



WATER DISTRIBUTION & WASTEWATER COLLECTION

WATER UTILITIES MANUAL of SPECIFICATIONS

CITY OF HAINES CITY
P.O. BOX 1507
HAINES CITY, FL 33845
Phone: (863) 421-3695 – Fax: (863) 421-3699

TABLE OF CONTENTS

INTRODUCTION

	Page
Acknowledgment	I
Document Title.....	I
Jurisdiction.....	I
Purpose.....	I
Scope.....	I

ARTICLE 2. - PART 1 STANDARDS

DIVISION I

GENERAL REQUIREMENTS

Section 9.1	Utility System Additions Policy	
9.1.1	General	9- 01
9.1.2	Procedures for Requesting Utility Service to Properties Lying Outside the Corporate Limits of the City of Haines City	9- 01
9.1.3	Responsibility for Installation	9- 02
9.1.4	Oversizing of Utilities Extensions	9- 03
Section 9.2	Definitions	
9.2.1	Definitions	9- 04
Section 9.3	Plan Review, Approval, Construction and Acceptance of Water and Wastewater Improvements	
9.3.1	Plans and Specifications	9- 07
9.3.2	Subdivision Related Water and Wastewater Improvements	9- 08
9.3.3	Water and Wastewater Improvements Associated Site Development within the City of Haines City Service Area	9- 09
9.3.4	Miscellaneous Water and Wastewater Improvements	9- 10
9.3.5	Compliance with other Regulatory Requirements	9- 10
9.3.6	Record Drawings.....	9- 11
9.3.7	List of Materials and Approved Manufacturers	9- 11

ARTICLE 3. - DIVISION II

DESIGN STANDARDS

Section 9. 4.	Gravity Sewers	
9.4.1.	General Considerations.....	9- 12
9.4.2.	Design Basis	9- 12
9.4.3.	Details of Design and Construction	9- 13
9.4.4.	Manholes.....	9- 15
9.4.5.	Service Connections	9- 16
9.4.6.	Grease Traps and Interceptors	9- 17
9.4.7.	Materials, Installation and Testing	9- 18
Section 9. 5.	Wastewater Force Mains	
9.5.1.	General Considerations.....	9- 19
9.5.2.	Design Basis	9- 19
9.5.3.	Details of Design and Construction	9- 20
9.5.4.	Material, Installation and Testing	9- 22
9.5.5.	Location and Identification.....	9- 22
9.5.6.	Additional Requirements	9- 22
Section 9. 6.	Wastewater Pump Stations	
9.6.1.	General Requirements.....	9- 23
9.6.2.	Design Basis	9- 23
9.6.3.	Details of Design and Construction	9- 24
9.6.4.	Flow Meter.....	9- 26
9.6.5.	Emergency Operation	9- 26
9.6.6.	Odor Control	9- 26
Section 9. 7.	Water Mains	
9.7.1.	General Considerations.....	9- 27
9.7.2.	Design Basis	9- 27
9.7.3.	Details of Design and Construction	9- 28
9.7.4.	Water Services and Connections	9- 30
9.7.5.	Water Metering	9- 30
9.7.6.	Material, Installation and Testing	9- 31
9.7.7.	Location and Identification.....	9- 31
9.7.8.	Cross Connection Control.....	9- 31

ARTICLE 4. - PART 2 SPECIFICATIONS

DIVISION III

GENERAL CONSTRUCTION REQUIREMENTS

Section 9.8. 1. General

9.8.1.	Grades, Survey Lines and Protection of Monuments	9- 33
9.8.2.	Utility Coordination.....	9- 33
9.8.3.	Maintenance of Traffic and Closing of Streets.....	9- 34
9.8.4.	Protection of Public and Property	9- 35
9.8.5.	Access to the Public Services	9- 36
9.8.6.	Public Nuisance	9- 37
9.8.7.	Construction Hours	9- 37
9.8.8.	Construction in Easements and Rights-of-Way.....	9- 37
9.8.9.	Suspension of Work Due to Weather	9- 38
9.8.10.	Use of Chemicals	9- 38
9.8.11.	Cooperation with Other Contractors and Forces	9- 38
9.8.12.	Subsurface Exploration.....	9- 38
9.8.13.	Cleaning.....	9- 38
9.8.14.	Salvage.....	9- 39
9.8.15.	Utility Service Interruption.....	9- 39
9.8.16.	Shop Drawings and Samples	9- 39

Section 9. 9. Site Preparation, Surface Removal and Restoration

9.9.1.	General.....	9- 40
9.9.2.	Clearing and Grubbing	9- 40
9.9.3.	Dust Control.....	9- 41
9.9.4.	Surface Removal.....	9- 41
9.9.5.	Restoration	9- 41

Section 9.10. Excavation, Backfill, Compaction and Grading

9.10.1.	General.....	9- 42
9.10.2.	Soil Boring and Subsurface Investigations.....	9- 42
9.10.3.	Existing Utilities	9- 42
9.10.4.	Material.....	9- 42
9.10.5.	Sheeting and Bracing in Excavations	9- 43
9.10.6.	Dewatering, Drainage and Flotation.....	9- 45
9.10.7.	Excavation	9- 45
9.10.8.	Bedding and Backfill	9- 47
9.10.9.	Compaction.....	9- 49
9.10.10.	Grading	9- 50
9.10.11.	Maintenance.....	9- 50
9.10.12.	Inspection and Quality Assurance	9- 50

Section 9.11.	Boring and Jacking	
9.11.1.	General.....	9- 51
9.11.2.	Pipe Materials	9- 51
9.11.3.	Pipe Handling	9- 52
9.11.4.	Construction Requirements	9- 52
9.11.5	Directional Bore Standards.....	9- 54
9.11.5.2	Construction Requirements	9- 60
9.11.5.3	Post-Construction	9- 66
Section 9.12.	Pressure Pipe Restraint	
9.12.1.	General.....	9- 71
9.12.2.	Restrained Joint Construction.....	9- 71
Section 9.13.	Pressure Connection	
9.13.1.	General.....	9- 72
9.13.2.	Tapping Sleeves.....	9- 72
9.13.3.	Notification and Connection to Existing Mains	9- 72
9.13.4.	Installation	9- 73

ARTICLE 5 - DIVISION IV

GRAVITY SEWERS, FORCE MAINS, AND

PUMP STATIONS

Section 9.14.	Pipe Material for Gravity Sewers	
9.14.1.	General.....	9- 75
9.14.2.	Pipe Materials	9- 75
9.14.3.	Joint Materials	9- 76
9.14.4.	Fittings	9- 76
9.14.5.	Inspection and Testing.....	9- 76
Section 9.15.	Gravity Sewer Pipe Laying, Jointing, and Miscellaneous Construction Details	
9.15.1.	Survey Line and Grade	9- 78
9.15.2.	Pipe Preparation and Handling	9- 78
9.15.3.	Sewer Pipe Laying.....	9- 78
9.15.4.	Trench Preparation and Pipe Bedding	9- 79
9.15.5.	Gravity Pipe and Water Main Separation.....	9- 79
9.15.6.	Plugs and Connections.....	9- 79
9.15.7.	Pipe Jointing	9- 79
Section 9.16.	Manholes	
9.16.1.	General.....	9- 80
9.16.2.	Pre-cast Concrete Sections	9- 80
9.16.3.	Casting	9- 81
9.16.4.	Construction Details	9- 81
9.16.5.	Cleaning.....	9- 83
9.16.6.	Inspection for Acceptance	9- 83
Section 9.17.	Service Laterals	
9.17.1.	General.....	9- 84
9.17.2.	Material.....	9- 84
9.17.3.	Construction Details	9- 84
9.17.4.	Termination of Service Laterals	9- 85
9.17.5.	Inspection.....	9- 85
9.17.6.	Restoration, Finishing and Cleanup.....	9- 85
9.17.7.	Location	9- 85
Section 9.18.	Testing and Inspection for Acceptance of Gravity Sewers	
9.18.1.	General.....	9- 86
9.18.2.	Testing for Leakage	9- 86
9.18.3.	Inspection for Alignment, Deflection and Integrity	9- 86

Section 9.19.	Wastewater Force Mains	
9.19.1.	General.....	9- 88
9.19.2.	Pipe Inspection and Test.....	9- 88
9.19.3.	PVC Pipe.....	9- 88
9.19.4.	Ductile Iron Pipe and Fittings.....	9- 88
9.19.5.	Pipe Handling	9- 90
9.19.6.	Air and Vacuum Release Valves	9- 90
9.19.7.	Notification and Connection to Existing Mains	9- 90
9.19.8.	Valves	9- 90
9.19.9.	Valves Boxes	9- 91
9.19.10.	Separation of Force Mains and Water Mains or Reuse Mains	9- 91
9.19.11.	Force Main Construction	9- 91
9.19.12.	Hydrostatic Test.....	9- 91
9.19.13.	Final Cleaning.....	9- 91
9.19.14.	Location and Identification.....	9- 92

Section 9.20.	Wastewater Pump Stations	
9.20.1.	General.....	9- 93
9.20.2.	Wet Well and Valve Slab.....	9- 93
9.20.3.	Access Frames and Covers	9- 93
9.20.4.	Pumps and Controls.....	9- 93
9.20.5.	Piping, Valves and Accessories.....	9- 93
9.20.6.	Standby Power Generator System	9- 94
9.20.7.	Flow Monitoring System	9-100
9.20.8.	Chain Link Fence.....	9-102
9.20.9.	Required Submittals.....	9-104
9.20.10.	Electrical Grounding System.....	9-105
9.20.11.	Inspection and Testing.....	9-105
9.20.12.	Access Road.....	9-106

Section 9.21.	Submersible Wastewater Pumps	
9.21.1.	General.....	9-107
9.21.2.	Pump Construction Details	9-107
9.21.3.	Motors.....	9-109
9.21.4.	Pump Control System	9-110
9.21.5.	Shop Painting.....	9-110
9.21.6.	Handling.....	9-110
9.21.7.	Warranty	9-110
9.21.8.	Tools and Spare Parts	9-110

Section 9.22. Pump Station Electrical Power and Control System

9.22.1.	General.....	9-112
9.22.2.	Panel Construction.....	9-112
9.22.3.	Power Supply and Main Disconnect.....	9-113
9.22.4.	Circuit Breakers	9-113
9.22.5.	Motor Circuit Protectors	9-113
9.22.6.	Motor Starter and Selector Switches	9-114
9.22.7.	Pump Alternator.....	9-114
9.22.8.	Lights and Alarms.....	9-114
9.22.9.	Emergency Power Receptacle	9-115
9.22.10.	Additional Requirements	9-115
9.22.11.	Testing, Service and Warranty	9-117

ARTICLE 6. - DIVISION V

WATER DISTRIBUTION

Section 9.23. Pipe Material for Water Mains and Service Connections

- 9.23. 1. General9-118
- 9.23. 2. Pipe Inspection and Testing.....9-118
- 9.23. 3. PVC Pipe.....9-118
- 9.23. 4. Ductile Iron Pipe and Fittings.....9-119
- 9.23. 5. Service Pipe, Stops, Fittings, and Service Saddles.....9-120

Section 9.24. Pipe Installation for Water Mains

- 9.24. 1. General.....9-121
- 9.24. 2. Pipe Handling9-121
- 9.24. 3. Separation of Water Mains and Sewers.....9-121
- 9.24. 4. Trench Preparation and Pipe Bedding9-122
- 9.24. 5. Hydrostatic Tests9-124
- 9.24. 6. Disinfection of Water Mains.....9-125
- 9.24. 7. Notification and Connection to Existing Mains9-127
- 9.24. 8. Water Service Piping and Connection.....9-127
- 9.24. 9. Location and Identification.....9-127

Section 9.25. Valves, Hydrants and Accessories for Water Mains

- 9.25. 1. General..... 9-128
- 9.25. 2. Resilient Wedge Gate Valves9-128
- 9.25. 3. **Section has been removed**
- 9.25. 4. Valve Installation.....9-129
- 9.25. 5. Valve Boxes.....9-130
- 9.25. 6. Air Release Valves9-130
- 9.25. 7. Fire Hydrants9-130

APPENDICES

	Page
APPENDIX 'A' Project Acceptance Certificate.....	A-1
APPENDIX 'B' List of Material and Approved Manufactures.....	B-1

INTRODUCTION

INTRODUCTION

DOCUMENT TITLE

The title of this document is “Water Utilities Manual of Standards and Specifications for Design and Construction”.

JURISDICTION

This Chapter shall apply to all proposed water, wastewater mains to be owned, operated or maintained by the City of Haines City, Water Distribution and Wastewater Collection Division. In addition, other permitting and regulatory agencies may have jurisdiction, and regulations which supplement or supplant the requirements outlined in this manual.

PURPOSE

These standards and specifications are adopted to establish minimum acceptable standards for the design and construction of water distribution and transmission facilities and wastewater collection and transmission facilities within the City of Haines City service area. Such facilities include water mains, gravity sewers, wastewater force mains, wastewater pump stations, and miscellaneous related appurtenances associated with such systems.

SCOPE

This Document is divided into three parts. Part 1 - Standards includes Divisions I and II. Division I presents general requirements governing review and approval of plans, and construction inspection and acceptance. Division II presents design standards for wastewater, and water main facilities.

Part 2 of this document, Specifications, includes Division III, IV and V. These three Divisions contain detailed technical specifications governing construction of water and wastewater main facilities within the City of Haines City.

Part 3 of this document is Standard Details. This part contains drawings showing standard details associated with the installation of wastewater and water main facilities.

PART 1 - STANDARDS

DIVISION I

GENERAL REQUIREMENTS

CHAPTER 9.1. UTILITY SYSTEM ADDITIONS POLICY

ARTICLE 1. EXTENSIONS TO PROPERTIES OUTSIDE THE CITY

Sec. 9.1.1. GENERAL

The following provides a means by which the City of Haines City's utility systems may be connected to or extended. In general, developers are responsible for all cost and installation of utility systems within and adjacent to the proposed development, except for portions of individually metered service installations.

Sec 9.1.2. PROCEDURES FOR REQUESTING UTILITY SERVICE TO PROPERTIES LYING OUTSIDE THE CORPORATE LIMITS OF THE CITY OF HAINES CITY

The extension of City of Haines City utility services to properties lying outside and non-contiguous to the corporate limits of the City of Haines City shall be considered by the City Commission. The extension of utility service to properties lying outside, but contiguous to the corporate city limits shall be considered by the City Manager. The extension of utility service to properties lying outside the corporate City limits, but contiguous to existing utility lines, may be considered by the City Manager. The below procedure shall be utilized in all applications for utility service to properties outside the corporate limits of the City.

9.1.2.1. The petitioner (Owner of Record) of the non-contiguous property to be served by the utility system must formally request that the City make City utility services available to the site. In order to initiate the request, the petitioner should contact the City Engineer (consultant) and provide the following information in order for Administration to properly evaluate the request:

9.1.2.1.1. A project location map and complete legal description of the subject property.

9.1.2.1.2. Proof of ownership, eg., a copy of deed to property site.

9.1.2.1.3. A comprehensive, itemized breakdown of the proposed land use intended for the subject site.

9.1.2.1.4. An estimate of daily water and wastewater demands of the subject property. Unit consumption/generation rates shall be in accordance with City standards unless the developer can provide evidence that other consumption/generation rates would be more appropriate.

9.1.2.2. For non-contiguous properties, the required information shall be provided to the City Engineer (consultant) at least 10 days prior to the Commission meeting at which the request for utility service is to be considered.

9.1.2.3. The petitioner must execute a “Petition for Utility Service” before the City Commission, or where applicable, the City Manager, will consider the request. The execution of a “Petition for Utility Service” obligates the developer to construct the utility system in compliance with certain conditions:

9.1.2.3.1. All utilities construction within the subject property shall be in conformance with all applicable Land Development Regulations, City codes, specifications, and requirements.

9.1.2.3.2. All costs associated with the extension of City of Haines City utility services to the subject property are to be made at no expense to the City, except as provided below for oversizing.

Sec. 9.1.3. RESPONSIBILITY FOR INSTALLATION:

9.1.3.1. The developer shall be totally responsible for all installation costs within and/or adjacent to his property and all costs incurred except for that cost previously agreed upon by the City as the City’s oversizing cost (See Sec. 9.1.4) and except as noted below.

9.1.3.2. The City may elect to install any extension of the utility system required from existing facilities to the development on a joint participation agreement, requiring the developer to reimburse the City for the cost incurred by the City or may require the developer to provide the entire installation at his expense. Any portion of the facilities to be installed or materials supplied by the City must be labeled as such on the plans.

9.1.3.3. Where an extension will benefit other property owners and/or developments, the City may consider the following options for line extensions:

9.1.3.3.1. The developer may prepay the entire cost of the extension. The developer will be reimbursed extension fees from other users connecting to the line within a 5 year period. Such reimbursement shall be up to 100% of the certified cost of the extension less his own extension fee.

9.1.3.3.2. The City may pay the cost of the extension if a letter of credit or other acceptable collateral is provided by the developer guaranteeing the City reimbursement of the entire cost of the extension over the subsequent 5 year period.

