided as part of construction and shall be at no cost to the City. Testing shall be performed by an independent engineering testing laboratory certified in the State of Florida.

The following are minimum testing requirements:

Subgrade: Testing for the subgrade thickness, bearing value and density shall be located no more than five hundred (500) feet apart and shall be staggered to the left, right and on the centerline of the roadway. The City or Designee may also require additional test locations. There shall be no less than one (1) test per road. Testing shall be in accordance with applicable FDOT, AASHTO, or ASTM standards. Certified test results shall be submitted to the City or Designee for approval prior to proceeding with the base course.

Limerock Base: Testing for the base thickness and density shall be located no more than 500-feet apart and shall be staggered to the left, right and on the centerline of the roadway. The City or Designee may also require additional test locations. There shall be no less than one test per road. Testing shall be in accordance with applicable FDOT, AASHTO, or ASTM standards. Certified test results shall be submitted to the City or Designee for approval prior to proceeding with the wearing surface.

Soil / Cement Base: Testing for the base thickness and strength shall be located no more than 500-feet apart and shall be staggered to the left, right and on the centerline of the roadway. The City or Designee may also require additional test locations. There shall be no less than one test per road. Testing shall include test cores taken after seven days to verify thickness and testing to verify a minimum seven day compressive strength of 300 PSI. Testing shall be in accordance with applicable FDOT, AASHTO, or ASTM standards. Certified test results shall be submitted to the City or Designee for approval prior to proceeding with the wearing surface.

Wearing Surface: Testing for wearing surface thickness shall be located no more than 500-feet apart and shall be staggered to the left, right and on the centerline of the roadway. The City or Designee may also require additional test locations. There shall be no less than one test per road. Testing shall include: certified design mix submitted for approval prior to placing asphalt, extractions taken in field at least one per day and corings to verify thickness. Testing shall be in accordance with applicable FDOT, AASHTO, or ASTM standards. Certified test results shall be submitted to the City or Designee for approval.

APPROVED MANUFACTURER LIST

Cat.	Description	Manufacturer	Water Model	Water Comments	Reclaimed Water Model	Reclaimed Water Comments	Wastewater Model	Wastewater Comments	Stormwater Model	Stormwater Comments
Valves	Air Release Valve	**ARVs shall have 316 stainless steel service saddles, piping, and ball valves.**								
		A.R.I.	S-014-016	S-050 will be accepted for low pressure applications	S-021		S-020		N/A	
		Valmatic	15A-50HP		15A-50HP		49ABW		N/A	
	Combination Air/Vacuum	**Aboveground enclosures shall be vented with tamper proof locking device. All dead-end water mains, temporary or permanent, shall be equipped with a lockable, manually operated blow-off at the terminus. Combination air valves shall have 316 stainless steel service saddles, piping, and ball valves.**								
		A.R.I.	D-040		D-021		D-020 or D-025		N/A	
		Valmatic	201C.2-258C		201C.2-258C		301 ABW		N/A	
	Ball Valve (Non-Service Connection)	**Ball Valves shall be stainless-steel, full port, 2" and smaller of a two-piece design. See Service Connection Section for additional applications. Ball valves for wastewater shall only be for Air Release and Combination Air/Vacuum Valve piping.**								
		APOLLO	86A-100 Series	87A-100 Series may be used for flanged applications	86A-100 Series	87A-100 Series may be used for flanged applications	86A-100 Series	87A-100 Series may be used for flanged applications	N/A	
		FNW	200A		200A		100A		N/A	
	Blow Off Valve	**Dead-end water mains, temporary or permanent, shall be equipped with a lockable, manually operated blow-off at the terminus with a gate valve and 2 inch blow-off. Where the water main profile is such that an air pocket or entrapment could occur, resulting in flow blockage, methods for air release shall be provided, including blow off valves.**								
		Kupferle Foundry Co	Truflo Series TF #550		Truflo Series TF#550		N/A		N/A	
		Water Plus Corp.	VB 2000B		VB 2000B		N/A		N/A	
	Butterfly Valve	**Butterfly Valves greater than 12" and their operators shall conform to AWWA C504. Bodies shall be cast-iron, self-lubricated, resilient seated. Shafts shall be stainless steel and capable of drip-tight shutoff at the rated pressure.**								
		Azure	Model 45		Model 45		N/A		N/A	
		Clow	4500 Series		4500 Series		N/A		N/A	
		DeZurik	BAW		BAW		N/A		N/A	
		Mueller	Lineseal XPII		Lineseal XPII		N/A		N/A	
		Valmatic	2000HP		2000HP		N/A		N/A	
	Check Valve	**Valves 4-inch and larger shall be 8 mil epoxy lined and shall be equipped with a lever and weight installed aboveground or in a valve vault.**								
		American	Series 600		Series 600		Series 600		N/A	
		Clow	1106LW	159-02 will be accepted for Check Valves larger than 12"	1106LW	159-02 will be accepted for Check Valves larger than 12"	1106LW	159-02 will be accepted for Check Valves larger than 12"	N/A	
		DeZurik	250/250A		250/250A		250/250A		N/A	
		Kennedy	1106LW	106 will be accepted for Check Valves larger than 12"	1106LW	106 will be accepted for Check Valves larger than 12"	1106LW	106 will be accepted for Check Valves larger than 12"	N/A	
		Mueller	Series 2600		Series 2600		Series 2600		N/A	
	Hydrants	**Fire Hydrants shall be installed with a blue roadway reflector. Hydrants shall be connected to water mains of 8-inch minimum size.**								
		American	5 1/4 B-84-B		5 1/4 B-84-B		N/A		NA	
		Clow	Medallion		Medallion		N/A		NA	
		Mueller	Centurion 200		Centurion 200		N/A		NA	
	Gate Valve	**Gate Valves 2" through 12" for underground service shall be iron body, non-rising stem with 2-inch square cast-iron operating nuts. Valves shall have corrosion resistant coating inside and out and be resilient seated, conforming to AWWA C509. All dead end lines will have gate valves at the terminus equal to the size of the main line with blow off attached. Aboveground Valves shall be flanged iron body, bronze mounted resilient seat gate valves, confirming to AWWA C509. Valves for fire suppression systems shall be approved by City fire officials.**								
		American	2500 Series	American equivalent for <2"	2500 Series	American equivalent for <2"	2500 Series	American equivalent for <2"	N/A	
		Clow	2638 F Series		2638 F Series		2638 F Series		N/A	
		Mueller	2361 Series	Mueller equivalent for <2"	2361 Series	Mueller equivalent for <2"	2361 Series	Mueller equivalent for <2"	N/A	
	Plug Valve	**Plug Valves shall be installed immediately prior to 45° bends entering manholes. Plug valves underground shall have valve boxes or in valve vaults and shall conform to CSM Section 11 Water Pipe, Fittings, Valves, and Appurtenances section.**								
		Clow	N/A		N/A		F412	FLG - 4" and Larger	N/A	
		Clow	N/A		N/A		5413	MJ - 4" and Larger	N/A	
		DeZurik	N/A		N/A		Series PEF or PEC	4" and Larger	N/A	
		Milikan/Pratt	N/A		N/A		Eccentric/Ballcentric	4" and Larger	N/A	
	Sewer Lateral Backwater Valve	**Backwater Valve shall be installed in all sewer laterals service lines for Medical and Industrial Facilities. Valve shall have a clear view top for inspection and an integral clean-out. Valve shall be normally open with no flow restrictions. Valve shall be located outside of the right-of-way and shall be the responsibility of the property owner.**								
		Mainline Backflow Products	N/A		N/A		Mainline #4963 P (PVC)	Installed in #2013 Access Box with a concrete collar		
	Pressure Backflow Assembly	**All backflow prevention devices are to be suited to the highest degree of hazard encountered at the connection. All commercial services shall be equipped with a reduced pressure zone backflow device meeting USC Cross Connection Control Laboratory and A.S.S.E. #1013 standards. Unless otherwise approved by the City, assemblies 3-inch diameter and larger shall be installed on an above-ground concrete pad. A reduced pressure zone backflow device shall be equipped on all potable water lines where reuse water is available. Devices shall conform to CSM Section 11 Water Pipe, Fittings, Valves, and Appurtenances section.**								
		Wilkins	975XL	up to 2"	N/A		N/A		N/A	
		Wilkins	375AST	3" to 12"	N/A		N/A		N/A	
		Watts	994		N/A		N/A		N/A	
	Dual Check Valves	**Dual Check Valves**								
		Wilkins	350DA	Fire Lines Only	N/A		N/A		N/A	
		Watts	774DCDA	Fire Lines Only	N/A		N/A		N/A	
	Tapping Valve	**Tapping Valves shall conform to AWWA C515. Each valve shall be provided with a flanged inlet end designed, faced, and drilled for attachment to the outlet flange of the tapping sleeve and a mechanical-joint-type bell end for connection for the branch main.**								
		American	2500 RW Series	Alignment Lip	2500 RW Series	Alignment Lip	2500 RW Series	Alignment Lip	N/A	
		Clow	2638	Alignment Lip	2638	Alignment Lip	2638	Alignment Lip	N/A	
		Mueller	T-2361 - MJXFL	Alignment Lip	T-2361 - MJXFL	Alignment Lip	T-2361 - MJXFL	Alignment Lip	N/A	