9.1.3.4. Ninety percent of all extension fees (excluding the developer’s fee) will be credited to the developer’s debt for a 5 year period. Said 5 year period commences at the time of final acceptance of the extension by the City. These extension fees are in addition to usual impact fees and connection fees.

9.1.3.5. Extensions will be of the City’s minimum size or greater if needed by the developer.

- 9.1.3.6. Where it is deemed by the City to be more feasible to serve a development with a new water or wastewater facility rather than by extending existing City utilities, the developer shall be responsible for the cost of constructing the required facilities. Water and/or wastewater treatment plants may be designed by the Developer's Engineer in accordance with City standard details and specifications and requirements of the City Engineer (consultant). Where desired, the City may require oversizing of the facility and reimburse the developer in accordance with the following procedures.

Sec 9.1.4. OVERSIZING OF UTILITIES EXTENSIONS

- 9.1.4.1. The City may, at its discretion, require the oversizing of utility lines, lift stations, and/or other utility facilities to benefit the overall utility system.
- 9.1.4.2. Where the City elects to oversize any utility line, lift station, or other utility facility, the City shall reimburse the developer for the documented cost differential directly attributable to oversizing or additional facilities of benefit only to the City. The determination of that portion of the extension cost paid by the City shall be made from a minimum of 3 bids, submitted for evaluation by the City.

SECTION 9.2.
DEFINITIONS

9.2. **DEFINITIONS**

Except where specific definitions are used within a specific section, the following terms, phrases, words, and their derivation shall have the meaning given herein when consistent with the context. Words used in the present tense include the future tense, words in the plural number include the singular number and words in the singular number include the plural number. The word “shall” is mandatory, and the word “may” is permissive.

AASHTO - means American Association of State Highway and Transportation Officials. Any reference to AASHTO standards shall be taken to mean the most recently published revision unless otherwise specified.

ANSI - means American National Standards Institute. Any reference to ANSI standards shall be taken to mean the most recently published revision unless otherwise specified.

ASTM - means American Society for Testing Materials. Any reference to ASTM standards shall be taken to mean the most recently published revision unless otherwise specified.

AWWA - means American Water Works Association. Any reference to AWWA Standards shall be taken to mean the most recently published revision unless otherwise specified.

CITY - means the City of Haines City, Florida.

CONTRACTOR - means the person, firm, or corporation with whom the contract for work has been made by the Owner, the Developer or the CITY.

DEVELOPER - means the person, firm, or corporation engaged in developing or improving real estate for use or occupancy.

DEVELOPER's ENGINEER - means an engineer or engineering firm registered with the State of Florida Department of Professional Regulation, retained by the DEVELOPER to provide professional engineering services for a project.

DIPRA - means Ductile Iron Pipe Research Association.

DIRECTOR - means the Public Works/Utilities Director of the City of Haines City, Florida, acting directly or through an assistant or other representative authorized by him.

DRAWINGS - means engineering drawings prepared by an ENGINEER to show the proposed construction.

ENGINEER - means an engineer or engineering firm registered with the State of Florida Department of Professional Regulation.

FDOT - means the Department of Transportation, State of Florida.

GEOTECHNICAL/SOILS ENGINEER - means a Registered Florida Engineer who provides services related to terrain evaluation and site selection, subsurface exploration and sampling, determination of soil and rock properties, foundation engineering, settlement and seepage analysis, design of earth and earth retaining structures, the design of subsurface drainage systems and the improvement of soil properties and foundation conditions, and testing and evaluation of construction materials.

MANUAL - means this City of Haines City Manual of Standards and Specifications for Wastewater, reuse water and Water Main Construction.

MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES - means the United States Department of Transportation Manual on Traffic Control Devices, latest edition.

NEMA - means National Electrical Manufacturers Association. Any reference to NEMA Standards shall be taken to mean the most recently published revision unless otherwise specified.

NSF - means National Sanitation Test Laboratory Foundation. Any reference to NSF Standards shall be taken to mean the most recently published revision unless otherwise specified.

CITY OF HAINES CITY - means City of Haines City, Florida.

OSHA - means the Federal Occupational Safety and Health Administration.

OWNER - means the person, firm, corporation, or governmental unit holding right of possession of the real estate upon which construction is to take place.

PLANS - means DRAWINGS as defined herein above.

STANDARDS - means the minimum design standards contained in Part 1 of the MANUAL.

STANDARD DRAWINGS - means the detailed drawings in Part 3 of this MANUAL related to water, reuse and wastewater main materials and installation.

STANDARD SPECIFICATIONS - means the Department of Transportation, State of Florida, Standard Specification for Road and Bridge Construction, latest edition.

SUBDIVISION REGULATIONS - means the City of Haines City Subdivision Regulations, latest edition.

TRAFFIC CONTROL AND SAFE PRACTICES MANUAL - means the State of Florida Department of Transportation Manual on Traffic Control and Safe Practices for Street and Highway Construction, Maintenance and Utility operation, latest edition

UTILITY ACCOMMODATION GUIDE - means the State of Florida Department of Transportation Utility Accommodation Guide, latest edition.

WATER MAINS - means water transmission mains, distribution mains, pipes, fittings, valves, hydrants, services, meters and miscellaneous related appurtenances.

WASTEWATER MAINS - means wastewater gravity sewers, force mains, pump stations, fittings, valves, service laterals, and miscellaneous related appurtenances.

WORK - means the labor, materials, equipment, supplies, services and other items necessary for the execution, completion and fulfillment of the contract.

SECTION 9.3.

PLAN REVIEW, APPROVAL, CONSTRUCTION, AND ACCEPTANCE OF WATER AND WASTEWATER IMPROVEMENTS

9.3.1. PLANS AND SPECIFICATIONS

9.3.1.1. GENERAL

All submitted plans shall be standard size sheet (24" x 36" or 11" x 17") with title block. Graphic scale (s) shall be provided on each sheet and all lettering shall be 1/8" or larger to permit photographic reproduction. Submittal of specifications is required. ALL PLANS sheets and the title page of submitted specifications must be signed, sealed and dated by the DEVELOPER's ENGINEER.

9.3.1.2. MASTER PLAN

Whenever possible, the entire water and wastewater systems shall be shown on a single Master Plan. The Master Plan shall indicate the general locations of all mains, manholes, valves, hydrants, services and service laterals with respect to the proposed development improvements and the existing water, reuse and wastewater systems. Main sizes shall be indicated in the Master Plan.

9.3.1.3. PLAN AND PROFILE

All mains shall be drawn in plan and profile.

Whenever possible, on-site water, reuse and wastewater systems shall be shown on the same PLANS sheet. As a minimum, the plan and profile drawings shall include the following information:

- a. General information such as north arrow, names of designer and engineer, revision block with dates, graphic scale (s) and sheet number.
- b. Profiles with elevations at 100 foot interval, or more frequently if required by good design practice.
- c. Development layout with horizontal and vertical controls.
- d. All conflicts with other utility and drainage systems.
- e. All manhole locations and rim elevations for manholes.
- f. Pipe data including size, lengths, material, and slopes.

- g. Size, type, and locations of fittings, valves, hydrants, air release/vacuum relief, and other related appurtenance.
- h. Limits of pipe deflection.
- i. Limits of special exterior coatings.
- j. Limits of special bedding requirements.
- k. Pipe restraint requirements.
- l. Details of connection to existing systems.
- m. Locations (s) and general layout of wastewater pumping station.
- n. Construction notes regarding cover, horizontal and vertical control, special construction requirements, and references to standard and special details.
- o. Other details and notes required to construct utilities.

9.3.1.4. DETAILS

The Plans shall include all applicable STANDARD DETAILS as shown in Part 3 of this MANUAL. Special details shall be prepared by the DEVELOPER's ENGINEER for aerial and underwater crossings of rivers, streams, canals and ditches. Other special details shall be prepared by the DEVELOPER's ENGINEER as required.

9.3.1.5. SCALE

The master plan shall be prepared at a scale not to exceed 1" to 200'. Plan and profile sheets shall not exceed a scale of 1" to 50'. Special details shall be of sufficiently large scale to show pertinent construction information.

9.3.2. SUBDIVISION RELATED WATER AND WASTEWATER IMPROVEMENTS

9.3.2.1. GENERAL

This section covers all water, reuse and wastewater improvements that are dedicated to City of Haines City and constructed in compliance with City of Haines City land Development Regulations.

9.3.2.2. DESIGN AND PLAN REVIEW

Design of water, and wastewater improvements associated with City of Haines City approved subdivisions shall be in compliance with the applicable City or County design. Standards and the specifications outlined in Divisions III, IV, and V of this MANUAL. PLANS will be reviewed and approved by the City of Haines City as part

of the subdivision review and approval process. Refer to the applicable subdivision regulations for other requirements governing plan review and approval.

9.3.2.3. CONSTRUCTION INSPECTION

Inspection of improvements shall be in accordance with criteria established in the Water Utilities Manual. The designated representative of the Water Distribution and Wastewater Collection Division shall inspect the water, reuse, and wastewater improvements to ensure their compliance with requirements in Divisions II, III, IV and V of this MANUAL.

9.3.2.4. APPROVAL AND ACCEPTANCE

Approval and acceptance of water, reuse and wastewater improvements shall be in accordance with the criteria established in this manual and miscellaneous requirements of the City of Haines City Subdivision Regulations.

9.3.3. WATER AND WASTEWATER IMPROVEMENTS ASSOCIATED WITH SITE DEVELOPMENT WITHIN THE CITY OF HAINES CITY SERVICE AREA

9.3.3.1. GENERAL

All water and wastewater improvements that are to be dedicated to City of Haines City shall be designed, reviewed, constructed and accepted in accordance with the criteria established in this manual.

9.3.3.2. DESIGN AND PLAN REVIEW

Design of water and wastewater improvements shall be in compliance with the design standards in Division II and the specifications outlined in Divisions III, IV and V of this MANUAL. PLANS will be reviewed and approved by the City of Haines City Engineering Division.

9.3.3.3. CONSTRUCTION INSPECTION

The DIRECTOR or his designated representative (s) shall periodically inspect all construction subject to these standards and specifications.

After all required improvements have been installed and tested, the DEVELOPER's ENGINEER shall submit certification to the CITY that the improvements have been constructed substantially according to approved plans and specifications. Non-compliance with approved plans or specifications or evidence of faulty materials or workmanship shall be called to the attention of the DEVELOPER or DEVELOPER's ENGINEER and if not corrected in an expeditious manner, all work on the project will be suspended and/or water services withheld. Additional laboratory tests shall be required when appropriate

9.3.3.4. MAINTENANCE, MATERIALS, AND WORKMANSHIP WARRANTY BOND

A letter of credit or bond shall be posted by the DEVELOPER and executed by a company authorized to do business in the State of Florida that is satisfactory to the CITY, payable to City of Haines City in the amount of ten (10) percent of the estimated construction cost of all required water and wastewater improvements to be owned and maintained by the CITY. Such bond shall guarantee maintenance of all improvements intended to be owned and maintained by the CITY for a one (1) year period, and the materials, workmanship and structural integrity of water, reuse and wastewater systems, and miscellaneous related facilities, excluding mechanical equipment for a one (1) year period, commencing after Certificates of Completion and Project Acceptance have been issued by the CITY.

See Appendix A for required forms. The manufacturer's warranty will be acceptable for mechanical equipment. As an alternative to the provision of a surety bond, the DEVELOPER may provide for the deposit of cash in an escrow account or a letter of credit acceptable to the CITY.

9.3.3.5. CERTIFICATE OF COMPLETION/APPROVAL FOR MAINTENANCE

After successful completion of all water and wastewater improvements, and after receipt of the required documents outlined in Appendix A, page A-3, the CITY will provide a "Certificate of Completion" verifying the satisfactory construction of all improvements intended to be owned and maintained by the CITY. After the one (1) year Warranty Period and verification by the CITY of satisfactory performance of all water and wastewater improvements, the CITY will issue the "Approval for Maintenance", thereby releasing the DEVELOPER from further responsibilities. See form on page A-4 in Appendix A.

9.3.4. MISCELLANEOUS WATER, REUSE AND WASTEWATER IMPROVEMENTS

All water, reuse and wastewater improvements constructed which are intended to be owned, operated or maintained by the CITY, excluding the improvements discussed in Sections 9.2 and 9.3, shall be designed, reviewed, inspected and accepted in strict compliance with the criteria established in Section 9.3.3,.

9.3.5. COMPLIANCE WITH OTHER REGULATORY REQUIREMENTS

It shall be the responsibility of the DEVELOPER to obtain and comply with all applicable Federal, State and Local regulatory permits.

9.3.6. RECORD DRAWINGS

The DEVELOPER's ENGINEER shall submit a certified set of Record Drawings to the CITY prior to issuance of Certificate of Completion for the improvements. The DEVELOPER's ENGINEER shall be responsible for recording information on the approved PLANS concurrently with construction progress. Record Drawings submitted to the CITY as part of the project acceptance shall comply with the following requirements:

1. Drawings shall be legibly marked to record actual construction.
2. Drawings shall show actual location of all underground and above ground water, reuse and wastewater piping related appurtenances. All changes to piping location including horizontal and vertical locations of utilities and appurtenances shall be clearly shown and referenced to permanent surface improvements. Drawings shall also show actual installed pipe material, class, etc.
3. Drawings shall clearly show all field changes of dimension and detail including changes made by field order or by change order.
4. Drawing shall clearly show all details not on original contract drawings but constructed in the field. All equipment and piping relocation shall be clearly shown.
5. Location of all manholes, hydrants, valves, and valve boxes shall be shown. All valves shall be referenced from at least two preferably three permanent points.
6. Dimensions between all manholes shall be field verified and shown. The inverts and grade elevation of all manholes shall be shown.
7. Each sheet of the PLANS shall be signed, sealed and dated by the DEVELOPER's ENGINEER as being "As-Builts" or "Record Drawings". Construction PLANS simply stamped "As-Builts" or "Record Drawings" and lacking in above requirements will not be accepted, and will be returned to the DEVELOPER's ENGINEER. The "Certificate of Completion" will not be issued until correct "Record Drawings" have been submitted.
8. The DEVELOPER's ENGINEER shall provide two complete set of "Record Drawings", also a complete set of record documents, in computerized form to the CITY. This documentation shall be on compact disk (CD) in AUTOCAD version 14 or above or DXF in addition to the compact disk the engineer shall provide a document listing the layers and color/linetype utilized in preparation of the drawing. These computer files shall contain all the information shown on the "Record Drawings".

9.3.7 LIST OF MATERIAL AND APPROVED MANUFACTURERS

A list of Materials and Approved Manufacturers for the various products specified in this MANUAL is included in Appendix 'B'. It is the intent of the CITY to review and update Appendix 'B' as appropriate to ensure efficient operation of the services and facilities under the jurisdiction of this MANUAL. For this purpose, the CITY shall evaluate technical submittals from interested manufacturers or suppliers at least once every three years.

DIVISION II
DESIGN STANDARDS

SECTION 9.4 GRAVITY SEWERS

Sec. 9.4.1. GENERAL CONSIDERATIONS

9.4.1.1. TYPE OF SEWERS

The CITY will approve PLANS for new sewer systems and extensions only when designed as separate system in which precipitation, runoff and groundwater are excluded.

9.4.1.2. DESIGN PERIOD

Sewer systems should be designed for the estimated ultimate tributary population, as delineated in the approved City of Haines City Wastewater Master Plan (latest edition) except in considering parts of the systems that can be readily increased in capacity.

9.4.1.3. LOCATION

Gravity sewers shall be located in dedicated right-of ways or utility easements. Whenever possible, sewers shall be located under pavement in dedicated right-of ways. All sewers located outside of dedicated right-of-ways shall require a minimum 15 foot easement. Additional easement widths shall be provided when the pipe size or depth of cover so dictate. If a gravity sewer is located adjacent to a road right-of-way, a minimum 10 foot easement shall be provided. Additional easement widths shall be provided if the pipe size or depth of cover is so dictated. No gravity sewers shall be placed under retention ponds, tennis courts, or other structures. In general, gravity sewers shall not be located along side or rear lot lines. Placement of a gravity sewer along side or rear lot line may be allowed on a case by case basis if such a sewer configuration results in efficient placement and utilization of the sewer system. This criteria shall also apply to sewer placement in retention pond berms. In any event, no manholes shall be placed along side or rear lot lines.

Sec 9.4.2. DESIGN BASIS

9.4.2.1. AVERAGE DAILY FLOW

The gravity sewer design shall be based on full ultimate development as known, or projected. Average daily wastewater flow shall be calculated by the current City of Haines City, Flow Rate Table as outlined in Administration and Procedures Manual - Chapter 7, Article 5.

9.4.2.2. PEAK DESIGN FLOW

Gravity sewers shall be designed on the basis of ultimate development maximum rates of flow, which shall be the product of selected peak factors times the accumulative average daily flow as calculated above.

In general, the following minimum peak factors shall be applicable for the range of average daily flow rates.

<u>Flow Range</u>	<u>Minimum Peak Factor</u>
Flows to 100,000 GPD	4.0
100,000 GPD 250,000 GPD	3.5
250,000 GPD to 1,000,000 GPD	3.0
Flows greater than 1,000,000 GPD	2.5

For design average daily flows above 2,000,000 GPD, peaking factors less than 2.5 may be considered if substantiated by extensive data. Under no circumstances shall peaking factors less than 2.0 be allowed.

9.4.2.3. DESIGN CALCULATIONS

DEVELOPER=s ENGINEER shall submit signed, sealed and dated design calculations with the PLANS for all sewer projects. Calculations shall show that sewers will have sufficient hydraulic capacity to transport all design flows.

Sec. 9.4.3. DETAILS OF DESIGN AND CONSTRUCTION

9.4.3.1. MINIMUM SIZE

No gravity sewer main conveying wastewater shall be less than 8 inches in diameter.

9.4.3.2. MINIMUM COVER

The minimum cover over gravity sewers shall be no less than 3 feet calculated from the finished grade. Exceptions to this requirement may be made for a short length of pipe where structural considerations are incorporated in the design.

9.4.3.3. SLOPE

All sewers shall be designed and constructed to give minimum velocities, when flowing full*, of not less than 2.0 feet per second. The following minimum slopes shall be provided; however, slopes greater than these are desirable:

* Gravity main capacity for design purposes shall be calculated at 50% full for pipe up to 15 inch diameter and 75% for pipe 18 inch diameter and greater.

<u>Sewer Size</u>	<u>Minimum Slope in Feet Per 100 Feet</u>
6 inch	0.57
8 inch	0.40
10 inch	0.24
12 inch	0.19
15 inch	0.15
18 inch	0.11
21 inch	0.09
24 inch	0.08
27 inch	0.07
30 inch	0.06
36 inch	0.05

Sewers shall be laid with uniform slope between manholes.

9.4.3.4. SIZE AND ALIGNMENTS

Size conversion between manholes shall not be allowed. All sewers shall be laid with straight alignment and uniform slope between manholes.

9.4.3.5. ADDITIONAL REQUIREMENTS

Main drain and backwash systems for pools and spas and storm drain systems shall not connect to the gravity sewer system.

In general, all sewer extensions for future connections shall terminate at a manhole. The City may allow such extensions without a terminal manhole on a case by case basis subject to all of the following conditions:

1. Total sewer extension length shall be limited to 50 feet.
2. Sewer extension location at the initiating manhole shall be mechanically plugged to the satisfaction of the CITY.
3. Such sewer extensions shall not be a part of the accepted sewer facilities. This shall be clearly delineated on the PLANS.
4. All such sewer extensions shall be inspected and accepted as part of the future construction phase.

Sec. 9.4.4. MANHOLES

9.4.4.1. LOCATION

Manholes shall be installed at the end of each gravity sewer; at all changes in grade, size or alignment; at all sewer intersections; and at distances not greater than 400 feet. Private sewer systems must be separated from the CITY sewer system by a manhole located at the right-of-way line.

Collection manholes are required at the end of the gravity system, before the wastewater pump station. (See **STANDRAD DETAIL NUMBER 950300**)

9.4.4.2. TYPE

A drop manhole connection as shown on the STANDARD DETAILS shall be provided for a sewer entering a manhole where its invert elevation is 24 inches or more above the exiting invert.

Where the difference in elevation between the incoming sewer invert and the manhole invert is less than 24 inches, the manhole invert shall be filleted to prevent solids deposition.

9.4.4.3. DIAMETER

For sewer 24 inches in diameter and smaller, the minimum inside diameter of manholes shall be 48 inches. For sewers greater than 24 inches and up to 36 inches, the minimum inside diameter shall be 60 inches. For sewers larger than 36 inches in diameter, a 72 inch inside diameter manhole shall be provided.

Minimum manhole inside diameter shall be 48 inches for up to 12 feet deep, 60 inches for up to 18 feet deep, 72 inches for greater depths.

A minimum overall access opening diameter of 30 inches shall be provided.

Access cover shall be double cover style; center access cover shall be 20" minimum diameter.

9.4.4.4. FLOW CHANNEL

The flow channel through manholes shall be made to conform in shape and slope to that of the sewers. Flow direction changes in excess of 90 degrees shall not be included in sewer alignments without special consideration. When directional changes exceeding 45 degrees occur, an additional flow line elevation drop of 0.1 foot across manholes shall be provided. Benching shall be provided which shall have a minimum slope of 2 inches per foot. At all changes in pipe sizes, the crown elevations of the pipes shall match.

9.4.4.5. MATERIALS

Manholes shall be constructed of precast units as specified in Section 9.16. Brick manholes shall not be permitted. Cast-in-place manholes may be accepted on a case by case basis for conflict resolution.

9.4.4.6. CASTINGS

Cast iron frames and covers shall be as specified in Section 9.16.3. Bolt down and /or gasket covers shall be provided where manholes are allowed by the City to be located in areas subject to ponding of flooding.

9.4.4.7. ACCESS

A 10 foot wide access road shall be provided for all manholes which are located outside of roadways. The top 8" inches of the access road shall be stabilized to a Florida Bearing value of 50 psi, and compacted to 95% of AASHTO T-180.

Sec. 9.4.5. SERVICE CONNECTIONS

9.4.5.1. GENERAL

Service connection shall be through a lateral and miscellaneous appurtenances, as shown on the STANDARD DETAILS, to connect the gravity sewer to the house or establishment served.

9.4.5.2. SIZE AND LENGTH

Service laterals and fittings shall be a minimum of 6 inches in diameter. All service laterals shall be less than 100 feet in length.

9.4.5.3. SLOPE

Service laterals shall have a minimum slope of 1%.

9.4.5.4. CONNECTION

In general, service laterals shall not be allowed to discharge into sanitary manholes, except at terminal manholes.

Sec. 9.4.6. GREASE TRAPS AND INTERCEPTORS

9.4.6.1. GENERAL

All Food Preparation/Service Establishments shall have outside grease traps sized as discussed herein. All wastewater flow from the kitchen areas of these establishments must flow through approved grease traps prior to entering the CITY system.

Grease traps and interceptors shall be provided when they are necessary for the proper handling of wastes containing ingredients harmful to the public sewer or sewage treatment plant or processes.

The minimum grease trap size shall be 750 gallons, two compartment type, as shown in the STANDARD DETAILS.

Interceptors shall be required for all automobile service/repair establishments, car wash and car wash structures, gasoline service stations, businesses or industries that use petroleum based, metal or sand products in their day to day activities, where a hazard exists, or where oils or other flammable items can be introduced or admitted into the sewer system by accident or otherwise.

The minimum interceptor size shall be 750 gallons, two compartment type with vent as shown in the STANDARD DRAWINGS.

All grease traps and interceptors shall be provided with an approved sampling station located down stream of the grease trap or interceptor and prior to connection with human waste lines.

The owner shall be responsible for proper and regular maintenance. The owner shall provide ingress and egress to the City for periodic inspection of the industrial waste system.

9.4.6.2. FAST FOOD RESTAURANTS

Grease trap capacity shall be 5 gallons per seat.

9.4.6.3. GENERAL RESTAURANTS

Grease trap capacity shall be sized at the rate of 10 gallons per seat.

9.4.6.4. 24-HOUR RESTAURANTS

Grease trap capacity shall be sized at the rate of 15 gallons per seat.

9.4.6.5. CONVENTION CENTER/MANUFACTURING CAFETERIAS

Single grease trap capacity shall be sized at the rate of 1.5 gallons, per meal.

9.4.6.6. MISCELLANEOUS FOOD PREPARATION/SERVICE ESTABLISHMENTS

Grease trap capacity shall be sized at the rate of 1.5 gallons per meal.

9.4.6.7. LOCATION

Each grease trap or interceptor shall be so located as to provide ready accessibility to the cover and means for servicing and maintaining the structure in working and operating condition.

9.4.6.8. GRIT INTERCEPTORS

Sand and mud traps shall be a minimum of 4' in diameter and constructed as shown in the STANDARD DETAILS.

9.4.6.9. LAUNDRIES

Commercial laundry and Laundromats shall be equipped with lint traps or their interceptors shall have a removal basket, or similar device, that will prevent strings, rags, buttons, or other material detrimental to the sewer system from passing into the City wastewater system.

9.4.6.10. HAZARDOUS MATERIALS

Any establishment that used hazardous material for all or any portion of its day-to-day operation is required to submit two (2) copies of the Materials Safety Data sheet for each hazardous product in use on site and two (2) copies of the proposed method of pre-treatment for review and approval.

In no case shall corrosive liquids, spent acids, or other harmful or hazardous waste which may destroy or injure the sewer system, or which might create noxious or toxic fumes, discharge into the City sewer system without being thoroughly diluted or neutralized by passing through a properly constructed and acceptable dilution or neutralizing device.

This Department and the appropriate Fire Department Official shall be immediately notified when an unauthorized discharge occurs which becomes reportable under State, Federal, and/or local regulations, or if people, animal, plants or the environment are otherwise possibly at risk.

Sec. 9.4.7. MATERIALS, INSTALLATION AND TESTING

Applicable provisions of Article 5, 6, and 7 shall apply.

SECTION 9.5. WASTEWATER FORCE MAINS

Sec. 9.5.1. GENERAL CONSIDERATIONS

9.5.1.1. DESIGN PERIOD

Force main systems shall be designed for the estimated ultimate tributary population, as delineated in the approved City of Haines City Wastewater Master Plan (latest edition except in considering parts of the systems that can be readily increased in capacity)

9.5.1.2. LOCATION

Force mains shall be located in dedicated rights-of-ways or utility easements. When installed in rights-of-way, force mains shall maintain a consistent alignment with respect to the centerline of the road. All force mains located outside of dedicated rights-of-way shall require a minimum 15 foot easement. Additional easement widths shall be provided when the pipe size or depth of cover so dictate. If a force main is located adjacent to a road right-of-way, a minimum 10 foot easement shall be provided. Additional easement widths shall be provided if the pipe size or depth of cover so dictate. Force mains shall not be placed under retention ponds, tennis courts or under structures. In general force mains shall not be located along side or rear lot lines. Placement of a force main along side or ear lot line may be allowed on a case by case basis if such a force main configuration results in efficient placement and utilization of the sewer system. This criteria shall also apply to force mains in retention pond berms.

Sec. 9.5.2. DESIGN BASIS

9.5.2.1. AVERAGE DAILY FLOW

Provisions of Section 9.6.2.2.2. shall apply.

9.5.2.2. PEAK DESIGN FLOWS

Provision of Section 9.6.2.1. shall generally apply. Consideration must be given to a 2 fps minimum velocity and a compatible head pressure for manifolded systems.

9.5.2.3. DESIGN OR CALCULATIONS

DESIGN or DEVELOPER's ENGINEER shall submit signed, sealed and dated design calculations with the PLANS for all force main projects. Calculations shall show that force mains will have sufficient hydraulic capacity to transport all design flows.

Sec. 9.5.3. DETAILS OF DESIGN AND CONSTRUCTION

9.5.3.1. VELOCITY AND DIAMETER

At design pumping rates, a cleansing velocity of at least 2 feet per second should be maintained. Maximum velocity at design pumping rates should generally not exceed 7 feet per second. The minimum force main diameter shall be 4 inches. Only 4", 6", 8", 10", 12", 16", 20", 24", 30", 36", 42", 48" and 54" diameter force mains shall be permitted.

9.5.3.2. DESIGN FRICTION LOSSES

Friction losses through force mains shall be based on the Hazen and Williams formula. In the use of Hazen and Williams formula, the value for "C" shall be 100.

When initially installed, force mains may have a significantly higher "C" factor. The higher "C" factor should be considered only in calculating maximum power requirements and duty cycle time of the motor.

9.5.3.3. DESIGN PRESSURE AND RESTRAINT

The force main and fittings, including all restrained joint fittings shall be designed to withstand pump operating pressures and pressure surges, but not less than 100 psi.

Only restrained joint devices shall generally be allowed. The number of restrained joints shall be calculated by a professional engineer, registered in the State of Florida or shall be in accordance with the "Restrained Joint Table" on the Standard Details.

9.5.3.4. TERMINATION

Force mains shall not terminate directly into a gravity sewer line. Force mains shall enter the gravity sewer system at a drop type connection to a manhole as shown on the Standard Details.

9.5.3.5. AIR RELEASE AND VACUUM RELIEF VALVES

Air release valves, or air/vacuum relief valves, shall be provided, as necessary, to prevent air locking and vacuum formation. All such valves shall be clearly delineated on the force main plan and profile in the DRAWINGS. The DEVELOPER's ENGINEER shall submit calculations to the CITY justifying the valve sizing. See additional requirements in Section 9.19.6.

9.5.3.6. AERIAL CROSSINGS

STRUCTURAL SUPPORT

Support shall be provided for all joints in pipes utilized for aerial crossings. The supports shall be designed to prevent overturning and settlement.

EXPANSION PROTECTION

Expansion joints shall be provided as required.

FLOOD CLEARANCE

For aerial stream crossings, the impact of flood waters and debris shall be considered. The bottom of the pipe shall be placed no lower than 1 foot above the 100 year flood elevation.

PIPE MATERIAL AND JOINTS

Flanged joints shall be used. Pipe and flange material shall be ductile iron, minimum class 53. All above ground pipe shall be painted as specified in Section 9.19.4.4. for aboveground wastewater force mains. Use of epoxy coated steel pipe may be allowed on a case by case basis.

VALVES

Underground valves shall be provided at both ends of the crossing so that the section can be isolated for testing or repair. The valves shall be easily accessible and not subject to flooding. An air release/vacuum relief valve shall be installed at the high point of the crossing.

GUARDS

Appropriate guards shall be installed at both ends of the crossing to prevent pipe access to the public.

PERMITS AND REQUIREMENTS OF OTHER AGENCIES

It shall be the responsibility of the DEVELOPER to obtain all applicable regulatory permits. When the Aerial Crossing is accomplished by attachment to a bridge or drainage structure, the DEVELOPER shall meet all requirements of the Agencies who own or have jurisdiction over such structures.

9.5.3.7. UNDERWATER CROSSINGS

PIPE MATERIAL AND COVER

A minimum cover of three feet plus a 6" concrete slab shall be provided over the pipe. The pipe material shall meet appropriate AWWA Standards for use in submerged conditions.

VALVES

Valves shall be provide at both ends of the water crossings so that the section can be isolated for testing or repair. The valves shall be easily accessible, and not subject to flooding. Both valves shall be provided in a manhole or a valve vault.

PERMITS

It shall be the responsibility of the DEVELOPER to obtain all applicable regulatory permits, including dredge and fill permits.

9.5.3.8. VALVES

Sufficient valves shall be provided on force main systems to facilitate effective isolation of the pipe system for repairs and maintenance. On straight runs of force mains, valve spacing shall not exceed 2000 feet. Additional valves shall be provided at inlets of fittings where force mains intersect to facilitate isolation of pipe segments.

Sec. 9.5.4. MATERIAL, INSTALLATION AND TESTING

Applicable provisions of Article 4, 5, and 6 shall apply.

Sec. 9.5.5. LOCATION AND IDENTIFICATION

A means for locating and identifying all force mains and valves shall be provided in accordance with the provisions in Article 6. and the STANDARD DETAILS.

Sec. 9.5.6. ADDITIONAL REQUIREMENTS

While designing force main systems, consideration shall be given to possible future connecting pumping stations. If applicable, this requirement shall be reviewed with the CITY prior to finalization of the design

SECTION 9.6 WASTEWATER PUMP STATIONS

Sec. 9.6.1. GENERAL REQUIREMENTS

The design standards outlined in this section apply to wastewater pump stations discharging a peak flow of 3000 gallons per minute or less. All such pump stations shall be a submersible. For designing pump stations discharging more than 3000 gallons per minute, the type of pump station and the Basis of Design shall be reviewed with the CITY and approval obtained before proceeding with the design.

Sec. 9.6.2 DESIGN BASIS

9.6.2.1. DESIGN FLOWS

Design flow shall be based upon the total ultimate development flow from all contributory areas to the pump station. The design average daily flow shall be computed as outlined in Section 9.2.1. The design pumping capability of the station shall be based upon the peak design flow which shall be calculated by multiplying the design average flow with the applicable minimum peaking factors as outlined below:

<u>Design Average Daily Flow</u>	<u>Minimum Peaking Factor For Peak Design Flow</u>
Flows to 100,000 GPD	4.0
100,000 GPD to 250,000 GPD	3.5
250,000 GPD to 1,000,000 GPD	3.0
Flows greater than 1,000,000 GPD	2.5

For design average daily flows above 2,000,000 GPD, peaking factors less than 2.5 may be considered if substantiated by extensive data. Under no circumstances shall peaking factors less than 2.0 be allowed.

9.6.2.2. NUMBER OF PUMPS

For pump stations with a peak design flow of 1500 GPM or less, a minimum of two pump units shall be provided. Where the peak design flow exceeds 1500 GPM, three or more units shall be provided. See Section 9.2.2.1.3. for standby requirements.

9.6.2.3. PUMP AND MOTOR SELECTION

Pump station shall be capable of pumping the peak design flow with the largest pumping unit out of service. Pumps shall be capable of meeting all system hydraulic conditions without overloading the motors. In addition a minimum 5 HP motor shall be required. Total dynamic head and flow capacity curves shall be prepared and submitted to the CITY along with the pump station plans.