APPROVED MANUFACTURER LIST

Cat.	Description	Manufacturer	Water Model	Water Comments	Reclaimed Water Model	Reclaimed Water Comments	Wastewater Model	Wastewater Comments	Stormwater Model	Stormwater Comments
Valve Boxes	Valve Boxes	**Units shall be two-piece, screw type, adjustable, cast iron with a minimum interior diameter of 5 inches and cast with the inscription of service (e.g. "WATER") in legible lettering at the top. Valve boxes shall have concrete pads installed with minimum dimensions of 24 x 24 x 4 inches when not located in the pavement and 24 x 24 x 6 inches when located in the pavement.**								
		Bringham & Taylor	4905 Series	Water or Fire service	4905 Series	Reclaimed Service	4905 Series	Sewer Service	N/A	
		Sigma Corp.	VB561-X	Water or Fire service	VB-2503	Reclaimed Service	VB261-X	Sewer Service	N/A	
		Star Pipe Products	VB-0002	Water or Fire service	VB-0023	Reclaimed Service	VB-0002	Sewer Service	N/A	
		Tyler Union	6850	Water or Fire service	6850	Reclaimed Service	6850	Sewer Service	N/A	
	Valve Boxes Locking Lids	**Two piece standard screw type heavy duty valve boxes with locking lids shall be cast iron and type of service (e.g. "WATER") cast in heavy duty traffic lid (H20 loading), conforming to ASTM A48.**								
		Bringham & Taylor	4904-L		4904-L		4904-L		N/A	
		Sigma Corp.	VB4560W		VB4560W		VB4560W		N/A	
		Star Pipe Products	VB-0018		VB-0018		VB-0018		N/A	
		Tyler Union	Locking Lid		Locking Lid		Locking Lid		N/A	
	ARV Enclosure	**All ARV above ground enclosures shall be vented with tamper proof locking device.**								
		Water Plus Corp.	171730	30" Tall Blue	171730	30" Tall Pantone Purple	171730	30" Tall Green	N/A	
		Safety Guard/Hydro Guard	15100 ENCL	34" Tall Blue	15100 ENCL	34" Tall Pantone Purple	15100 ENCL	34" Tall Green	N/A	
Manholes	Frames and Covers	**Manhole frames shall have a minimum 23-3/8-inch opening unless otherwise specified on the drawings. Frames and Covers shall conform to ASTM A48 Class 30 or Grade 65-45-12 meeting the requirements of ASTM A 536. If a watertight lid is required, the manhole lid shall have an ORS gasket factory installed.**								
		U.S. Foundry	N/A		N/A		170-PB Ring CE-PB Cover	Ring No. 8021468 Cover No. 8017774	170-PB RingCE-PB Cover	Ring No. 8021468 Cover No. 80175333
		EJ Group, Inc	N/A		N/A		1337 Sewer	6" Tall	1337 Storm	6" Tall
	Riser Rings	**Riser rings must be approved in advance by the FDOT or the City Public Works**								
		Mack Industries, Inc.	N/A		N/A				N/A	
	Coating (Exterior)	**The exterior manhole surfaces shall receive two coats.**								
		Carboline	N/A		N/A		Bitumastic 300M		Bitumastic 300M	
		Conseal	N/A		N/A		CS-55		CS-55	
	Coating (Interior)	**Manholes into which force mains discharge, as well as the adjacent manhole downstream from the receiving manhole, shall be HDPE lined. Other interior manhole surfaces shall receive two coats.**								
		Carboline	N/A		N/A		Bitumastic 300M		N/A	
		Conseal	N/A		N/A		CS-55		N/A	
	Manhole Lining	**Linings shall be applied to internal manhole HDPE with a minimum 2 mm thickness in accordance with CSM Section 14 Wastewater Gravity Sewer System.**								
		GSE Studliner	N/A		N/A		HDPE Liner	Factory Installed	N/A	
		AGRU America	N/A		N/A		Sure-Grip	Factory Installed	N/A	
	Manhole Insert	**All manhole cover and ring assemblies shall be furnished and installed complete with an insert. The manhole inserts shall be manufactured from corrosion-proof material, such as HDPE or stainless steel. All metal component shall be Type 304 or 316 stainless steel.**								
		USSI-USA	N/A		N/A		Inflow Defender - Black	HDPE w/ 1/8" min. continuous polymer thickness	N/A	
	MH-to-Pipe Connector	**The manhole-to-pipe connector shall be manufactured from Neoprene EPDM. The connector shall be a minimum of 3/8 inch thick and shall conform to ASTM C443 and ASTM C923. The connector shall be resistant to ozone, weathering, aging, chemicals, animal and vegetable fats, oils, and petroleum products. The connector shall be designed to accommodate pipe movement up to 2 inches radically or 22 degrees angularly in any direction.**								
		Trelleborg Pipe Seals	N/A		N/A		Kor-N-Seal® 106-406 Series		Kor-N-Seal® 106-406 Series	
		A-Lok Products, Inc.	N/A		N/A		Z-Lock (cast-in-place)		Z-Lock (cast-in-place)	
	Drop Bowl Seal	**All drop bowl shall be fully sealed in place.**								
		3M	N/A		N/A		Series 5200 Marine Caulk		N/A	
	Vapor Barrier Joint Tape	**Tape shall have a 12-inch width and conform to ASTM C877 (Type III) Standard Specification for External Sealing Bands for Concrete Pipe, Manholes, and Precast Box Sections.**								
		Canusa (CCI)	N/A		N/A		Wrapid Seal/Wrapid Tape		Wrapid Seal/Wrapid Tape	
		Cretex	N/A		N/A		External Joint Wrap		External Joint Wrap	
		GPT (an EnPro Industries Company)	N/A		N/A		Boa Tape		Boa Tape	
Clamps	Repair Clamps	**Repair clamps shall have 18-8 Type 304 SS bands, nuts, bolts, and side bars. Bolts and heavy hex nuts shall be low alloy per ASTM A242 and AWWA C111. Lugs shall be ductile iron per ASTM A536. Gaskets shall be graded virgin SBR compounded for water service meeting ASTM D2000.**								
		Ford	F1	PVC/DIP	F1	PVC/DIP	N/A		N/A	
		Ford	FP2	HDPE	FP2	HDPE	N/A		N/A	
		Krausz USA	N/A		N/A		HYMAX		N/A	
		Romac	SL1		SL1		SL1		N/A	
		Smith Blair	256		256		256		N/A	
		TPS	Quick Cam		Quick Cam		Quick Cam		N/A	
	Bell Joint Leak Clamps	**Clamps shall be used for pipe sizes 2 through 8 inches in diameter. Clamps shall be 18-8 Type 304 SS. Lugs shall be ductile iron per ASTM A536. Gaskets shall be SBR per ASTM D2000. Bolts and heavy hex nuts shall be low alloy per ASTM A242.**								
		Ford	FCC		FCC		N/A		N/A	
		Ford	FIBC		FIBC		N/A		N/A	
		Romac	516	Ductile Iron and PVC	516	Ductile Iron and PVC	517	PVC	N/A	
		Smith Blair	274	PVC	274	PVC	274	PVC	N/A	
	Snap Clamps	**Clamps shall be used for pipe sizes 1/2-inch to 8-inch diameter to repair pin holes and other small leaks. Clamp shells shall be 18-8 Type 304SS. Gaskets shall be Buna-N with heavy grid design extending from lug to lug.**								
		Ford	FLSC		FLSC		N/A		N/A	
		Ford	FSC		FSC		N/A		N/A	
		Romac	SS1 or SS2		SS1 or SS2		SS1 or SS2		N/A	
	Manhole Drop Bowl Adjustment Clamp	**Manhole Drop Bowl Adjustment Clamp**								
		Duran Inc.	N/A		N/A		Reliner		N/A	

APPROVED MANUFACTURER LIST

Cat.	Description	Manufacturer	Water		Reclaimed Water		Wastewater		Stormwater	
			Model	Comments	Model	Comments	Model	Comments	Model	Comments
Pipe	Wrap Clamps	**Clamp shall have 360-degree coverage. Gaskets shall be Buna-N or EPDM**								
		Ford	FSC		FSC		N/A		N/A	
		Ford	FLSC		FLSC		N/A		N/A	
		Krausz USA	N/A		N/A		HYMAX		N/A	
	PVC Coupling Leak Clamps	**Clamps shall be used for pipe sizes 2 through 8 inches in diameter. Clamps shall be 18-8 Type 304 SS. Lugs shall be ductile iron per ASTM A536. Gaskets shall be SBR per ASTM D2000. Bolts and heavy hex nuts shall be low alloy per ASTM A242.**								
		Ford	FCC		FCC		FCC		N/A	
		Ford	FIBC		FIBC		FIBC		N/A	
	Ductile Iron	**Ductile iron/Cast iron: Minimum pressure class shall be Class 350. Exterior coatings shall be as specified in CSM. Manufacturers shall be members in good standing with DIPRA to maintain approval status.**								
		American	Cement Lined		Cement Lined		Protecto 401	Epoxy Coated	N/A	
		Griffin	Cement Lined		Cement Lined		Protecto 401	Epoxy Coated	N/A	
		McWane Inc.	Cement Lined		Cement Lined		Protecto 401	Epoxy Coated	N/A	
		US Pipe	Cement Lined		Cement Lined		Protecto 401	Epoxy Coated	N/A	
	PVC	**PVC Pipe: (8" to 12" = Class 150 DR 18, 14" and larger = Class 165 minimum DR 25). PVC piping at depths of 10 feet or greater to top of pipe shall have a minimum DR of 26 for all pipe diameters.**								
		Diamond Plastics Corp	C900-16	Blue	C900-16	Pantone Purple	C900-16	Green	N/A	
		IPEX	C900-16	Blue	C900-16	Pantone Purple	C900-16	Green	N/A	
		J.M. Eagle	C900-16	Blue	C900-16	Pantone Purple	C900-16	Green	N/A	
		National Pipe and Plastics	C900-16	Blue	C900-16	Pantone Purple	C900-16	Green	N/A	
		North American Pipe Company (NAPCO)	C900-16	Blue	C900-16	Pantone Purple	C900-16	Green	N/A	
		Sanderson	C900-16	Blue	C900-16	Pantone Purple	C900-16	Green	N/A	
	PVC (Service Mains)	**PVC piping installed as part of main sewer line construction shall be SCH 40, SDR 35.**								
		Diamond Plastics Corp	N/A		N/A		Sani-21 Sewer	Green	N/A	
		J.M. Eagle	N/A		N/A		Gravity Sewer	Green	N/A	
		National Pipe and Plastics	N/A		N/A		Ever-Green Sewer	Green	N/A	
		North American Pipe Company (NAPCO)	N/A		N/A		Gravity Sewer	Green	N/A	
		Sanderson	N/A		N/A		Gravity Sewer	Green	N/A	
	HDPE	**HDPE Pipe (4" and greater shall have Ductile Iron Pipe outside diameter and conform to ASTM D3350 and PE3408 with minimum pressure rating shall be 150 psi DR11, 3" and smaller shall be CTS with minimum pressure rating of 200 psi DR 9). Pipe compound shall be suitably protected against UV degradation. Manufacturer shall be listed with PPI as meeting the requirements of the resin used to manufacture the pipe.**								
		J.M. Eagle	HDPE	Blue	HDPE	Pantone Purple	HDPE	Green	N/A	
		Performance Pipe	Driscoplex 4000	Blue	Driscoplex 4000	Pantone Purple	Driscoplex 4000	Green	N/A	
		PolyPipe	EHMW	Blue	EHMW	Pantone Purple	EHMW	Green	N/A	
	PE	**2 Inches and Less: Tubing shall comply with AWWA C800 and AWWA C901 with a DR of 9, be approved for potable water service by the NSF and bear the NSF seal**								
		Endot	EndoPure PE-4710 SDR 9 CTS OD	Blue	EndoPure PE-4710 SDR 9 CTS OD	Pantone Purple	N/A		N/A	
		Charter Plastics	PE4710 Blue Ice - CTS	Blue	PE4710 Lavender Ice - CTS	Pantone Purple	N/A		N/A	
		Philips Driscopipe		Blue		Pantone Purple	N/A		N/A	
	RCP	**RCP**								
		Rinker Materials	N/A		N/A		N/A			
		OldCastle	N/A		N/A		N/A			
		Forterra	N/A		N/A		N/A			
	Ductile Iron Fittings	**Ductile Iron Fittings shall conform to C153 and be in accordance with the City CSM.**								
		Sigma Corp.	Cement Lined		Cement Lined		Protecto 401		N/A	
		Star Pipe Products	Cement Lined		Cement Lined		Protecto 401		N/A	
		Tyler Union	Cement Lined		Cement Lined		Protecto 401		N/A	
	MJ Hydrant Connector	**MJ Hydrant Connector**								
		Star Pipe Products	Cement Lined		Cement Lined		Protecto 401		N/A	
		Tyler Union	Cement Lined		Cement Lined		Protecto 401		N/A	
	Expansion Joints	**Expansion Joints**								
		Metraflex	Metrasphere	Above grade	Metrasphere	Above grade	Metrasphere	Above grade	N/A	
		Proco	240/242	Above grade	240/242	Above grade	240/242	Above grade	N/A	
		Mercer Rubber	500/600 Series	Above grade	500/600 Series	Above grade	500/600 Series	Above grade	N/A	
	Ductile Iron MJ Restraints	**Mechanical joint wedge-action restraining gland, epoxy coated restrain ductile iron pipe to mechanical joint fittings, pipe, and appurtenances.**								
		EBAA Iron, Inc.	Megalug Series 1100		Megalug Series 1100		Megalug Series 1100		N/A	
		Sigma Corp.	One-LOK D-Slide		One-LOK D-Slide		One-LOK D-Slide		N/A	
		Star Pipe Products	3000 Series		3000 Series		3000 Series		N/A	
		Tyler Union	Tufgrip TLD 1000		Tufgrip TLD		Tufgrip TLD		N/A	
		Uni-Flange	1400 Series		1400 Series		1400 Series		N/A	
	PVC MJ Restraints	**Mechanical Joint Wedge-action restraining glands shall be epoxy-coated and shall restrain the PVC pipe to the mechanical joint fittings and appurtenances.**								
		EBAA Iron, Inc.	Megalug 2000 PV		Megalug 2000 PV		Megalug 2000 PV		N/A	
		Sigma Corp.	One-LOK D-SLCE		One-Lok D-SLCE		One-LOK D-SLCE		N/A	
		Star Pipe Products	4000 Series		4000 Series		4000 Series		N/A	
		Tyler Union	Tufgrip TLP		Tufgrip TLP		Tufgrip TLP		N/A	
		Uni-Flange	1500 Series		1500 Series		1500 Series		N/A	