Such curves shall be based upon the static head friction losses outlined in Section 9.3.2. of these specifications. Head capacity curves shall verify that the pumps are operating at peak efficiency and are suitable for the design flow application. Pump and motor selection and total dynamic head and flow capacity curves shall reflect hydraulic conditions in cases where receiving force main systems are interconnected to additional pumping stations.

9.6.2.4. DESIGN CALCULATION

DEVELOPER=s ENGINEER shall submit signed, sealed and dated design calculations for all wastewater pump stations. Calculations shall include total dynamic head and flow capacity curves with copies of manufacturers pump curves, hydraulic analysis of force main system, operating cycle calculations with wet well sizing, and buoyancy calculations.

Sec. 9.6.3. DETAILS OF DESIGN AND CONSTRUCTION

9.6.3.1. FLOODING

Wastewater pumping station structures and electrical and mechanical equipment shall be protected from physical damage by the 100 year flood. Wastewater pumping stations should remain fully operational and accessible during the 100-year flood. Regulations of Local, State and Federal agencies regarding flood plain obstructions shall be considered.

9.6.3.2. ACCESSIBILITY

The pumping station shall be readily accessible by maintenance vehicles during all weather conditions. The access road to the pumping station shall be paved. The facility shall not be located in road rights-of-way.

In a phased development, a stabilized access road may be accepted during the initial phase with paving to be accomplished in the later phase.

9.6.3.3. BUOYANCY

Buoyancy of the pump station structures shall be considered and adequate provisions shall be made for protection against flotation.

9.6.3.4. PUMP REQUIREMENTS

Submersible wastewater pump stations shall comply with the requirements spelled out in Section 9.21. Only approved pumps listed in Appendix D shall be allowed. Submersible pumps and motors shall be designed specifically for raw sewage use, including totally submerged operation during a portion of each pumping cycle. Submersible pumps shall be readily removable and replaceable without dewatering the wet well or disconnecting any piping in the wet well.

Pumps shall be capable of handling raw sewage and passing spheres of at least 3 inches in diameter. Pump suction and discharge openings shall be at least 4 inches in diameter.

9.6.3.5. WET WELL REQUIREMENTS

Wet well shall be minimum 6-foot diameter and shall have a minimum 4.5 foot depth below the inlet invert. Additional depth shall be provided based on station design and cycle time, and potential.

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

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

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

No interior ladders shall be permitted in the wet well.

Only one inlet connection shall be permitted to a wet well. Provide a tee on the inlet, to direct the influent downward.

9.6.3.6. PUMP STATION WATER SYSTEM

All wastewater pump stations shall be provided with a water system with adequate capacity and pressure for station wash down and other requirements. The station water system shall be completely separated from the potable water supply by means of a reduced pressure type backflow preventer or other CITY approved system.

9.6.3.7. ELECTRICAL EQUIPMENT, POWER SUPPLY AND POWER CORDS

Requirements in Sections 9.21 and 9.22 shall apply.

9.6.3.8. CONTROLS

Requirements in Section 9.22 shall apply.

9.6.3.9. SITE SIZING AND EASEMENT REQUIREMENTS

Pump station sites shall be sized as delineated on the Lift Station Yard Plan in the DRAWINGS. The DEVELOPER shall dedicate pump station site by warranty deed or plat to the CITY. Dedicated easements shall also be required around the site as delineated on the Lift Station Yard Plan in the DRAWINGS. In general, the site for the paved access road shall also be dedicated to the CITY by Warranty deed or plat. An exception to this requirement may be allowed on a case by case basis in the form of an ingress/egress easement for the access road.

9.6.3.10. SITE FENCING

Fencing at the pump station site perimeter shall comply with the technical criteria established in Section 9.20. In general, all pump station sites shall be fenced. However, exception to this requirement may be made for pump stations serving residential areas only, on a case by case basis and subject to sufficient landscape screening.

Sec. 9.6.4. FLOW METER

Indicating, totalizing and recording flow measurement shall be provided at pumping stations designed to handle peak flows of 1500 GPM or more. Applicable provisions of Section 9.20. shall apply.

Bypass piping around the meter shall be provided for all stations with flow meters to facilitate meter maintenance.

Sec. 9.6.5. EMERGENCY OPERATION

All wastewater pump stations shall be provided with stand-by emergency diesel generators. Such stand-by generator shall comply with the requirements spelled out in Section 9.20. All such generators shall be rated and designed to operate the pump station under design conditions. (See appendix B for generator suppliers)

Sec. 9.6.6. ODOR CONTROL

An odor control system shall be provided for all pump stations over 1500 GPM peak flow.

Sec. 9.6.7 COLLECTION MANHOLE

Requirements in Section 9.4 shall apply.

SECTION 9.7 WATER MAINS

Sec. 9.7.1. GENERAL CONSIDERATIONS

9.7.1.1. TYPE OF WATER MAINS

The CITY will approve PLANS for water supply mains and extensions only when such mains are designed and constructed in accordance with the criteria set forth in this MANUAL.

9.7.1.2. DESIGN PERIOD

Water mains should be designed for the estimated ultimate tributary population, as delineated in the approved City of Haines City Water Master Plan (latest edition) except in considering parts of the system that can be readily increased in capacity. Water systems shall be designed to satisfy the domestic water demand and fire protection requirements for the area.

9.7.1.3. LOCATION

Water mains shall be located in dedicated rights-of-way or utility easements. When installed in rights-of-way, water mains shall, in general, maintain a consistent alignment with respect to the centerline of the road. All water mains located outside of dedicated rights-of-way shall require a minimum 15 foot easement. Additional easement widths shall be provided when the pipe size or depth of cover so dictate. If a water main is located adjacent to a road right-of-way, a minimum 10 foot easement shall be provided abutting the right-of-way. Additional easement widths shall be provided if the pipe size or depth of cover so dictate. Water mains shall not be placed under retention ponds, tennis courts, or other structures. In general, water mains shall not be located along side or rear lot lines. Placement of a water main along side or rear lot line may be allowed on a case by case basis if such a water main configuration results in efficient placement and utilization of the water main network. The criteria shall also apply to water mains in retention pond berms.

Sec. 9.7.2. DESIGN BASIS

9.7.2.1. AVERAGE DAILY FLOW AND PEAK FLOWS

Average daily water flow shall be calculated by referencing the flow rates as outlined in Appendix A. Appendix A is subject to revision. Maximum daily and peak hourly water flow rates shall be calculated by referencing the service area peaking factors in Appendix B.

9.7.2.2. FIRE FLOW REQUIREMENTS

Fire flow requirements shall be determined in accordance with applicable City or County Fire Department Codes. Where fire flow requirements exceed the anticipated available fire flow from the central water system, on-site fire protection system or other Fire Department approved mitigation measures shall be utilized. (Minimum requirement as per AWWA M31 is 500 gpm at a residual pressure of 20psi).

Sec. 9.7.3. DETAILS OF DESIGN AND CONSTRUCTION

9.7.3.1. DESIGN PRESSURE AND RESTRAINT

The water main and fittings, including all restrained joint fitting shall be designed to withstand pump operating pressures and pressure surges, but not less than 150 psi.

Only restrained joint devices shall generally be allowed. The number of restrained joints shall be calculated by a Professional Engineer, registered in the State of Florida or shall be in accordance with the "Restrained Joint Table" in the STANDARD DETAILS.

9.7.3.2. DIAMETER

Only 4", 6", 8", 10", 12", 16", 20", 24", 30", 36", 42", 48" and 54" diameter water mains shall be permitted. At the end of cul-de-sac areas, a 4" looped connection as shown on the STANDARD DETAILS will be allowed to prevent dead ends. As a minimum, six (6) inch looped systems shall be required in low density residential projects. Where looping of mains is not practical, minimum eight (8) inch mains shall be required, unless detailed calculations are submitted to substantiate the sufficiency of a 6 inch main.

In commercial, industrial, and high density residential areas, minimum eight (8) inch looped mains shall be required. Larger size mains shall be required if necessary to allow the withdrawal of the required fire flow while maintaining the minimum residual pressure specified in Section 21.

9.7.3.3. FIRE HYDRANT LOCATION AND SPACING

As a minimum, specifications outlined in the latest version of City of Haines City Land Development Regulations and applicable City of Haines City Fire Departments Codes shall apply. As a minimum, hydrants shall be placed at 2000 foot intervals to provide for proper flushing for all off-site mains.

9.7.3.4. DEAD ENDS

In order to provide increased reliability of service and reduce head loss, dead ends shall be minimized by making appropriate tie-ins whenever practical, as determined by the CITY. Where dead-end mains occur, they shall be provided with a fire hydrant or with an approved blow-off for flushing purposes. No flushing device shall be directly connected to any sewer.

9.7.3.5. VALVES

Sufficient valves shall be provided on water mains so that inconvenience and sanitary hazards will be minimized during repairs. Valves shall be located at not more than 500 foot intervals in commercial, industrial and high density residential areas and at not more than 1000 foot intervals in all other areas. Appropriate valving shall also be provided at the downstream sides of tees and crosses to ensure effective isolation of water lines for repair, maintenance or future extension. This shall include all sides of tees and crosses within looped systems, where flow is potentially multidirectional.

9.7.3.6. SEPARATION OF WATER MAINS AND SEWERS

Refer to Section 9.5.3.7 of these specifications for applicable requirements. No water pipe shall pass through or come in contact with any part of a sewer manhole.

Extreme caution should be exercised when locating water mains at or near certain sites such as sewer treatment plants or industrial complexes. Individual septic tanks must be located and avoided.

9.7.3.7. SURFACE WATER CROSSINGS

The CITY shall be consulted before final PLANS are prepared. Requirements outlined in Sections 9.5.3.6 and 9.5.3.7 shall apply. All above ground pipe shall be painted as specified in Section 9.23.4.4. for water mains.

9.7.3.8. AIR RELIEF VALVES

At high points in water mains where air can accumulate, provisions shall be made to remove the air by means of automatic air relief valves. Automatic air relief valves shall not be used in situations where flooding of the manhole or chamber may occur. See details in STANDARD DETAILS.

9.7.3.9. CHAMBER DRAINAGE

Chambers, pits or manholes containing valves, blow-offs, meters, or other such appurtenances to a distribution system shall not be connected directly to any storm drain or sanitary sewer, nor shall blow-offs or air relief valves be connected directly to any sewer.

9.7.3.10. DISINFECTION FOLLOWING REPAIR OR REPLACEMENT

Any part of the CITY water system which has direct contact with finished water and has been out of service for repair, alteration, or replacement shall be disinfected as outlined in Section 9.24.6 of these specifications.

Sec. 9.7.4. WATER SERVICES AND CONNECTIONS

Water services and connections shall conform to the applicable provisions of Section 50 and 51 and the STANDARD DETAILS. Only 3/4", 1", 1-1/2", 2", 3", 4", 6", 8" and 12" services will be permitted. Where water services greater than 12" are required dual services shall be provided.

Sec. 9.7.5. WATER METERING

9.7.5.1. GENERAL

All water service connections shall be metered. In general, the method of metering will follow the guidelines listed below. However, the DEVELOPER's ENGINEER must obtain approval before finalizing the design of the metering system.

9.7.5.2. SINGLE FAMILY, DUPLEX, AND MULTI-FAMILY SUBDIVISION WITH PUBLIC RIGHTS OF WAY

Each unit shall be individually metered. Single and Double services shall be installed at property lines as indicated by the STANDARD DETAILS.

9.7.5.3. SINGLE FAMILY AND DUPLEX SUBDIVISIONS WITH PRIVATE STREETS

Individual meters may be permitted in accordance with Section 9.7.5.2 if the private streets are designed to CITY Standards and easements are dedicated over the entire private street common areas. In addition, sufficient area must be available outside of paved areas to locate water mains, services, and meters. If the above criteria cannot be met, the subdivision shall be metered pursuant to Section 9.7.5.5.

9.7.5.4. COMMERCIAL, INDUSTRIAL, AND INSTITUTIONAL PROJECTS WITHOUT PRIVATE FIRE LINES

Each building shall be individually metered. Meter (s) shall be located in the public rights of way at the property line.

9.7.5.5. COMMERCIAL, INDUSTRIAL, INSTITUTIONAL, MULTI-FAMILY WITH PRIVATE STREETS, APARTMENTS, AND CONDOMINIUM PROJECTS WITH PRIVATE FIRE LINES

In general, all such projects shall require installation of a fire line master meter. Where on-site fire systems contain less than 75 feet of main, a dual system (separate domestic and fire lines) may be considered. Dual systems shall require installation

of a detector check or double detector check as determined by the CITY. Individual meters to each unit may be considered on a case-by-case basis subject DEVELOPER executing a Meter Installation and Easement Agreement.

9.7.5.6. SHOPPING CENTERS

In general, shopping centers shall require installation of a fire line master meter. Individual meters to each unit will be considered subject to the DEVELOPER executing an Easement Agreement.

9.7.5.7. METER INSTALLATION

All meters will be installed by the CITY after payment of applicable fees and charges. All meters less than two inch in size will be installed underground in an approved meter box. Meters two inch and larger shall be installed above ground and as shown in the STANDARD DETAILS. In general, meters two inch and larger shall be located in a meter easement located adjacent to the public right of way.

9.7.5.8. METER SIZING

Size of all meters shall be determined by the Developer. The DEVELOPER's ENGINEER shall provide sufficient information on estimated peak flows and low flows so that meter size can be verified correct. The DEVELOPER's ENGINEER shall include head losses through metering device when designing the water system.

Sec. 9.7.6. MATERIAL, INSTALLATION AND TESTING

Applicable provisions of Divisions III, IV, and V shall apply.

Sec. 9.7.7. LOCATION AND IDENTIFICATION

A means for locating and identifying all water mains and valves shall be provided in accordance with Sections 9.23, 9.24 and the STANDARD DETAILS.

Sec. 9.7.8. CROSS CONNECTION CONTROL

9.7.8.1. GENERAL

In order to protect the public water supply system from contamination due to cross-connections, the DEVELOPER shall install CITY approved backflow prevention devices where there is the potential of a non-potable substance coming into contact with the public water system, for services over 3/4". Some of the common instances requiring installation of the cross connection control devices are listed below. However, the DEVELOPER's ENGINEER must obtain CITY approval before finalizing the design of a Cross Connection Control Device. The City provides double-check backflow preventers for 3/4" domestics services only.

9.7.8.2. COMMERCIAL, INDUSTRIAL AND MULTI-FAMILY RESIDENTIAL

All commercial and industrial projects shall, as a minimum, require installation of approved double check valve assembly. Projects with a higher degree of hazard may be required to install an approved reduced pressure principle assembly.

All projects with fire sprinkler and standpipe systems, and projects with extensive on-site water systems shall be required, as a minimum, to install an approved double check detection assembly.

All systems shall be designed in accordance with the latest edition of the City of Haines City's 'Cross-Connection Control Manual'.

9.7.8.3. IRRIGATION SYSTEMS

Pressure-type vacuum breakers or reduced pressure principle (RPZ) assembly shall be utilized on all irrigation systems.

9.7.8.4. LOCATION AND INSTALLATION

In general, all backflow prevention devices are to be located directly following the water meter on DEVELOPER's property. Backflow prevention devices shall be installed to facilitate maintenance and testing. It shall be the DEVELOPER's responsibility to pay for, install and maintain all backflow prevention devices. Refer to the STANDARD DETAILS for specific recommended installation of various services.

PART 2 - SPECIFICATIONS

DIVISION III

**GENERAL CONSTRUCTION
REQUIREMENTS**

GENERAL

Sec. 9.8.1. GRADES, SURVEY LINES, AND PROTECTION OF MONUMENTS

9.8.1.1. GRADE

All work shall be constructed in accordance with the lines and grades shown on the PLANS. The full responsibility for keeping alignment and grade shall rest upon the CONTRACTOR.

Maximum distance between temporary Bench Marks is one thousand (1,000) feet, and shall be in close proximity to construction.

All bench Marks shall be clearly marked and protected thought-out construction. Make no changes or relocations without prior written notice to engineer.

Surveyor shall replace any control points which may be lost or destroyed at no additional cost to the City. Establish all replacement points based on original control.

9.8.1.2. SURVEYS

The CONTRACTOR shall furnish and maintain, at his own expense, stakes and other such materials and give such assistance, including qualified helpers, for setting reference marks to the satisfaction of the CITY and the ENGINEER. The CONTRACTOR shall check such reference marks by such means as he may deem necessary and, before using these, shall call the CITY's attention to any inaccuracies. The CONTRACTOR shall, at his own expense, establish all working or construction lines and grades as required from the reference marks and shall be solely responsible for the accuracy thereof. The CONTRACTOR shall, however, be subject to the check and review of the CITY.

9.8.1.3. MONUMENT PRESERVATION

Property corners and survey monuments (including G.I.S. Monuments) shall be preserved using care not to disturb or destroy them. If a property corner or survey monument is disturbed or destroyed during construction, for any reason said property corner or survey monument shall be restored by a land surveyor registered in the State of Florida. All costs for this work shall be paid for by the CONTRACTOR.