APPROVED MANUFACTURER LIST

Cat.	Description	Manufacturer	Water		Reclaimed Water		Wastewater		Stormwater	
			Model	Comments	Model	Comments	Model	Comments	Model	Comments
Fittings,Restraints,Couplings,Tapping Sleeves	DIP Bell Joint Restraints (4 to 12-inch)	**Bell and Rod Restraints shall not be used unless otherwise noted by the City. All restraints shall be split serrated on the bell and spigot ends.**								
		EBAA Iron, Inc.	1500TD Series		1500TD Series		1500TD Series		N/A	
		Sigma Corp.	PV-LOK PWP		PV-LOK PWP		PV-LOK PVP		N/A	
		Tyler Union	3000		3000		3000		N/A	
		Uni-Flange	1390C Series		1390 Series		1390 Series		N/A	
		American	Fast Grip Gasket Flex Ring Joint Lok-Ring Joint	Gasket Bell Lock Bell Lock	Fast Grip Gasket Flex Ring Joint Lok-Ring Joint	Gasket Bell Lock Bell Lock	Fast Grip Gasket Flex Ring Joint Lok-Ring Joint	Gasket Bell Lock Bell Lock	N/A	
		US Pipe	Field Lok 350 Gasket TR-Flex	Gasket Bell Lock	Field Lok 350 Gasket TR-Flex	Gasket Bell Lock	Field Lok 350 Gasket TR-Flex	Gasket Bell Lock	N/A	
	DIP Bell Joint Restraints (14-inch and larger)	**Bell and Rod Restraints shall not be used unless otherwise noted by the City. All restraints shall be split serrated on the bell and spigot ends.**								
		EBAA Iron, Inc.	11000HD		11000HD		11000HD		N/A	
		Sigma Corp.	SLDEH		SLDEH		SLDEH		N/A	
		American	Fast Grip Gasket Flex Ring Joint Lok-Ring Joint	Gasket Bell Lock Bell Lock	Fast Grip Gasket Flex Ring Joint Lok-Ring Joint	Gasket Bell Lock Bell Lock	Fast Grip Gasket Flex Ring Joint Lok-Ring Joint	Gasket Bell Lock Bell Lock	N/A	
		US Pipe	Field Lok 350 Gasket TR-Flex	Gasket Bell Lock	Field Lok 350 Gasket TR-Flex	Gasket Bell Lock	Field Lok 350 Gasket TR-Flex	Gasket Bell Lock	N/A	
	PVC Bell Joint Restraints (4 to 12-inch)	**Bell and Rod Restraints shall not be used unless otherwise noted by the City. All restraints shall be split serrated on the bell and spigot ends.**								
		EBAA Iron, Inc.	1500TD Series		1500TD Series		1500TD Series		N/A	
		Sigma Corp.	PV-LOK PWP		PV-LOK PWP		PV-LOK PWP		N/A	
		Star Pipe Products	1000, 1100C, 1200		1000, 1100C, 1200		1000, 1100C, 1200		N/A	
		Tyler Union	TufGrip TLP		TufGrip TLP		TufGrip TLP		N/A	
		Uni-Flange	1390 Series		1390 Series		1390 Series		N/A	
	PVC Bell Joint Restraints (14-inch and larger)	**Bell and Rod Restraints shall not be used unless otherwise noted by the City. All restraints shall be split serrated on the bell and spigot ends.**								
		EBAA Iron, Inc.	2800 Series		2800 Series		2800 Series		N/A	
		Star Pipe Products	4100P		4100P		4100P		N/A	
	Coupling	**Couplings shall be installed with restraints and tie rods.**								
		EBAA Iron, Inc.	3800 Mega-Coupling		3800 Mega-Coupling		3800 Mega-Coupling		N/A	
		Romac	Alpha or Alpha XL		Alpha or Alpha XL		Alpha or Alpha XL		N/A	
	Gravity Sewer Pipe Connectors	**Joints shall be installed with stainless steel hardware. Flexible pipe connectors and transitions for repair only.**								
		Fernco	N/A		N/A		Strong Back RC 1000 Series	For repair only	N/A	
		Mission Rubber	N/A		N/A		Flex-Seal ARC	For repair only	N/A	
	Tapping Sleeves	**Tapping sleeves 4 inches and greater shall be designed for a minimum water working pressure of 150 psi and fabricated from 304 stainless steel. The design shall allow or the insertion of bolts from either side and the internal seal shall be "O-ring" type. The outlet flange shall be ANSI drilled to match the tapping valve. The sleeve shall be ANSI/NSF 61 Annex G certified.**								
		JCM	432		432		432		N/A	
		Romac	SST		SST		SST		N/A	
		Smith-Blair	665		665		665		N/A	
		TPS	Triple Tap		Triple Tap		Triple Tap		N/A	
Services	Service Saddles	**Service Saddles shall be installed with stainless steel hardware.**								
		Fernco	N/A		N/A		Qwik Seal		N/A	
		Inserta Tee	N/A		N/A		Inserta Tee		N/A	
		Mission	N/A		N/A		Twistee		N/A	
		Ford	FC202-CC	DIP/PVC, Temp. Jumper	FC202-CC	DIP/PVC, Temp. Jumper	N/A		N/A	
		Smith Blair	317	DIP	317	DIP	N/A		N/A	
		Smith Blair	397	PVC	397	PVC	N/A		N/A	
	HDPE Service Saddles	**Service Saddles shall be installed with stainless steel hardware.**								
		Ford	FS300		FS300		FS300		N/A	
		Romac	305H-306H		305H-306H		305H-306H		N/A	
		TPS	Series T3		Series T3		Series T3		N/A	
	Corporation Stops	**Corporation Stops**								
		Ford	FB1000-4-NL	1inch Service	FB1000-4-NL		N/A		N/A	
		Ford	FB1000-6-NL		FB1000-6-NL		N/A		N/A	
		Ford	FB1000-7-NL	2 inch Service	FB1000-7-NL		N/A		N/A	
	Curb Stops	**Curb Stops (lock wing), "Y" Branch, etc. shall be in accordance with the table in Section 11 Water pipe Fittings, Valves, and Appurtenances.**								
		Ford	B41-444W-NL		B41-444W-NL		N/A		N/A	
		Ford	B41-666W-NL		B41-666W-NL		N/A		N/A	
		Ford	B41-777W-NL		B41-777W-NL		N/A		N/A	

APPROVED MANUFACTURER LIST

Cat.	Description	Manufacturer	Water Model	Water Comments	Reclaimed Water Model	Reclaimed Water Comments	Wastewater Model	Wastewater Comments	Stormwater Model	Stormwater Comments
	Service "Y" Branch	**Service "Y" Branch**								
		Ford	Y44-274-NL		Y44-274-NL		N/A		N/A	
	Service "T" Branch	**Service "T" Branch**								
		Ford	T444-666-NL		T444-666-NL		N/A		N/A	
		Ford	T444-774-NL		T444-774-NL		N/A		N/A	
		Ford	T444-777-NL		T444-777-NL		N/A		N/A	
	Service Ell Coupling	**Service Ell Coupling**								
		Ford	L44-44-NL		L44-44-NL		N/A		N/A	
		Ford	L44-66-NL		L44-66-NL		N/A		N/A	
		Ford	L44-77-NL		L44-77-NL		N/A		N/A	
	Gravity Sewer Cleanout Frame and Lid	**Gravity Sewer Cleanout Frame and Lid**								
		Neenah	N/A		N/A		R-1974-A	Round	N/A	
		Spears	N/A		N/A		P106-040	Model Number Varies with Size of Plug	N/A	
Meters and Gauges	Flow Meters (Fire Service)	**Flow Meter calibration documentation shall be provided to the City after installation.**								
		Neptune	HP Protectus III S		HP Protectus III S		N/A		N/A	
	Flow Meters	**No underground meters will be allowed without a meter box.**								
		Neptune	TRU/FLO Compounds		TRU/FLO Compounds		N/A		N/A	
	Strainers	**Strainer shall be easily removable and have an effective straining area of double the appropriate inlet. Strainers shall cover 150 psi working pressure plate-type for use with water meters 2" - 20" and shall prevent debris greater than 3/16 inch in diameter from entering or damaging the meter.**								
		Neptune					N/A		N/A	
	Plastic Meter Boxes	**Reclaimed water meter boxes shall be constructed inside the City right-of-way line and shall conform to City of Tavares Standard Details.**								
		Carson	1419-12	Black w/ T Lid CI reader cover	1419-12	Violet w/ T Lid CI reader cover	N/A		N/A	
		Carson	1220-12 (Jumbo)	Black w/ T Lid CI reader cover	1220-12 (Jumbo)	Violet w/ T Lid CI reader cover	N/A		N/A	
		NDS	D-1200-CICIR	Black w/ T Lid CI reader cover	D-1200-CICIR	Violet w/ T Lid CI reader cover	D-1200-CICIR		N/A	
		NDS	D-1500-OLCIR (Jumbo)	Black w/ T Lid CI reader cover	D-1500-OLCIR (Jumbo)	Violet w/ T Lid CI reader cover	D-1500-OLCIR		N/A	
	Polymer Concrete Meter Boxes	**Meter boxes shall conform to City of Tavares Standard Details.**								
		Oldcastle Polymer	1118		1118		N/A		N/A	
		Oldcastle	2436		2436		N/A		N/A	
		GlasMasters	S132412F2N	Tier 15 Blue	S132412F2N	Tier 15 Blue	N/A		N/A	
		GlasMasters	S173012F2N15-1	Tier 15 Blue (Jumbo)	S173012F2N15-1	Tier 15 Blue (Jumbo)	N/A		N/A	
		CDR	B02173012M	Tier 15 Blue	B02173012M	Tier 15 Blue	N/A		N/A	
		CDR	B12132412M	Tier 15 Blue (Jumbo)	B12132412M	Tier 15 Blue (Jumbo)	N/A		N/A	
	Pressure Gauges	**Pressure gauges shall be stainless steel with stainless steel diaphragm, liquid filled, 4-inch-diameter dial with 0-100 pressure range.**								
		Blue Ribbon	N/A		N/A		BR301L		N/A	
		WKA	N/A		N/A		233.3		N/A	
	Diaphragm	**Pressure gauges shall be stainless steel with stainless steel diaphragm, liquid filled, 4-inch-diameter dial with 0-100 pressure range.**								
		Blue Ribbon	N/A		N/A		Series 1000		N/A	
		Hyett	N/A		N/A		43MCR-01		N/A	
	Locating/Tracer Wire	**Locating wire shall be #10 THW (solid copper with color coating).**								
		Copperhead	1045-EHS	Directional Drill Only, Blue	1045-EHS	Directional Drill Only, Pantone Purple	1045-EHS	Directional Drill Only, Green	N/A	
		Copperhead	1030 SF	Open Cut Only, Blue	1030 SF	Open Cut Only, Pantone Purple	1030 SF	Open Cut Only, Green	N/A	
		Pro-Line	HDD-CCS	Directional Drill Only, Blue	HDD-CCS	Directional Drill Only, Pantone Purple	HDD-CCS	Directional Drill Only, Green	N/A	
		Pro-Line	HF-CCS	Open Cut Only, Blue	HF-CCS	Open Cut Only, Pantone Purple	HF-CCS	Open Cut Only, Green	N/A	
	Locating/Tracer Wire Connectors	**Locating Wire Connectors**								
		Copperhead	SnakeBite	10 AWG LSC1030	SnakeBite	10 AWG LSC1030	SnakeBite	10 AWG LSC1030	N/A	
		Tracer Lock	DB Connector		DB Connector		DB Connector		N/A	
	Marking Tape	**Nonmetallic Marking Tape shall be "Extra-Stretch" marking tape consisting of 6-ply copolymer film bonded together without the use of adhesives, specifically formulated for prolonged use underground. It shall have a minimum thickness of 6 mils and be a 3 inch wide strip. Tape shall bear a continuous printed message repeated every 16 to 36 inches warning of the installation below.**								
		Division Reef Industries	Terra Tape	"Water"	Terra Tape	"Reclaimed"	Terra Tape	"Sewer"	N/A	
		Pro-Line	103121153	"Water"	103125173	"Reclaimed"	103123183	"Sewer"	N/A	
	Under-the-Sink Grease Traps	**Under-the-Sink Grease Traps**								
		Thermaco	N/A		N/A		Big Dipper		N/A	
		Zurn	N/A		N/A		Retroceptor		N/A	
	Grease Interceptor	**All services connections from restaurants, commercial food preparers, or others as designated by the City for the removal of FOG from discharges to the City System shall be equipped with a grease interceptor. Equipment must meet the criteria in Florida Building Code, Chapter 10, Plumbing and Florida Administrative Code. The min. removal efficiency shall be 80% for animal fats or vegetable oils and 90% for trace petroleum-based wastes. Effluent oil and grease concentrations shall be less than 100 mg/L.**								
		Thermaco	N/A		N/A		Trapzilla		N/A	
		Oldcastle Precast	N/A		N/A				N/A	