Sec. 9.8.2. UTILITY COORDINATION

9.8.2.1. LOCATION OF UTILITIES

Prior to proceeding with trench excavation, the CONTRACTOR shall contact all utility companies in the area to aid in locating their underground services. It shall be the CONTRACTOR's responsibility to contact utility companies at least three (3) normal

working days before starting construction. The CONTRACTOR shall proceed with caution in the excavation and preparation of the trench so that the exact location of underground utilities may be determined.

The CONTRACTOR shall take all reasonable precautions against damage to existing utilities. However, in the event of a break in an existing water and reuse mains, gas main, sewer or underground cable, the CONTRACTOR shall immediately notify the responsible official of the organization operating the interrupted utility. The CONTRACTOR shall lend all possible assistance in restoring services and shall assume all costs, charges, or claims connected with the interruption and repair of such services.

9.8.2.2. DEVIATIONS OCCASIONED BY STRUCTURES OR UTILITIES

Wherever obstructions are encountered during the progress of the WORK and interfere to such an extent that an alteration in the PLANS is required, the CITY shall have the authority to order a deviation from the line and grade or arrange with the owners of the structures for the removal, relocation or reconstruction of the obstructions.

Where gas, water, telephone, electrical or other existing utilities are an impediment to the vertical or horizontal alignment of the proposed pipe line, the CITY shall order a change in grade or alignment or shall direct the CONTRACTOR to arrange with the owners of the utilities for their relocation. If a change in line or grade of a gravity sewer is necessary, the CITY will require the addition of any manholes needed to maintain the integrity of the sewer system.

9.8.2.3. TEST PITS

Test pits for the purpose of locating underground pipeline, utilities, or structures in advance of the construction shall be excavated and backfilled by the CONTRACTOR. Test pits shall be backfilled immediately after their purpose has been satisfied and maintained in a manner satisfactory to the authority having jurisdiction. The costs for such test pits shall be borne by the CONTRACTOR.

Sec. 9.8.3. MAINTENANCE OF TRAFFIC AND CLOSING OF STREETS

The CONTRACTOR shall carry on the WORK in a manner which will cause a minimum of interruption to traffic. Where traffic must cross open trenches, the CONTRACTOR shall provide suitable bridges at street intersections and driveways. The CONTRACTOR shall post suitable signs indicating that a street is closed and necessary detour signs for the proper maintenance of traffic. Prior to closing of any streets, CONTRACTOR shall notify and obtain the approval of responsible authorities and the CITY.

Unless permission to close a street is received in writing from the proper authority (CITY, COUNTY, FDOT, etc.), all excavated material shall be placed so that vehicular and pedestrian traffic may be maintained at all times. If the CONTRACTOR's operations cause traffic hazards, he shall repair the road surface, provide temporary ways, erect wheel guards or fences, or take other measures for safety satisfactory to the authority having jurisdiction.

Detours around construction will be subject to the approval of the authority having jurisdiction and the CITY. Where detours are permitted, the CONTRACTOR shall provide all necessary barricades and signs as required to divert the flow of traffic. While traffic is detoured, the CONTRACTOR shall expedite construction operations.

Periods when traffic is being detoured will be strictly controlled by the CITY. It shall be the sole responsibility of the CONTRACTOR to take precautions to prevent injury to the public due to open trenches. Night watchmen may be required where special hazards exist, or police protection provided for traffic while work is in progress. The CONTRACTOR shall be fully responsible for damage or injuries whether or not police protection has been provided.

Sec. 9.8.4. PROTECTION OF PUBLIC AND PROPERTY

9.8.4.1. BARRICADES, GUARDS AND SAFETY PROVISIONS

The CONTRACTOR shall be solely responsible for adhering to the rules and regulations of OSHA and other appropriate authorities regarding safety provisions. To protect persons from injury and to avoid property damage, adequate barricades, construction signs, lights and guards as required shall be placed and maintained by the CONTRACTOR at his expense during the progress of the WORK and until it is safe for traffic to use the roads and streets.

All material piles, equipment and pipe which may serve as obstructions to traffic shall be enclosed by fences or barricades and shall be protected by proper lights when the visibility is poor.

All signage and barricades shall be in accordance with the MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES and the TRAFFIC CONTROL AND SAFE PRACTICES MANUAL.

9.8.4.2. PROTECTION OF UTILITY STRUCTURES

Temporary support, adequate protection and maintenance of all underground and surface utility structures, including drains, sewers, manholes, hydrants, valves, valve covers, power poles and miscellaneous other utility structures encountered in the progress of the WORK shall be furnished by the CONTRACTOR at his expense. Any such structures which may have been disturbed shall be restored upon completion of the WORK.

9.8.4.3. OPEN EXCAVATION

All open, excavations shall be adequately safeguarded by providing temporary barricades, caution signs, lights and other means to prevent accidents to persons and damage to property. The CONTRACTOR shall, at his own expense, provide suitable and safe bridges with hand railings and other crossings for accommodating travel by

pedestrians and workmen. Bridges provided for access to private property during construction shall be removed when no longer required. The length of open trench will be controlled by the particular surrounding conditions, but shall be limited to 300 feet unless otherwise approval by the CITY.

If the excavation becomes a hazard, or if it excessively restricts traffic at any point, the CITY may require special construction procedures, such as limiting the length of open trench, fencing, prohibiting excavated material in the street and requiring that the trench shall not remain open overnight. The CONTRACTOR shall take precautions to prevent injury to the public due to open trenches. All trenches, excavated material, equipment or other obstacles which could be dangerous to the public shall be well lighted at night.

9.8.4.4. PROTECTION OF TREES AND SHRUBS

All trees and shrubs not shown to be removed on the PLANS shall be protected by the CONTRACTOR at his expense. No excavated materials shall be placed so as to injure such trees or shrubs. Trees or shrubs destroyed by negligence of the CONTRACTOR or his employees shall be replaced by him with new stock of similar size and age at the sole expense of the CONTRACTOR.

9.8.4.5. PROTECTION OF LAWN AREAS

Lawn areas shall be left in as good or better condition as before starting of the WORK. Where sod is to be removed, it shall be carefully restored with new sod of the same type.

9.8.4.6. RESTORATION OF FENCES

Any fence, or part thereof, that is damaged or removed during the course of the WORK shall be replaced or repaired by the CONTRACTOR and shall be left in as good a condition as before the starting of the WORK. The manner in which the fence is repaired or replaced and the materials used shall be subject to the approval of the CITY.

9.8.4.7. PROTECTION AGAINST SILTATION AND BANK EROSION

The CONTRACTOR shall arrange his operations to minimize siltation and bank erosion on construction sites and on existing or proposed water courses and drainage ditches. The CONTRACTOR, at his own expense, shall remove any siltation deposits and restore to original grade.

Sec. 9.8.5. ACCESS TO THE PUBLIC SERVICES

Neither the materials excavated nor the materials or equipment used in the construction of the WORK shall be so placed as to prevent free access to public services. All excavated material shall be piled in a manner that will not endanger the WORK and that will avoid obstructing

streets, sidewalks and driveways. Excavated material suitable for backfilling shall be stockpiled separately on the site. No material shall be placed closer than 2' 0" from the edge of an excavation. Fire hydrants under pressure, valve pit covers, valve boxes, curb stop boxes, or other utility controls shall be left unobstructed and accessible until the WORK is completed.

Gutters shall be kept clear or other satisfactory provisions made for street drainage. Natural water courses shall not be obstructed or polluted. Surplus material and excavated material unsuitable for backfilling shall be transported and disposed of off the site in disposal areas obtained by the CONTRACTOR.

Sec. 9.8.6. PUBLIC NUISANCE

The CONTRACTOR shall not create a public nuisance including but not limited to encroachment on adjacent lands, flooding of adjacent lands, or excessive noise or dust. The CONTRACTOR shall eliminate noise to as great an extent as practicable at all times.

Sec. 9.8.7. CONSTRUCTION HOURS

No WORK shall be done between the hours of 7:00 p.m. and 7:00 a.m., or on Saturday, Sundays and legal holidays of the City unless the proper and efficient prosecution of the WORK requires operations during the night, weekend or holidays. Written notification for doing untimely WORK shall be provided to the CITY a minimum 24 hours before starting such items of the WORK.

Sec. 9.8.8. CONSTRUCTION IN EASEMENTS AND RIGHTS-OF-WAY

9.8.8.1. CONSTRUCTION IN EASEMENTS

In easements across private property, the CONTRACTOR shall confine all operations within the easement area and shall be responsible and liable for all damage outside of the easement area. Trees, fences, shrubbery or other type of surface improvements located in easements will require protection during construction. Precautions shall be taken by adequate sheeting or other approved method to prevent any cave-in or subsidence beyond the easement limits or damage to improvements within the easement. In general, the easement area is intended to provide reasonable access and working area for efficient operation by the CONTRACTOR. Where easement space for efficient operation is not provided, the CONTRACTOR shall be responsible for organizing his operations to perform within the restrictions shown on the PLANS.

9.8.8.2. CONSTRUCTION IN FLORIDA DEPARTMENT OF TRANSPORTATION RIGHT-OF-WAY

The CONTRACTOR shall strictly adhere to the requirements of the Florida Department of Transportation where construction work is in a right-of-way under the jurisdiction of the State of Florida and shall take care to avoid any unreasonable traffic conflicts due to the WORK in road right-of-way.

9.8.8.3. CONSTRUCTION IN POLK COUNTY RIGHT-OF-WAY

WORK shall be governed by the Polk County right-of-way regulations.

9.8.8.4. CONSTRUCTION IN CITY RIGHT-OF-WAY

Work shall be governed by the City of Haines City, Public Works Department regulations.

Sec. 9.8.9. SUSPENSION OF WORK DUE TO WEATHER

During inclement weather, all WORK which might be damaged or rendered inferior by such weather conditions shall be suspended. During suspension of the WORK from any cause, the WORK shall be suitably covered and protected so as to preserve it from injury by the weather or otherwise.

Sec. 9.8.10. USE OF CHEMICALS

All chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, reactant, or of other classification, must show approval of either United States Environmental Protection Agency or United States Department of Agriculture. Use of all such chemicals and disposal of residues shall be in strict conformance with label instructions.

Sec. 9.8.11. COOPERATION WITH OTHER CONTRACTORS AND FORCES

During construction progress, it may be necessary for other contractors and persons employed by the CITY to work in or about the site. The CITY reserves the right to put such other contractors to work and to afford such access to the construction site and at such times as the CITY deems proper. The CONTRACTOR shall not impede or interfere with the work of such other contractors and shall cooperate with the other contractor (s) for proper prosecution of the work.

Sec. 9.8.12. SUBSURFACE EXPLORATION

The CONTRACTOR shall make such subsurface explorations as he believes necessary to perform the WORK.

Sec. 9.8.13. CLEANING

9.8.13.1. DURING CONSTRUCTION

During construction, the CONTRACTOR shall, at all times, keep the construction site and adjacent premises as free from material, debris and rubbish as is practicable and shall remove the same from any portion of the site if, in the opinion of the CITY, such material, debris, or rubbish constitutes a nuisance or is objectionable.

9.8.13.2. FINAL CLEANING

At the conclusion of the WORK, all tools, temporary structures and materials belonging to the CONTRACTOR shall be promptly taken away. The CONTRACTOR shall remove and promptly dispose of all water, dirt, rubbish or any other foreign substances.

Sec. 9.8.14. SALVAGE

Any existing CITY-owned equipment or material including but not limited to valves, pipes fittings, couplings, etc., which is removed or replaced as a result of construction may be designated as salvage by the CITY and, if so, shall be carefully excavated if necessary and delivered to the CITY at a location within the City.

Sec. 9.8.15. UTILITY SERVICE INTERRUPTION

No foreseeable work shall interrupt customer service without prior approval and direct coordination by the City. Written proposal shall be provided to the City for approval a minimum 96 hours before the proposed work. The Contractor shall notify in writing all affected customers a minimum 48 hours before the proposed work. The City shall maintain the ultimate authority to cease the work and reinstate customer service at any time during the shutdown if the approved scope of the work is not strictly adhered to.

Sec. 9.8.16. SHOP DRAWING AND SAMPLES

Prior to construction the CONTRACTOR shall submit three (3) copies of the shop drawings, signed by the DEVELOPER's ENGINEER, to the CITY. The data shown on the shop drawings shall be complete with respect to dimensions, design criteria, materials of construction and the like to enable review of the information as required.

The CONTRACTOR shall, if requested by the CITY, furnish certificates, affidavits of compliance, test reports, or samples for check analysis for any of the materials specified in this MANUAL.

SECTION 9.9. SITE PREPARATION, SURFACE REMOVAL AND RESTORATION

Sec. 9.9.1. GENERAL

This Section covers clearing, grubbing, and stripping of the construction sites. The CONTRACTOR shall clear and grub all of the area within the limits of construction as shown on the PLANS and approved by the CITY prior to the beginning of any WORK. All site work shall conform to the applicable site clearing ordinance, and landscaping and tree ordinances of the CITY.

Sec. 9.9.2. CLEARING AND GRUBBING

9.9.2.1. CLEARING

The surface of the ground for the area to be cleared and grubbed shall be completely cleared of all timber, brush, stumps, roots, grass, weeds, rubbish and all other objectionable obstructions resting on or protruding through the surface of the ground. However, trees and shrubs shall be preserved as specified in Section 9.4.4. Clearing operations shall be conducted so as to prevent damage to existing Structures and installations and to those under construction, and so as to provide for the safety of employees and others

9.9.2.2. GRUBBING

Grubbing shall consist of the complete removal of all stumps, roots larger than 1-1/2 inches in diameter, matted roots, brush, timber, logs and any other organic or metallic debris not suitable for foundation purposes, resting on, under or protruding through the surface of the ground to a depth of 18 inches below the subgrade. All depressions excavated below the original ground surface for or by the removal of such objects shall be refilled with suitable materials and compacted to a density conforming to the surrounding ground surface.

9.9.2.3. STRIPPING

In areas so designated, top soil shall be stripped and stockpiled. Topsoil so stockpiled shall be protected until it is placed as specified. Any topsoil remaining after all WORK is in place shall be disposed of by the CONTRACTOR.

9.9.2.4. DISPOSAL OF CLEARED AND GRUBBED MATERIAL

The CONTRACTOR shall at his expense dispose of all material and debris from the clearing and grubbing operation in accordance with all applicable ordinances.

Sec. 9.9.3. DUST CONTROL

CONTRACTOR shall control dust resulting from clearing and grubbing operations to prevent nuisance to adjacent property owners and the general public. CONTRACTOR shall use dust control methods and materials approved by the CITY.

Sec. 9.9.4. SURFACE REMOVAL

Along the proposed pipe lines as indicated on the PLANS, the CONTRACTOR shall remove the surface materials only to such widths as will permit a trench to be excavated which will afford sufficient room for proper efficiency and proper construction. All applicable regulations shall be followed. Where sidewalks, driveways, pavements and curb and gutter are encountered, care shall be taken to protect against fracture or disturbance beyond reasonable working limits. All fractured, broken or disturbed surfaces shall be restored to their original condition prior to completion of the WORK.

Sec. 9.9.5. RESTORATION

Restoration of all surfaces including road subbase, soil cement, limerock base, asphaltic concrete surface, portland cement concrete pavement and driveways, sidewalks and concrete curbs shall be in accordance with the requirements of the authority having jurisdiction. All grassing and mulching shall be done as specified. Solid sodding shall be placed on all slopes steeper than 4:1, within 10 feet of all proposed structures and where existing sod is removed or disturbed by the WORK. In addition, CONTRACTOR shall restore all storm drains, culvert, inlets and storm manholes to equal or better condition.

SECTION 9.10. EXCAVATION, BACKFILL, COMPACTION AND GRADING

Sec. 9.10.1. GENERAL

This Section covers excavation, backfill, fill and grading associated with utility trench and structural construction. All such WORK shall be performed by the CONTRACTOR concurrently with the WORK specified in Divisions IV and V of these specifications. The CONTRACTOR shall furnish all labor, materials, equipment and incidentals necessary to perform all excavation, backfill, fill, compaction, grading and slope protection required to complete the WORK shown on the DRAWINGS and specified herein. The WORK shall include, but not necessarily be limited to: pump stations, manholes, vaults, conduit, pipe, roadways and paving; all backfilling, fill and required borrow; grading; disposal of surplus and unsuitable materials; and all related WORK such as sheeting, bracing water handling.

Sec. 9.10.2. SOIL BORINGS AND SUBSURFACE INVESTIGATIONS

The CONTRACTOR shall examine the site and undertake subsurface investigations, including soil borings, before commencing the WORK. The CITY will not be responsible for presumed or existing soil conditions in the WORK area.

Sec. 9.10.3. EXISTING UTILITIES

CONTRACTOR shall locate existing utilities in the areas of WORK. If utilities are to remain in place, the CONTRACTOR shall provide adequate means of protection during earthwork operations. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, the CONTRACTOR shall consult the owner of such piping or utility immediately for directions. Payment for damage and repair to such piping or utilities is the CONTRACTOR's responsibility. Refer to Section 9.8.2 for utility coordination requirements.