Cat.	Description	Manufacturer	Water Model	Water Comments	Reclaimed Water Model	Reclaimed Water Comments	Wastewater Model	Wastewater Comments	Stormwater Model	Stormwater Comments
Miscellaneous	Oil/Water Separators	**All services connections from restaurants, commercial food preparers, or others as designated by the City for the removal of FOG from discharges to the City System shall be equipped with an appropriately sized oil/water separator. Equipment must meet the criteria in Florida Building Code, Chapter 10, Plumbing and Florida Administrative Code. The min. removal efficiency shall be 80% for animal fats or vegetable oils and 90% for trace petroleum-based wastes. Effluent oil and grease concentrations shall be less than 100 mg/L.**								
		Freytech	N/A		N/A		Ecoline-B		N/A	
		Freytech	N/A		N/A		Xerxes		N/A	
	Casing Spacers	**Casing Spacers shall be a two piece prefabricated unit by a single manufacturer. Casing spacers shall have a shell made from either 304SS, 14-gauge mild steel which has been heat fusion coated with PVC plastic, (PVC coating shall be .01 inch thick over the entire band including the runner studs) or high density polyethylene.**								
		BWM Company	BWM-SS-8/ SS 12		BWM-SS-8/ SS 12		BWM-SS-8/ SS 12		N/A	
		Cascade Water Works	Series CCS 8"/12"		Series CCS 8"/12"		Series CCS 8"/12"		N/A	
		CCI Pipeline	CCS8/CCS12		CCS8/CCS12		CCS8/CCS12		N/A	
		Pipeline Seal & Insulator	Series S8G-2/S12-G		Series S8G-2/S12-G		Series S8G-2/S12-G		N/A	
	Casing End Seals	**The annular space between pipe and steel casing shall be brick and mortar with end seals to secure ends.**								
		BWM Company	Model WR and PO		Model WR and PO		Model WR and PO		N/A	
		Cascade Water Works	Model CCES		Model CCES		Model CCES		N/A	
		CCI Pipeline	Model ESW and ESC		Model ESW and ESC		Model ESW and ESC		N/A	
		Pipeline Seal & Insulator	Model C and W		Model C and W		Model C and W		N/A	
	Fiberglass Wet well	**Fiberglass wet wells shall have a 24-inch (minimum) thick reinforced concrete hold-down base which extends 24 inches beyond the outside of the wet well.**								
		LFM Fiberglass Structures	N/A		N/A				N/A	
		Containment Solutions, Inc.	N/A		N/A				N/A	
	Hatches (Wet Well)	**Access covers shall have a clear opening of 36" x 48" with 1/4 inch aluminum diamond plate door panels, reinforced to withstand a live load of 300 psi. All access frame, cover, hardware and fasteners shall be constructed of 316 stainless steel. All surface in contact with concrete shall have a shop coat of zinc chromatic primer, approved alkali paint, or approved protective coating.**								
		Halliday Products	N/A		N/A			With Retro Grate Fall thru Protection System	N/A	
		USF Fabrication Inc.	N/A		N/A			With Hinge Hatch Safety Grate	N/A	
	Flushing System	**Automatic Flushing Systems shall consist of a UV resistant base and cover. The cover shall be green, impact resistant, and lockable to the base with a special key. The system should include a glass reinforced nylon control valve that operates via an electronic solenoid. A lithium battery shall provide power to the unit and located above the discharge of the flushing water.**								
		Mueller	Hydro-Guard HG-1		Hydro-Guard HG-1		N/A		N/A	
Precast Concrete Structures	Interior Liners	**Minimum thickness shall be 2 mm with extruded welded joints by a certified welder.**								
		GSE Studliner	N/A		N/A		HDPE Liner	Factory Installed	N/A	
		AGRU America	N/A		N/A		Sure-Grip	Factory Installed	N/A	
	Jointing Material	**Joints shall be watertight and conform to Federal specification SS S-00210.**								
		Henry Company	N/A		N/A		RAM-NEK			
	Structures	**Precast manhole and wet well structures shall use Type II Portland cement with aggregate meeting ASTM C33 and meet the minimum reinforcing requirements of ASTM C478.**								
		Del Zotto Products								
		Mack Industries, Inc.								
		Oldcastle Precast								
		Allied Precast								
Pumps	Submersible Non-Clog Sewage Pump	**The design shall be such that the lifting cover, stator housing, and volute casing are ASTM A48, Class 25 gray iron construction, with all nuts, bolts, washers, and other fastening devices coming into contact with the sewage constructed of 316 stainless steel. All mating faces shall be machined and fitted with O-rings where watertight sealing is required. All rotating parts shall be accurately machined and shall be sufficient cause for rejection of the equipment.**								
		Pentair	N/A		N/A		Hydromatic Pumps		N/A	
		Sulzer	N/A		N/A		ABS Pumps		N/A	
		Xylem	N/A		N/A		Flygt Pumps	M-300 Series for Grinder Pumps	N/A	
		Homa	N/A		N/A		Homa Pumps			
	Package Grinder Pump Station	**Package Grinder Pump Station**								
		Xylem	N/A		N/A		Flight Compit Series		N/A	
		Xylem	N/A		N/A		Flight Micro Series		N/A	
		E/One	N/A		N/A		D-Series or W-Series Grinder Pump Station		N/A	
	Stationary Solids Handling Pump	**Stationary Solids Handling Pump**								
		Thompson Pump & Manufacturing Company	N/A		N/A				N/A	
	Floats	**Floats shall be equipped with individual weights.**								
		Anchor Scientific	N/A		N/A				N/A	
	Level Transducer	**Transducer shall be a 3-wire type to operate from a supply voltage of 10.5 to 24 VDC and produce a 1-5 VDC instrumentation signal in direct proportion to the measured level excursion over a factory-calibrated range.**								
		Xylem	N/A		N/A		Multitrode 1.0/10XX to Model 9.0/10		N/A	
		Blue Ribbon	N/A		N/A		Level Transmitter	BC001	N/A	
Electrical	Spark Tester	**Spark Tester shall be capable of producing a test voltage of 100-125 volts/mil of coating thickness applied.**								
		Tinker & Rasor	N/A		N/A		Holiday Detector	AP/W	N/A	
	Control Wiring Ducts	**All control wiring shall be contained within wiring duct with covers.**								
		Panduit	N/A		N/A				N/A	
	Control Wiring Ties	**Control wire groupings shall be bundled and tied not less than every three inches with nylon self-locking cable ties.**								
		Panduit	N/A		N/A				N/A	