Sec. 9.10.4. MATERIAL

9.10.4.1. GENERAL

Materials for use as bedding and backfill, whether insituted or borrow, shall be as described under this section. The CONTRACTOR shall, upon request by the CITY, make an appropriate sample of this material available for testing by the CITY or its designated representative.

9.10.4.2 STRUCTURAL FILL

Materials for structural fill shall be bedding rock or select common fill as specified herein or other suitable material as approved by the CITY.

9.10.4.3. COMMON FILL

Shall be local materials as defined in the Florida Department of Transportation, Standard Specifications for Road and Bridge Construction, Section 902, Article 902-6.

Material falling within the above specifications, encountered during the excavation, may be stored in segregated stockpiles for reuse. All Material which, in the option of the CITY, is not suitable for reuse, shall be spoiled as specified herein for disposal of unsuitable materials.

9.10.4.4. SELECT COMMON FILL

Select common fill shall be as specified above from common fill, except that the material shall contain no stones larger than ½ inch in largest dimension, and shall be no more than 5 percent by weight finer than the No. mesh sieve.

9.10.4.5. BEDDING ROCK

Shall be FDOT, size no. 89 as defined in the Florida Department of Transportation, Standard Specifications for Road and Bridge Construction, Section 901, Article 901-1.4, Table 1.

Sec. 9.10.5. SHEETING AND BRACING IN EXCAVATIONS

9.10.5.1. GENERAL

If required to support the sides of excavations, to prevent any movement which could in any way diminish the width of the excavation below that necessary for proper construction and to protect adjacent structures, existing piping and/or foundation material from disturbance, undermining or other damage, the CONTRACTOR shall construct and maintain sheeting and bracing. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed, they shall be immediately filled and rammed.

9.10.5.2 MISCELLANEOUS REQUIREMENTS

For trench sheeting for pipes, no sheeting is to be withdrawn if driven below mid-diameter of any pipe and no wood sheeting shall be cut off at a level lower than one foot above the top of any pipe unless otherwise directed by the CITY. If, during the progress of the WORK, the CITY decides that additional wood sheeting should be left in place, it may direct the CONTRACTOR to do so. If steel sheeting is used for trench sheeting, removal shall be as specified above, unless written approval is given by the CITY for an alternate method of removal. All sheeting and bracing not left in place shall be carefully removed in such a manner as not to endanger the construction of other structures, utilities, existing piping or property. Unless otherwise approved or indicated on the Drawings or in the Specifications, all sheeting and bracing shall be removed after completion of the substructure. All voids left or caused by withdrawal

of sheeting shall be immediately refilled with sand by ramming with tools specially adapted to that purpose, by watering or otherwise as may be directed.

The operations shall not cause injury to any portion of the WORK completed, or in progress, or to the surface of streets, or to private property. The dewatering operation shall comply with the requirements of appropriate regulatory agencies. Additionally, where private property will be involved, advance permission shall be obtained by the CONTRACTOR. Permission shall be obtained prior to discharging into storm drains. Discharging into sanitary sewer systems shall not be permitted.

9.10.5.3. ADDITIONAL REQUIREMENTS

The CONTRACTOR shall, at all times during construction, provide and maintain proper equipment and facilities to remove promptly and dispose of properly all water entering excavations and keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition until the fill, structure, or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural elevations.

Dewatering shall at all times be conducted in such a manner as to preserve the natural undisturbed bearing capacity of the subgrade soils at proposed bottom of excavation.

It is expected that well points will be required for predrainage of the soils prior to final excavation for some of the deeper in-ground structures, or piping and for maintaining the lowered groundwater level until construction has been completed to such an extent that the structure, pipeline or fill will not be floated or otherwise damaged. Well points shall be surrounded by suitable filter sand and negligible fines shall be removed by pumping.

The CONTRACTOR shall furnish all materials and equipment and perform all work required to install and maintain the drainage systems for handling groundwater and surface water encountered during construction of structures, pipelines and compacted fills.

During structure construction and backfilling, water levels shall be measured in observation wells located as directed by the ENGINEER.

The right of the CITY to order sheeting and bracing left in place shall not be construed as creating any obligation on its part to issue such orders, and its failure to exercise its right to do so shall not relieve the CONTRACTOR from liability for damages to persons or property occurring from or upon the work occasioned by negligence or otherwise, growing out of a failure on the part of the CONTRACTOR to leave in place sufficient sheeting and bracing to prevent any caving or moving of the ground.

The CONTRACTOR shall construct the cofferdams and sheeting outside the neat lines of the foundation unless indicated otherwise to the extent he deems it desirable for his method of operation. Sheeting shall be plumb and securely braced and tied in position.

Sheeting, bracing and cofferdams shall be adequate to withstand all pressures to which the structure will be subjected. Pumping, bracing and other work within the cofferdam shall be done in a manner to avoid disturbing any construction already performed. Any movement or bulging which may occur shall be corrected by the CONTRACTOR at his own expense so as to provide the clearances and dimensions.

Sec. 9.10.6 DEWATERING, DRAINAGE AND FLOTATION

9.10.6.1. GENERAL

The CONTRACTOR shall excavate, construct and place all pipelines, concrete work, fill, and bedding rock, in-the-dry. Pipe trenches and other construction excavations shall be kept dry by well pointing, rim ditch and sump, bedding rock and sump or other methods as allowed by the permitting authorities and approved by the City. For purposes of these specifications “in-the-dry” shall be considered as no standing water and no loose saturated soils.

Discharge water shall be clear, with no visible soil particles. Stilling ponds or other methods of filtering silt may be necessary for sumping operations. Discharge from dewatering shall be disposed of in such a manner that it will not interfere with the normal drainage of the area in which the WORK is being performed, create a public nuisance, or form ponding.

Continuous pumping will be required as long as water levels are require to be natural levels.

Electric pumps shall be utilized where practicable, in order to minimize noise. Residential type mufflers shall be used on all piston driven pumps or generators.

Sec. 9.10.7 EXCAVATION

9.10.7.1. GENERAL

Excavation consists of removal and storage or disposal of material encountered when attaining required grade elevations and in accordance with the notes shown in the Drawings.

Authorized earth excavation includes removal and disposal of pavements and other obstructions visible on ground surface, underground structures and utilities indicated to be demolished and removed, and other materials encountered that are not classified as rock excavation or unauthorized excavation. Unauthorized excavation consists of removal of material beyond the limits needed to establish required grade and subgrade elevations without specific direction of the CITY. Unauthorized excavation, as well as remedial work directed by the CITY shall be at the CONTRACTOR’s expense. Such remedial work shall be performed as directed by the CITY.

If requested by the CITY, when excavation has reached required subgrade elevations, a Geotechnical/Soils Engineer shall make an inspection of conditions. If the subgrade is unsuitable, CONTRACTOR shall carry excavation deeper and replace excavated material with select common fill or bedding rock, as directed by the CITY.

If the CONTRACTOR excavates below grade through error or for his own convenience or through failure to properly dewater the excavation or disturbs the subgrade before dewatering is sufficiently complete, he may be directed by the CITY to excavate below grade and refill the excavation using select common fill or bedding rock.

Sloped sides of excavations shall comply with local codes and ordinances, and with OSHA requirements. CONTRACTOR shall shore and brace where sloping is not possible due to space restrictions or instability of the material being excavated. Shoring and slopes shall be maintained in a safe condition until completion of the work.

CONTRACTOR shall stockpile satisfactory excavated materials at a location approved by the CITY until required for backfill and fill. When needed in the WORK, material shall be located and graded at the direction of a Geotechnical/Soils Engineer.

Stockpiles shall be placed and graded for proper drainage. All soil materials shall be located away from the edge of excavations. All surplus and/or unsuitable excavated material shall be legally disposed of by the CONTRACTOR. Any permits required for the hauling and disposing of this material shall be obtained by the CONTRACTOR prior to commencing hauling operations.

9.10.7.2. EXCAVATION FOR STRUCTURES

All such excavations shall conform to the elevations and dimensions shown on drawing within a tolerance of plus or minus 0.10 feet and extending a sufficient distance from footings and foundations to permit placing and removing form work, installation of services and other construction, inspection or as shown on the Drawings. In excavating for footings and foundations, care shall be exercised not to disturb the bottom of the excavation. Bottoms shall be trimmed to required lines and grades to leave a solid base to receive concrete.

9.10.7.3. TRENCH EXCAVATION

Excavation for all trenches required for the installation of utility pipes shall be made to the depths indicated on the Drawings and in such manner and to such widths as will give suitable room for laying the pipe within the trenches, for bracing and supporting and for pumping and drainage facilities.

The bottom of the excavations shall be firm and essentially dry and in all respects acceptable to the CITY.

Where pipes are to be laid in bedding rock, select common fill or encased in concrete, the trench may be excavated to or just below the designated subgrade. The material remaining in the bottom of the trench shall be no more than slightly disturbed.

Where the pipes are to be laid directly on the trench bottom, bell holes shall be made as required.

Sec. 9.10.8. BEDDING AND BACKFILL

9.10.8.1. GENERAL

Material placed in fill areas under and around structures and pipelines shall be deposited within the lines and to the grades shown on the DRAWINGS or as directed by the CITY, making due allowance for settlement of the material. Fill shall be placed only on properly prepared surfaces which have been inspected and approved by the CITY. If sufficient select common or common fill material is not available from excavation on site, the CONTRACTOR shall provide fill as may be required.

Fill shall be brought up in substantially level lifts starting in the deepest portion of the fill. The entire surface of the WORK shall be maintained free from ruts and in such condition that construction equipment can readily travel over any section.

Fill shall be placed and spread in 8" to 12" layers unless otherwise specified. Prior to the process of placing and spreading, all materials not meeting those specified under Section 9.4 shall be removed from the fill areas. The CONTRACTOR shall assign a sufficient number of men to this WORK to insure satisfactory compliance with these requirements.

If the compacted surface of any layer of material is determined to be too smooth to bond properly with the succeeding layer, it shall be loosened by harrowing or by another approved method before the succeeding layer is placed.

All fill materials shall be placed and compacted "in-the-dry". The CONTRACTOR shall dewater excavated areas as required to perform the work and in such a manner as to preserve the undisturbed state of the natural inorganic soils.

Prior to filling, the ground surface shall be prepared by removing vegetation, debris, unsatisfactory soil materials. CONTRACTOR shall plow, strip or break up sloped surfaces steeper than one vertical to four horizontal so that fill material will bond with the existing surface. When existing ground surface has a density less than that specified under Section 10.9 for the particular area classification, CONTRACTOR shall break up the ground surface, pulverize, moisture-condition to the optimum moisture content and compact to required depth and percentage of maximum density.

Material which is too wet shall be spread on the fill area and permitted to dry, assisted by harrowing if necessary, until the moisture content is reduced to allowable limits. If added moisture is required, water shall be applied by sprinkler tanks or other sprinkler

systems, which will insure uniform distribution of the water over the area to be treated and give complete and accurate control of the amount of water to be used. If too much water is added, the area shall be permitted to dry before compaction is continued. The CONTRACTOR shall supply all hose, piping, valves, sprinklers, pumps, sprinkler

tanks, hauling equipment and all other materials and equipment necessary to place water in the fill in the manner specified. CONTRACTOR shall compact each layer to required percentage of maximum dry density or relative dry density in accordance with Section 10.9. Backfill or fill material shall not be placed on surfaces that are muddy, frozen or contain frost or ice. When unavoidable wet conditions exist, bedding rock shall be used for backfilling.

9.10.8.2 BEDDING AND BACKFILL FOR STRUCTURES

Bedding rock shall be used for bedding under all precast structures as indicated on the STANDARD DETAILS. The CONTRACTOR shall take all precautions necessary to maintain the bedding in a compacted state and to prevent washing, erosion or loosening of this bed. Appropriate fill shall be used as backfill against the exterior walls of the structures. Fill shall be compacted sufficiently in accordance with Section 10.9.2. of these specifications.

Backfilling shall be carried up evenly on all walls of an individual structure. No backfilling shall be allowed against walls until the walls and their supporting slabs, if applicable, have attained sufficient strength.

In locations where pipes pass through building walls, the CONTRACTOR shall take precautions to consolidate the fill up to an elevation of at least one (1) foot above the bottom of the pipes. Structural fill in such areas shall be placed for a distance of not less than three (3) feet either side of the center line of the pipe in level layers not exceeding eight (8) inches in depth.

The surface of filled areas shall be graded to smooth true lines, strictly conforming to grades indicated on the DRAWINGS. No soft spots or uncompacted areas will be allowed in the WORK.

Temporary bracing shall be provided as required during construction of all structures to protect partially completed structures against all construction loads, hydraulic pressure and earth pressure. The bracing shall be capable of resisting all loads applied to the walls as a result of backfilling.

9.10.8.3. BEDDING AND BACKFILL FOR PIPES

Bedding for pipe shall be as shown on the PLANS and detailed on the STANDARD DETAILS. The CONTRACTOR shall take all precautions necessary to maintain the bedding in a compacted state and to prevent washing, erosion or loosening of this bed.

Backfilling over and around pipes shall begin as soon as practicable after the pipe has been laid, jointed and inspected. All backfilling shall be prosecuted expeditiously and as detailed on the STANDARD DETAILS.

Any space remaining between the pipe and sides of the trench shall be carefully backfilled and spread by hand or approved mechanical device and thoroughly compacted with a tamper as fast as placed, up to a level of one (1) foot above the top of the pipe. The filling shall be carried up evenly on both sides. Compaction shall be in accordance with the STANDARD DETAILS and Section 10.9.

The remainder of the trench above the compacted backfill, as just described above, shall be filled and thoroughly compacted in uniform layers. Compaction shall be in accordance with the STANDARD DETAILS and Section 10.9.

Sec. 9.10. 9. COMPACTION

9.10. 9.1. GENERAL

The CONTRACTOR shall control soil compaction during construction to provide the percentage of maximum density specified. The CONTRACTOR shall be provided copies of all soils testing reports, prepared by a GETECHNICAL/SOILS ENGINEER, demonstrating compliance with these SPECIFICATIONS.

The following minimum soils compaction requirements are applicable to all WORK unless a greater degree of compaction is required by the permitting authority or special requirement of the Engineer.

9.10. 9.2. PERCENTAGE OF MAXIMUM DENSITY REQUIREMENTS

When existing trench bottom has a density less than 95% of the maximum dry density as determined by AASHTO/T-180, the CONTRACTOR shall compact to required percentage of maximum density.

Fill or undisturbed soil from the bottom of the pipe trench to grade shall be densified to a minimum density of 95% of the maximum dry density as determined by AASHTO T-180.

Fill under and around structures and paving, and to the extent of the excavation shall be densified to a minimum density of 98% of the maximum dry density as determined by AASHTO T-180.

9.10. 9.3. COMPACTION TESTS

In general, one compaction test shall be taken for each 12" layer of fill for each 300 feet of pipe and for every 100 square feet of backfill around structures. The CITY may determine that more compaction tests are required to certify the installation depending on field conditions.

CONTRACTOR shall be liable for all costs associated with retesting of soils on Capital Projects, and Developer shall be responsible for these costs on private development projects.

Sec. 9.10.10. GRADING

All areas within the limits of construction, including transition areas, shall be uniformly graded to produce a smooth uniform surface. Areas adjacent to structures or paved surfaces shall be graded to drain away from structures and pavement. Ponding shall be prevented. The area shall be compacted to the specified depth and percentage of maximum density.

No grading shall be done in areas where there are existing utilities that may be uncovered or damaged until such lines have been relocated or otherwise protected.

Sec. 9.10.11 MAINTENANCE

CONTRACTOR shall protect his graded areas from traffic and erosion and keep them free of trash and debris. CONTRACTOR shall repair and reestablish grades in settled, eroded and rutted areas.

Sec. 9.10.12. INSPECTION AND QUALITY ASSURANCE

9.10.12.1. INSPECTION

CONTRACTOR shall examine the areas and conditions under which excavating, filling and grading are to be performed, and shall not proceed until disputed conditions have been resolved. CONTRACTOR shall examine existing grade prior to commencement of WORK and report to the CITY if elevations or existing grade vary from elevations shown on DRAWINGS.

9.10.12.2. QUALITY ASSURANCE

All work shall be performed in compliance with applicable requirements of governing authorities having jurisdiction.

The CITY shall be responsible for costs associated with soils testing and geotechnical inspection services on Capital projects. The Developer shall be responsible for costs associated with soils testing and geotechnical inspection services on private development projects.

Quality assurance testing shall be performed during construction to ensure compliance with the Contract. CONTRACTOR shall provide all assistance necessary to allow the testing service to inspect and approve fill materials and fill layers before further construction is performed. The CONTRACTOR shall at all times demonstrate compliance with the compaction requirements stipulated in the MANUAL.