APPROVED MANUFACTURER LIST

Cat.	Description	Manufacturer	Water Model	Water Comments	Reclaimed Water Model	Reclaimed Water Comments	Wastewater Model	Wastewater Comments	Stormwater Model	Stormwater Comments
E	Emergency Generator	**Emergency Generator**								
		Cummins Power Generator	N/A		N/A				N/A	
		Ingersoll Rand	N/A		N/A				N/A	
		Tradewinds Power Corp	N/A		N/A				N/A	
	Control Panel	**Control Panel shall meet requirements of approved control panel supplier.**								
		Unitron Controls	N/A		N/A				N/A	
	Enclosure	**Enclosures shall be NEMA 12/3R of 316SS and white polyester with powder coated finish inside and out. There will be a 3 point pad with lockable handle and door stop. General dimensions shall be 36"x36"x12" alternate dimensions to require approval by the City.**								
		Custom Enclosure	N/A		N/A				N/A	
		Hoffman	N/A		N/A				N/A	
	Main Service Disconnect Breaker	**Main Service Disconnect Breakers shall be stainless steel**								
		General Electric	N/A		N/A		NP1578001B		N/A	
		Schneider Electric/Square D	N/A		N/A		FAL		N/A	
		Siemens	N/A		N/A		HNF364S		N/A	
	Surge Protector	**Surge protectors shall conform to UL 1449, 3rd edition listed and labeled with a minimum 10 year warranty. They shall be rated 80,000 amps per mode for duplex and triplex lift stations and 150,000 Amperes per mode for master stations. All devices shall be provided with a NEMA 4X plastic enclosure which is approved in lieu of stainless steel.**								
		Schneider Electric/Square D	N/A		N/A		Surgelogic		N/A	
	Seal-Off	**Seal-off shall be explosion proof.**								
		Cooper	N/A		N/A				N/A	
	Alarm Light	**Alarm Light shall have base and globe.**								
		AC/DC Equipment Co.	N/A		N/A		R40-XLS-25		N/A	
	Alarm Horn	**Alarm Horn**								
		Federal Signal	N/A		N/A		350-120-30		N/A	
	Fuses	**Fuses shall be provided with all field instruments requiring power supplies.**								
		Littelfuse	N/A		N/A				N/A	
		Bussman	N/A		N/A				N/A	
		Mersen	N/A		N/A				N/A	
	Hand-Auto-Off Selector (HOA)	**Hand-Auto-Off Selector (HOA)**								
		Schneider Electric/Square D	N/A		N/A		9001SKS43BH13		N/A	
	Horn Silence Button (HSS)	**Horn Silence Button (HSS)**								
		Schneider Electric/Square D	N/A		N/A		9001SKR1BH5		N/A	
	Mechanical Interlock	**Mechanical interlocks shall be mounted on a common steel bar and shall lock without the use of hooks, latches, magnets, or springs and shall be silver-tungsten alloy.**								
		Schneider Electric/Square D	N/A		N/A				N/A	
	Main Circuit Breaker (MCB)	**Main circuit breaker shall conform to S29450 with circuit breaker auxiliary switch.**								
		Schneider Electric/Square D	N/A		N/A		QBL		N/A	
	Emergency Circuit Breaker (ECB)	**Emergency breakers shall have one auxiliary S.P.D.T. contact.**								
		Schneider Electric/Square D	N/A		N/A		QBL		N/A	
	Motor Circuit Breaker (MB)	**Motor Circuit Breaker (MB)**								
		Schneider Electric/Square D	N/A		N/A		QBL or QOU		N/A	
	Control Circuit/GFCI/ SCADA Breaker	**Control Circuit/GFCI/ SCADA Breaker**								
		Schneider Electric/Square D	N/A		N/A		QOU		N/A	
	Motor Starter (MS)	**Motor starters shall be open-frame, across-the-line, NEMA rated and magnetic. Starters of NEMA size 1 and above shall be designed for addition of at least two auxiliary contacts. Starters rated "O", "OO", or half size are not acceptable. Power contact shall be double-break and made of cadmium oxide silver.**								
		Schneider Electric/Square D	N/A		N/A		8536SC03V02S	Size #1	N/A	
		Schneider Electric/Square D	N/A		N/A		8536SD01V02S	Size #2	N/A	
		Schneider Electric/Square D	N/A		N/A		8536SE01V02S	Size #3	N/A	
		Schneider Electric/Square D	N/A		N/A		85365F01V02S	Size #4	N/A	
	Overload Heater (OL)	**Overload Heater (OL)**								
		Schneider Electric/Square D	N/A		N/A				N/A	
	Overload Reset	**Overload Reset**								
		Schneider Electric/Square D	N/A		N/A				N/A	
	Control Circuit Transformer (XMRF)	**Control Circuit Transformer (XMRF)**								
		Schneider Electric/Square D	N/A		N/A				N/A	
	Main Circuit Transformer (MCT)	**Main Circuit Transformer (MCT)**								
		Schneider Electric/Square D	N/A		N/A				N/A	
	Supplemental Protector Breaker (SPB)	**SPB shall be 3 pole, 1 amp for phase monitor.**								
		Schneider Electric/Square D	N/A		N/A				N/A	
	Phase Monitor (PM)	**Phase monitors shall be field adjustable, close differential type with 85-100% pick-up and 75-98% drop-out.**								
		Diversified Electronics	N/A		N/A				N/A	
		MPE Electronics	N/A		N/A				N/A	
	Pump Automatic Alternator (PAA)	**Pump Automatic Alternator (PAA)**								
		Diversified Electronics	N/A		N/A				N/A	
		MPE Electronics	N/A		N/A				N/A	

Pump Station Control Panel

APPROVED MANUFACTURER LIST

Cat.	Description	Manufacturer	Water Model	Water Comments	Reclaimed Water Model	Reclaimed Water Comments	Wastewater Model	Wastewater Comments	Stormwater Model	Stormwater Comments
	Alt. Test Switch	**Test switches shall be heavy duty, oil tight, pushbutton type with momentary contacts and override circuitry to revert to normal power if emergency source should fail during test.**								
		Schneider Electric/Square D	N/A		N/A				N/A	
		Eaton	N/A		N/A		XTD1F1A2		N/A	
	Relay	**All self trip relays shall demonstrate ability to simulate a fault condition. All protective relays shall be supplied by the engine-generator manufacturer as required.**								
		Allen-Bradely/Rockwell Automation	N/A		N/A		700-HB33A1		N/A	
		Eaton	N/A		N/A		D5PR3A		N/A	
		Schneider Electric/Square D	N/A		N/A		850KUR13V20		N/A	
	Relay Base	**Relay Base**								
		Eaton	N/A		N/A		D3PA2	8 Pin	N/A	
		Idec	N/A		N/A		SR2P-06	8 Pin	N/A	
		Idec	N/A		N/A		SR3P-05	11 Pin	N/A	
	Duplex Receptacle/GFCI (DR)	**Duplex Receptacle/GFCI (DR)**								
		Pass & Seymour	N/A		N/A		1595-I		N/A	
		Hubbell	N/A		N/A		GFR5352IA		N/A	
	Elapse Time Meter (ETM)	**Elapse Time Meter (ETM)**								
		Eaton	N/A		N/A		6-T-3H-508RPM-406		N/A	
	Terminal Strip (TS)	**Terminal Strip (TS)**								
		Phoenix Contact	N/A		N/A				N/A	
		Schneider Electric/Square D	N/A		N/A		9080GK6		N/A	
	Terminal Strip End Blocks and End Clamps	**Terminal Strip End Blocks and End Clamps**								
		Phoenix Contact	N/A		N/A				N/A	
		Schneider Electric/Square D	N/A		N/A		9080GK6B		N/A	
	Pilot Light (PL)	**Three pilot lights shall typically be included to indicate normal, emergency and off positions of transfer switch.**								
		Eaton	N/A		N/A		C22-L-XG-120		N/A	
		Schneider Electric/Square D	N/A		N/A		9001 SKP38ZG9		N/A	
	Run Indicator Light (RL)	**Run Indicator Light (RL)**								
		Schneider Electric/Square D	N/A		N/A		C22-L-XG-120		N/A	
		Eaton	N/A		N/A		9001 SKP38ZG9		N/A	
	Moisture and Temperature Fail Light (MT)	**Moisture and Temperature Fail Light (MT)**								
		SSAC	N/A		N/A		LLC54BA		N/A	
	Variable Frequency Drive (VFD)	**Variable Frequency Drive (VFD)**								
		Schneider Electric/Square D	N/A		N/A				N/A	
		Eaton	N/A		N/A				N/A	
		Yasakawa	N/A		N/A				N/A	
	SCADA/RTU	**SCADA/RTU**								
		Xylem/Multitrode	N/A		N/A		MultiSmart Controller RTU	Preferred by City of Tavares	N/A	
		Allen-Bradely/Rockwell Automation	N/A		N/A				N/A	
	SCADA/RTU Antennae	**SCADA/RTU Antennae**								
		Commscope	N/A		N/A		DB589-Y		N/A	
		GE	N/A		N/A		902-960 Yagi 6 Element		N/A	
		Yagi	N/A		N/A		10dBd		N/A	
	SCADA/RTU Radio	**SCADA/RTU Radio**								
		Cal Amp	N/A		N/A				N/A	
		GE	N/A		N/A		MDS TransNet 900		N/A	
	SCADA/RTU Enclosure	**SCADA/RTU Enclosure**								
		Pentair Equipment	N/A		N/A		A24H2412SSLP		N/A	
	SCADA/RTU Panel	**SCADA/RTU Panel**								
		Best Controls	N/A		N/A				N/A	
		Unitron Controls	N/A		N/A				N/A	
	SCADA/RTU Battery	**SCADA/RTU Battery**								
		Powe Sonic	N/A		N/A		PS-12120F2		N/A	
	SCADA/RTU Cable	**SCADA/RTU Cable**								
		Commscope	N/A		N/A		LDF4-50A		N/A	
	SCADA/RTU Zip Ties	**SCADA/RTU Zip Ties**								
		Panduit	N/A		N/A		MLT4S-CP		N/A	
	SCADA Antenna	**SCADA Antenna**								
		Commscope	N/A		N/A		DB589-Y		N/A	
	SCADA Surge Protector	**SCADA Surge Protector**								
		Poly Phase Corporation	N/A		N/A		IS-B50LN-C2		N/A	
	SCADA/RTU Antennae Pole	**Pole varies depending on lift station elevation.**								
		Rhon	N/A		N/A		Rohn		N/A	

APPROVED MANUFACTURER LIST

Cat.	Description	Manufacturer	Water		Reclaimed Water		Wastewater		Stormwater	
			Model	Comments	Model	Comments	Model	Comments	Model	Comments
	Generator Receptacle	**Generator Receptacle**								
		Hillcrest Enterprises	N/A		N/A		KRE-4100	Under 100 Amp	N/A	
		Thomas & Betts	N/A		N/A		JRSB2034HR	Over 100 Amp	N/A	
	Transfer Switch	**Switch gear model will vary depending on lift station size**								
		Emerson	N/A		N/A		300 NEMA 3R-H		N/A	
		Marathon Thomson Power	N/A		N/A		TS870 NEMA 3RX/4XDD		N/A	
	Unistrut Conduit PVC-Coated Conduit	**Unistrut Conduit SCH 40 PVC-Coated Conduit**								
		ABB	N/A		N/A				N/A	
		Cantex	N/A		N/A				N/A	
		Perma-Cote	N/A		N/A				N/A	
		Unistrut	N/A		N/A		P1000SST		N/A	