SECTION 9.11. BORING AND JACKING

Sec. 9.11.1. GENERAL

The installation of a casing pipe by the method of boring and jacking shall be covered by these specifications. The overall work scope shall include, but not limited to, boring and jacking pits and equipment, sheeting, steel casing pipe, skid, steel straps, coatings, location signs as required, miscellaneous appurtenances to complete the entire WORK as shown on the STANDARD DETAILS, and restoration. Applicable provisions of Division III, IV, and V shall apply concurrently with these specifications. Boring and jacking operations shall be performed within the right-of way and/or easements shown on the DRAWINGS.

Sec. 9.11.2. PIPE MATERIALS

9.11.2.1. STEEL CASING

Steel casings shall conform to the requirements of ASTM Designation A139 (straight seam pipe only) Grade "B" with a minimum yield strength of 35,000 psi. Minimum casing pipe size and wall thickness shall be as indicated in the following table, where Polk County and D.O.T. requirements are for road crossings and CSX Transportation requirements are for railroad crossings, unless otherwise shown or specified:

<u>F.D.O.T./Polk County</u>		<u>CSX Railroad</u>		
O.D.	Wall	O.D.	Coated	Noncoated
12"	0.188"	12"	0.188"	0.251"
14"	0.188"	14"	0.219"	0.282"
16"	0.188"	16"	0.219"	0.282"
24"	0.250"	24"	0.344"	0.407"
30"	0.312"	30"	0.406"	0.469"
36"	0.375"	36"	0.469"	0.532"
42"	0.500"	42"	0.500"	0.563"

Field and shop welds of the casing pipes shall conform with the American Welding Society (AWS) standard specifications. Field welds shall be complete penetration, single-bevel groove type joints. Weld shall be airtight and continuous over the entire circumference of the pipe and shall not increase the outside pipe diameter by more than 3/4 inch.

9.11.2.2. CARRIER PIPE

The carrier pipe shall be a minimum pressure class 150 ductile iron pipe, greater if otherwise indicated. Ductile iron pipe shall comply with all areas of these specifications. Carrier pipe joints shall be individually restrained.

9.11.2.3. INSPECTION

All casing pipe to be installed may be inspected at the site of manufacture for compliance with these Specifications by an independent laboratory selected and paid for by the CITY. The manufacturer's cooperation shall be required in these inspections.

All casing pipe shall be subjected to a careful inspection prior to being installed. If the pipe fails to meet the specifications it shall be removed and replaced with a satisfactory replacement at no additional expense to the CITY.

9.11.2.4. CERTIFICATION

All casing pipe shall be accompanied by manufacturers certification that casing meets all specified standards, with an enumeration of each parameter specified herein and such other parameters as required by the permitting authority.

Sec. 9.11.3. PIPE HANDLING

Care shall be taken in loading, transporting, and unloading to prevent injury to the pipe or coatings. Pipe shall not be dropped. All pipe shall be examined before laying, and no piece shall be installed which is found to be defective. Any damage to the pipe or coatings shall be repaired to the satisfaction of the CITY.

Sec. 9.11.4. CONSTRUCTION REQUIREMENTS

9.11.4.1. WORK COORDINATION

It shall be the CONTRACTOR's responsibility to perform the boring and jacking work in strict conformance with the requirements of the agency in whose right of way or easement the work is being performed. Any special requirements of the agency such as insurance, flagmen, etc., shall be strictly adhered to during the performance of WORK. The special requirements shall be performed by the CONTRACTOR.

9.11.4.2. DEWATERING

Dewatering through the casing during construction shall not be permitted. All dewatering methods shall be as specified in Section 9.10.

9.11.4.3. CARRIER PIPE SUPPORT

The carrier pipes shall be supported within the casing pipes so that the pipe bells do not rest directly on the casing. The load of the carrier pipes shall be distributed along the casing by casing spacers.

9.11.4.4. JACKING PITS

Excavation adjacent to the roads shall be performed in a manner to adequately support the roads. Bracing, shoring, sheeting or other supports shall be installed as needed. CONTRACTOR shall install suitable reaction blocks for the jacks as required. Jacking operations shall be continuous and precautions shall be taken to avoid interruptions which might cause the casing to “freeze” in place. Upon completion of jacking operations, the reaction blocks, braces, and all other associated construction materials shall be completely removed from the site.

9.11.4.5. MISCELLANEOUS REQUIREMENT

Correct line and grade shall be carefully maintained. Earth within the casing shall not be removed too close to the cutting edge in order to prevent the formation of voids outside the casing. If voids are formed, they shall be satisfactorily filled with grout by pumping.

The sections of steel casing shall be field welded in accordance with the applicable portions of AWWA C206 and AWS D7.0 for field welded pipe joints. CONTRACTOR shall wire brush the welded joints and paint with Inertol Quick-Drying Primer 626 by Koppers Company or approved equal. After completion of jacking, CONTRACTOR shall clean the interior of the casing of all excess material.

SEC. 9.11.5 DIRECTIONAL BORE DESIGN, REQUIREMENTS, AND POST-CONSTRUCTION STANDARDS

9.11.5.1 DESIGN / PRECONSTRUCTION REQUIREMENTS

The purpose of this standard is to provide guidelines for use by the development community and others during the design and installation of underground water mains and wastewater force mains using horizontal directional bores integral to the development of commercial, industrial, or residential subdivision properties.

9.11.5.1.1 REFERENCES

References for horizontal directional drilling include Mini-Horizontal Directional Drilling Manual (1995), North American Society of Trenchless Technology (NASTT), Chicago, IL; PPI Handbook of Polyethylene Piping (1998), Plastics Pipe Institute, Washington, D.C.; PLEXCO Polyethylene Industrial Piping Systems; “Technical Information; Technical Note: Horizontal Directional Drilling (Guided Bore) with PLEXCO Pipe”, et al.

9.11.5.1.2 ENGINEER RESPONSIBILITIES

The design ENGINEER assumes all responsibility for proper design of the directional bore.

The ENGINEER should determine if the soils at the site are suitable for directional drilling based on previous experience with the site soils or a geotechnical investigation. All existing utilities, surface and subsurface structures must be located (in three dimensions) for the design.

9.11.5.1.2.1 MINIMUM GROUND COVER

The minimum ground cover over a directionally bored water or wastewater utility line shall be 36 inches. There shall be at least 18 inches vertical clearance when crossing under any existing water main with a wastewater force main.

9.11.5.1.2.2 DESIGN CALCULATIONS

The ENGINEER should limit curvature in any direction to lessen force on the pipe during pullback. Ideally, the directional bore should lie in a vertical plane.

The ENGINEER shall submit, as part of the permits application plans submittal package, design calculations indicating predicted / permissible (maximum safe) pull force, pipe pull rating, and minimum permissible pipe bend radius. Maximum safe pull force shall be shown on the project design drawings. Some factors to be considered in calculating the safe pull force follow. Additional

discussion can be found in Appendix A. The pullback force is calculated at the leading end of the pipe behind the pulling head. The frictional resistance is highest just prior to movement and decreases with movement. When pullback ceases, frictional forces and drag forces increase due to the thixotropic nature of drilling mud. The mud starts to gel when it is undisturbed. Buoyant force pushes the pipe up against the top of the borehole, creating frictional drag between the pipe and the borehole.

Minimum curvature at the entry and exit pits is limited by the steering capabilities of the boring equipment. When the bending radius is too small, the safe pulling strength of **HDPE** pipe may be significantly reduced by the additional tensile stresses due to curvature. All bending stresses due to various curvatures in the boring path are additive and should be subtracted from the safe pull force. The “safe” pull-load is time dependent.

The ENGINEER must show the directional bore in profile view on the plans, showing the pipe as it should be installed. Maximum pull strength and minimum radius of curvature shall be listed. All existing utilities shall be shown on the plans. The ENGINEER shall provide signed and sealed “As-Built” drawings of the constructed bore path, including any abandoned in place bores. The ENGINEER shall certify that the pipe was installed within acceptable limits per the pipe specifications.

9.11.5.1.3 CONTRACTOR RESPONSIBILITIES

The CONTRACTOR shall supply all labor, supervision, tools and equipment, and materials necessary to install carrier pipe by directional bore method for potable water or wastewater systems. Installation of the carrier pipe system includes the installation of water mains or wastewater force mains and/or any other devices or materials deemed necessary for the respective systems. For CITY projects, materials may be supplied by the City.

The CONTRACTOR shall provide experienced operators to perform directional boring. The operator shall have performed at least three directional bores of similar pipe diameter and bore length.

The CONTRACTOR shall be fully responsible for placement of the pipe per the ENGINEER’s specifications. See Paragraph 2.2.7 for tolerances.

The CONTRACTOR shall supply experienced persons who have received proper training in the use of the fusion equipment according to the recommendations of the pipe manufacturer and fusion equipment supplier to perform thermal fusion of the specific HDPE pipe to be used.

9.11.5.1.4 EQUIPMENT

The directional drilling equipment shall consist of a directional-drilling rig of sufficient capacity to perform the bore and pull back the pipe.

The steerable, directional-boring equipment shall produce a stable fluid lined tunnel with a minimum burial depth of 36-inches for the carrier pipe installation.

The tunneling equipment shall employ a fluid cutting technique. The soil shall be cut by small diameter, high-pressure jets of drilling fluid. The jets shall cut the soil in advance of the boring tool, impregnating and lining the tunnel wall with drilling fluid. The drilling fluid shall be inert and pose no environmental risk, such as bentonite or a polymer-surfactant mixture producing a slurry of proper consistency.

The hydraulic power system shall be self-contained and free of leaks, with sufficient pressure and volume to power the drilling operation. Calibration of the electronic detection system shall be verified by uncovering the tool (head) at the first ten (10) foot point. The boring tool (head) shall be remotely steerable by means of an electronic detection system. The **tool (head)** location shall be monitored in three dimensions and logged every 10 feet from the drilling rig. The boring tool shall pull the carrier pipe through the fluid lined tunnel as it traverses the surface being crossed.

The rig shall have means to monitor and record the maximum pullback force during the pullback operation. The pulling strength of the boring equipment shall not exceed the HDPE pipe safety pull strength as per the manufacturer's recommendation.

9.11.5.1.4.1 BUTT FUSION

The butt fusion machine used to join sections of HDPE pipe shall have controls and gauges for setting pressures **and temperatures** used for facing, heating, and fusing.

Facing should be conducted at a pressure that produces properly faced pipe ends.

Heating pressure should be set so that the pipe ends maintain contact against the heater, but are not forced against the heater (zero contact pressure).

Fusing pressure shall be as recommended by the pipe manufacturer and fusion equipment supplier.

Heater surfaces must be clean and free of contaminants such as dirt, oil, grease, and melted or charred plastic. To clean the heater, only wooden implements and clean, dry, lint-free non-synthetic cloths should be used. The heater should be checked periodically for uniform surface temperature using a surface pyrometer.

9.11.5.1.5 DIRECTIONAL BORE MATERIAL

9.11.5.1.6.1 PIPE

Pipe shall be High Density Polyethylene (HDPE) as per AWWA C906.

Carrier: HDPE pipe shall be DR 11, working pressure rating of 160 psi. The following are approved pipe manufacturers:

CRS, PolyPipe PE 3408, 4" to 24" diameter.
Plexco PE 3408, 4" to 24" diameter.
Driscopipe 4000 Series, 4" to 24" diameter.

Material for pipes to be used for potable water application shall be approved by the National Sanitation Foundation (NSF).

All material must be inspected by Water Utilities Engineering 48 hours (two working days) before the bore begins.

9.11.5.1.6.2 FITTINGS

All fittings, sizes 4 inch and larger shall meet the requirements of AWWA Standard C 906-90 (or most recent revision).

All fittings shall be ductile iron pipe size.

All fittings shall meet the requirements of ANSI NSF Standard 61.

All fittings shall be made of materials conforming to polyethylene code designation PE 3408.

Standard dimension ratio shall be DR11.

Pressure class shall be 160 psi.

9.11.5.1.6.3 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 co-extrusion or impregnation in accordance with the following schedule. Fully colored pipe co-extruded from permanently pigmented HDPE is also acceptable.

<u>SERVICE</u>	<u>STRIPED PIPE</u>	<u>SOLID COLORED PIPE</u>
Potable Water	Blue stripes	Blue
Reclaimed Water	Purple stripes	Purple
Wastewater	Green stripes	Green

Markings on the pipe shall include the following:

- Nominal size and OD base.
- Standard material code designation.
- Dimension.
- Pressure class.
- AWWA designation (AWWA C906).
- Material test category of pipe.

9.11.5.1.7 TRACER WIRE

All piping shall be installed with a continuous, insulated, solid #10 gauge copper wire for water main or force main location purposes by means of an electronic line tracer.

The wire insulation shall be solid color in accordance with the coding described in 1.6.4 above. Blue coated (for water mains), or green coated (for wastewater), number 10 gauge UF (Underground Feeder per National Electric Code Article 339) solid tracer wire must be taped along all pipes. Sections of wire shall be spliced together using Buchanon connectors or similar approved method for splicing. Twisting the wires together is not acceptable. Spools of #10 wire are available in 500-foot rolls.

Upon completion of the directional bore, the CONTRACTOR shall demonstrate to the CITY that the wire is continuous and unbroken through the entire run of the pipe by providing full signal conductivity (including splices) when energizing for the entire run in the presence of the INSPECTOR. If the wire is broken, the CONTRACTOR shall repair or replace it. See Paragraph 2.2.11.

9.11.5.1.8 FITTINGS AND RESTRAINERS

9.11.5.1.8.1 PIPE FLANGE JOINTS

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.

9.11.5.1.8.2 MECHANICAL JOINTS

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 are Mega-Lug and MJR.

9.11.5.1.9 MAINTENANCE OF TRAFFIC

The maintenance of traffic, in accordance with the governing right-of-way authority, shall be the responsibility of the CONTRACTOR.

If the CONTRACTOR has the capability within his organization, he shall provide the necessary personnel and equipment for maintenance of traffic. Persons participating in maintenance of traffic operations must be FDOT qualified and copies of their certificates verifying their qualifications shall be provided to Water Utilities Engineering prior to start of the directional work.

If the CONTRACTOR is unable to provide the required maintenance of traffic, he shall subcontract the work to supply the necessary personnel and equipment. The use of a subcontractor's personnel and equipment shall in no way transfer the responsibility for the maintenance of traffic from the CONTRACTOR.

9.11.5.2 CONSTRUCTION REQUIREMENTS

9.11.5.2.1 GENERAL

All directional bore operations shall be contained within right-of-way and / or easements shown on the DRAWINGS.

Work shall not start until the CONTRACTOR has all necessary permits from the appropriate governing regulatory agencies, including the City of Haines City Public Works Engineering group, and not until Water Utilities Engineering has been given 48 hours (two working days) prior notification to inspect construction materials. Any material may be rejected if out of specification or damaged (i.e. out-of-round, deep cuts, etc.).

CONTRACTOR shall not begin drilling operation until the INSPECTOR is present. The INSPECTOR must be present during the entire boring operation once the ground is penetrated.

9.11.5.2.1.2 INSPECTION SCHEDULES

The CONTRACTOR is to schedule the directional bore such that the INSPECTOR is on site and that the bore is completed before 4:00PM. Directional bores shall not start after 1:00PM unless approved by City of Haines City Water Utilities Department.

9.11.5.2.2 CONTRACTOR RESPONSIBILITIES

The CONTRACTOR shall provide the following materials and services for directional bore unless otherwise specified by OWNER / DEVELOPER:

Traffic control.

Tracer wire for carrier pipe (#10 gauge or larger, solid), per standards.

Site preparation and excavation.

Dewatering – Groundwater Pump or Well Point System as needed.

Sheeting and shoring, as necessary.

All fusion welding.

Preliminary site restoration (fill open pits, grading).

Site clean up including removal and proper disposal of all waste materials and drilling fluid.

The CONTRACTOR shall record data on the bore log (see section 9.11.5.2.2.1) and shall also ensure the following items are monitored and controlled:

- Calibrate locator/tracking system
- Field verify calibration by field measurement of actual location of first rod
- Ensure that the flow of bentonite is continuous
- Ensure pulling pressure does not exceed pipe manufacturer's specifications
- Fusing of pipe is within pipe manufacturer's specifications
- Cool down time is calculated and complied with
- Pipe is fused prior to start of extended bores (ie. Greater than 100 linear feet).

9.11.5.2.2.1 MEASUREMENT RECORDING

The CONTRACTOR shall record location and depth measurements every ten (10) feet over the course of the bore and provide that data to the CITY. Data collected by the City inspector does not relieve the Contractor from the responsibility of recording his own data. The CONTRACTOR shall log all necessary data from the locator / tracking system:

- Position.
- Roll Angle.
- Tilt Angle.
- Depth – **Every ten (10) feet.**
- Temperature of Data Transmitter.
- Remaining Battery Life.
- Pull Back Force (Maximum pull back force shall be recorded).

9.11.5.2.2.2 MATERIALS

CONTRACTOR shall supply the following materials:

- All HDPE fittings, couplings, and carrier pipe (unless otherwise specified).
- Final site restoration (sod, seed, mulch, concrete/ asphalt repair).
- Required Right-Of-Way Permits.

9.11.5.2.2.3 PERMITS AND INSPECTIONS

An INSPECTOR for the CITY shall witness and verify the CONTRACTOR'S logging of pertinent data. The INSPECTOR may log his own data in the Department's own Directional Bore Log sheet for the City's use.

CONTRACTOR shall notify all involved agencies prior to start of construction. The CONTRACTOR is responsible for verifying that all permits are current and not expired. The CONTRACTOR shall notify the ENGINEER of Record and the CITY if expired.

The CONTRACTOR shall call “Sunshine State One-Call” (phone number: 800-432-4770) 48 hours prior to performing any excavation. **The CONTRACTOR shall confirm the location of utilities before starting the directional bore.**

9.11.5.2.2.4 DRAWINGS

The CONTRACTOR shall perform directional bore in accordance with the approved project DRAWINGS. In no case shall the bore extend into private property unless an easement is provided prior to start of construction. Vertical tolerances shall be plus or minus 1 foot of elevations shown on drawings. Horizontal tolerances shall be plus or minus 2 feet of alignment shown in drawings. These tolerances shall be met unless required separations for other utilities must be met and puts the bore in conflict. Failure to meet tolerances, if not preapproved by ENGINEER, may be grounds for rejecting the bore. The CONTRACTOR may, at the discretion of the ENGINEER, be required to abandon the bore and re-drill a new one at CONTRACTOR’s own expense.

9.11.5.2.2.5 SAFETY AND DUE CARE

The CONTRACTOR shall provide all structures, safety equipment, and professional services required for the health and safety of the general public and of personnel involved in directional boring work in accordance with the requirements of the Federal, State, and Local Authorities. This includes proof of construction personnel certificates of trench safety training at the time of construction.

The CONTRACTOR shall take all measures necessary to protect surrounding public and private property, adjacent buildings, roads, drives, sidewalks, drains, sewers, utilities, trees, structures, and appurtenances from damage due to directional bore work.

The CONTRACTOR shall exercise due care at all times and shall not apply more than the safe pull force to the carrier pipe recommended by the ENGINEER.

9.11.5.2.2.6 TRACER WIRE

The CONTRACTOR shall install a blue coated #10 gauge solid tracer wire on all water carrier pipe and green coated #10 gauge solid tracer wire on all wastewater force main carrier pipe. The CONTRACTOR will be responsible to provide a tracer wire that tests positive for continuity the entire length of the bore prior to acceptance by the INSPECTOR.

9.11.5.2.2.7 INSPECTION NOTICE

CONTRACTOR shall give 48-hour (two working days) advance notice to CITY prior to start of work. The INSPECTOR is required to inspect materials **prior to the bore** and to be on site during the boring operation and installation of the pipe.

9.11.5.2.2.8 SURFACE DEFECTS

The CONTRACTOR shall be fully responsible for all steerable, fluid lined directional boring operation. Any noticeable surface defects resulting from operation of this boring equipment shall be repaired by the CONTRACTOR at his expense. The CONTRACTOR is recommended to take preconstruction videos of the construction site to avoid unwarranted claims for damages resulting from the construction.

9.11.5.2.2.9 INSURANCE

The CONTRACTOR shall meet all CITY insurance requirements, as defined by the City's Risk Management Department, when working in a right-of-way, using a right-of-way use permit.

9.11.5.2.3 DRILLING REQUIREMENTS

The horizontal alignment shall be as shown on the drawings, plus or minus 2 feet. The vertical alignment shall be as shown on the drawings, plus or minus 1 foot. If the CONTRACTOR cannot meet these tolerances for whatever reason, he shall confer with the ENGINEER prior to the start of the bore and the ENGINEER shall approve any changes.

The pipe shall have a minimum cover of 36 inches.

Compound curvatures should be minimized as the safe pulling strength of the pipe may be significantly reduced by the additional tensile stresses due to curvatures. This is limited by the maximum deflection as set forth by the HDPE pipe manufacturer or AWWA Standards, whichever is more stringent.

The entry angle should be 12° to 14° ideally (not to exceed 15°). Exit angle should be 6° to 12° to facilitate the pullback operation.

Erosion and sedimentation control measures and on-site containers shall be installed to prevent drilling mud from spilling out of entry and/or exit pits.

Drilling mud shall be disposed of off-site in accordance with applicable local, State and Federal requirements and/or permit conditions.

Pilot holes shall be drilled on bore path with no deviation greater than plus or minus 1 foot from the design depth over a length of 100 feet. In the event that the allowable deviation is exceeded, **the CONTRACTOR shall notify the ENGINEER/CITY, and the CITY may require the ENGINEER/DEVELOPER/CONTRACTOR to pull back and re-drill from a location along the bore path before the deviation.**

Upon successful completion of the pilot hole, the borehole shall be reamed to a minimum of 25 percent greater than the outside diameter of the pipe being installed. For bores with more than two radii of curvature (entrance and exit), the borehole should be reamed up to 50 percent larger than the outside diameter of the carrier pipe.

The CONTRACTOR shall not attempt to ream at a rate greater than the drilling equipment and mud system are designed to safely handle.

In the event of a drilling hole blowout, the CONTRACTOR shall be responsible for restoring to original condition any damaged property and cleaning up the environment in the vicinity of the blowout.

9.11.5.2.4 PIPE INSTALLTION

After reaming the borehole to the required diameter, the pipe shall be pulled through the hole. In front of the pipe shall be a swivel and barrel reamer to compact the borehole walls.

Once pullback operations have commenced, the operation shall continue without interruption until the pipe is completely pulled into the borehole. The frictional resistance is the highest just prior to movement and decreases with movement. When pullback ceases, frictional forces and drag forces increase due to the thixotropic nature of drilling mud. The mud starts to gel when it is undisturbed. Therefore, **PULLBACK SHALL NEVER BE STOPPED, EXCEPT FOR DRILLING ROD REMOVAL, UNTIL THE PIPE IS COMPLETELY PULLED INTO ITS PERMANENT POSITION.**

Adequate lengths of pipe shall be provided at both the launching and receiving ends to facilitate service connection assemblies.

After pullback, pipe may take several hours to recover from the axial strain. When pulled from the reamed borehole, the pull-nose should be pulled out 3-4 percent longer than the total length of the pull to avoid having the pull-nose sucked back below the borehole exit level due to stretch recovery and thermal contraction to an equilibrium temperature.

The pipe entry area shall be graded as needed to provide support for the pipe and to allow free movement into the borehole. The pipe shall be guided into the borehole to avoid deformation of, or damage to, the pipe.

The pipe shall be installed in a manner that does not cause upheaval, settlement, cracking, and movement or distortion of surface features. Any damages caused by the CONTRACTOR's operations shall be corrected by the CONTRACTOR.

In the event that unexpected subsurface conditions impeding drilling operations are encountered, the procedure shall be stopped and not continued until the CITY has been consulted. The pipe shall be pulled back through the borehole using the wet insertion construction technique.

If the final grade of the finished bore is not satisfactory to the CITY or any other jurisdictional entity, the pipe shall be abandoned, **full pressure grouted in place in accordance with the jurisdictional entity**, and an alternate installation shall be made. The abandoned pipe shall be properly shown on "as-built" drawings to be submitted following conclusion of the construction work.

The INSPECTOR shall inspect the installed pipe for roundness and / or damage. Evidence of over-pulling or significant surface scratching shall be brought to the attention of the ENGINEER and the CITY. Deformations of more than 10 percent may be grounds to abandon the bore and have the CONTRACTOR re-drill another line.

9.11.5.2.5 BUTT FUSION PROCEDURES

Fusion welds shall be performed by an experienced technician that has been properly trained to meet the pipe manufacturer's procedures. All welds shall meet the pipe manufacturer's recommendations.

The CONTRACTOR may do a preliminary pressure test on the completed string of pipe prior to installation. A pressure test shall be required on the completed directional bore prior to final acceptance.

9.11.5.2.5.1 PIPE JOINING

As the pipe ends are melted against the heater during the heating period, the molten plastic will swell and form melt beads around the pipe ends. The melt beads should be the same size on both pipe ends, and uniformly sized all the way around.

After melting has been completed, the ends should be separated just enough to remove the heater, observed for uniformity of the beads and quickly (within three seconds) brought together with the recommended pressure. If melted plastic sticks to heater, the two ends should not be joined. The ends should be allowed to cool and the procedure started over. Excess pressures should not be used as this will squeeze too much melt out of the fusion area and result in a weakened joint.

9.11.5.2.6 CONNECTING TWO SECTIONS OF DIRECTIONALLY BORED PIPE

If the overall length of the required utility installation can not be safely pulled using one directional bore, then the CONTRACTOR shall be required to make more than one pull to accomplish the installation.

Where two adjacent pulls meet, the CONTRACTOR shall dig a pit and join the two sections together at the elevation of the two segments as if it were a continuous pull-in.

The two sections of HDPE shall be joined together using an electrofusion coupling per the coupling manufacturer's recommendations.

9.11.5.3 POST-CONSTRUCTION

The as-built variance from the specified bore path shall not exceed plus or minus 1 foot in the vertical plane and plus or minus 2 feet in the horizontal plane.

The CONTRACTOR shall be considered as having completed the requirements of the directional bore when he has successfully completed the work, including pressure testing, to the satisfaction of the DEVELOPER/OWNER's ENGINEER and the CITY INSPECTOR.

The completed HDPE water main or force main shall be pressure tested at 150 psig for two hours for final acceptance and the pressure shall not fall below 145 psig during the test period.

9.11.5.3.1 AS-BUILTS

When the directional bore is completed, the CONTRACTOR shall provide data log sheets and marked up as built drawings to the INSPECTOR, and the DEVELOPER/OWNER's ENGINEER, as required.

APPENDIX A DIRECTIONAL BORE DESIGN FACTORS

Calculations for computing the maximum safe pullback force should be submitted with the project design package.

The following equations from the PLEXCO Polyethylene Industrial Piping Systems; “Technical Information; Technical Note: Horizontal Directional Drilling (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 totally 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, F_p , is approximated by:
$$F_p = \mu \times w_B \times L,$$
Where μ is the coefficient of friction between pipe and ground;
 w_B is the net downward or upward force on the pipe (lb/ft); and
 L is length (ft).
- (b) **FRictional RESISTANCE OF DRILLING MUD:** The frictional resistance is highest just prior to movement and decreases with movement. When pullback ceases, frictional forces and drag forces increase due to the thixotropic 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) **BOUYANT 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 frictional drag between the pipe and the borehole. The buoyant weight of the pipe is, Where: D = pipe outside diameter, γ_b = specific weight of the mud slurry (lb/ft³), and w_a = 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 recommended bend radius of $1200 \times D_{ROD}$, where D_{ROD} is the nominal rod diameter. When the bending radius is around $150 \times D_{PIPE}$ 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, θ (in radians), the capstan effect,
Where: μ = coefficient of friction between pipe and slurry or pipe and ground,
 w_b = 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, σ_{SP} , may be calculated by subtracting the bending stress due to curvature from the allowable tensile stress:

$$\sigma_{SP} = \sigma_{allow} - \frac{(E \times D)}{2r}$$

The “safe pull force” can be found by multiplying the safe pull stress by the cross-sectional area of the pipe.

Where:, σ_{allow} = 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 F-1804 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, Washington, D.C.

**APPENDIX B
DIRECTIONAL BORE GUIDELINES**

Directional Bore – Safe Pull Strength (for DR11, DIP Size HDPE)

Pipe Size (inches)	Safe Pull	Minimum Bend Strength (lbs.) Depth	Wall Thickness Radius (inches)	Maximum Defect
4	7600	96	0.36	38367
6	15800	138	0.55	38362
8	27200	181	0.73	5/32
10	41000	222	0.91	38426
12	57900	264	1.1	38355

Schedule:

Schedule the bore with Water Utilities 48 hours (2 working Days) prior to boring if bore is over 100 linear feet, contractor needs to fuse pipe together the day before. Contractor needs to physically locate existing utilities, following the 48 hour sunshine One-Call Guidelines Material Inspection to be done before the bore is scheduled. Surface cuts or scratches greater or equal to maximum defect depth are not acceptable.

Blue Strip for Water
Green Strip for Sewer
#10 gauge wire attached to pipe

Performing the Bore:

- Set up the Bore Log.
- Calibrate Contractor's locator with actual depth measurements - Check the depth of the first rod.
- Ream the bore hole.
- Check the flow of bentonite - Must be continuous.
- Check the pulling pressure.
- Do not allow operator to exceed safe pull strength.
- Mark up drawing with "As-Built" data.
- Record pull back pressure.
- Fuse DR11 together - minimum 440° F to maximum 460° F
- Cool down time equals: Diameter ÷ 2

Directional Bore Log

Page: ____ of ____

Project Name: _____

Project Number: _____ Date: _____

Contractor / Site Representative: _____

Bore Location / Number: _____ Size / Material: _____

Starting Location: _____ Bore Rod Length: _____

	Total Length Bored*	Distance From Start Point	Depth	Comments
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

*Lengths to be measured in rod length increments

Inspector / City Representative: _____ Contractor: _____

SECTION 9.12. PRESSURE PIPE RESTRAINT

Sec. 9.12.1. GENERAL

All pressure pipe and fittings shall be restrained as specified in Section 9.12.2. Use of thrust blocks for pressure pipe shall generally not be allowed. .

Sec. 9.12.2. RESTRAINED JOINT CONSTRUCTION

Sections of piping requiring restrained joints shall be constructed using pipe and fittings with restrained “Locked-type” joints manufactured by the pipe and fitting manufacturer and other means of mechanical restraint retainer including retainer glands, push joint restraining gaskets, etc., and the joints shall be capable of holding against withdrawal for line pressures equivalent to the test pressure. Any restrained joints that allow for elongation upon pressurization will not be allowed in those locations where the pipe comes out of the ground.

Restrained pipe joints that achieve restraint by incorporating cut out sections in the wall of the pipe shall have a minimum wall thickness at the point of cut out that corresponds with the minimum specified wall thickness for the test of the pipe.

The minimum number of restrained joints required for resisting forces at fittings and changes in direction of pipe shall be determined from the length of restrained pipe on each side of fittings and changes in direction necessary to develop adequate resisting friction with the soil.

The required number of restrained joints shall be determined by the ENGINEER or as shown in a tabular form depicted on the “Restrained Joint Table” in the STANDARD DETAILS.

Wherever 2-45° bends are used in place of a 90° bend and the minimum restrained joints required from one 45° bend extend beyond the other 45° bend, the 2-45° bends will be considered as though a 90° bend were located midway between the 2-45° bends.

SECTION 9.13. PRESSURE CONNECTION

Sec. 9.13.1. GENERAL

Installation of pressure connections 4" and larger shall be made in accordance with this section

Sec. 9.13.2. TAPPING SLEEVES

9.13.2.1. GENERAL

Tapping sleeves shall be mechanical joint sleeves or fabricated steel sleeves as specified below. All pressure connections to asbestos cement pipe, and all "size on size" (full size) taps shall utilize mechanical joint sleeves.

9.13.2.2. MECHANICAL JOINT SLEEVES

Sleeves shall be cast of gray-iron or ductile iron or ductile iron and have an outlet flange with the dimensions of the Class 125 flanges shown in ANSI B16.1 properly recessed for tapping valve. Glands shall be gray-iron or ductile iron. Gaskets shall be vulcanized natural or synthetic rubber. Bolts and nuts shall comply with ANSI A21.11/AWWA C111. Sleeves shall be capable of withstanding a 200 psi working pressure.

9.13.2.3. STEEL TAPPING SLEEVES

Sleeves shall be fabricated of minimum 3/8" carbon steel meeting ASTM A285 Grade C. Outlet flange shall meet AWWA C-207, Class "D" ANSI 150 lb. drilling and be properly recessed for the tapping valve. Bolts and nuts shall be high strength low alloy steel to AWWA C111 (ANSI A21.11). Gasket shall be vulcanized natural or synthetic rubber. Sleeve shall have manufacturer applied fusion bonded epoxy coating, minimum 12 mil thickness.

9.13.2.4. TAPPING VALVES

Tapping valves shall meet the requirements of Section 9.25.2 except that units shall be flange by mechanical joint ends. Valves shall be compatible with tapping sleeves as specified above and specifically designed for pressure connection operations.

Sec. 9.13.3. NOTIFICATION AND CONNECTION TO EXISTING MAINS

All connections to existing mains shall be made by the CONTRACTOR only after the connection procedure and his work scheduling has been reviewed and approved by the CITY.

The CONTRACTOR shall submit a written request to the CITY a minimum of five (5) working days prior to scheduling said connections. In his request he shall outline the following:

1. Points of Connection, fittings to be used, and method of flushing and disinfection if applicable.
2. Estimated construction time for said connections.

The CITY shall review the submittal within three (3) working days after receiving it and inform the CONTRACTOR regarding approval or denial of his request. If his request is rejected by the CITY, the CONTRACTOR shall resubmit his request modifying it in a manner acceptable to the CITY.

All connections shall only be made on the agreed upon date and time. All materials required to make the connection must be onsite prior to beginning the work. If the CONTRACTOR does not initiate and complete the connection work in the agreed upon manner, he shall be required to reschedule the said connection by following the procedure outlined above.

The CONTRACTOR shall not operate any valves in the system.

Sec. 9.13.4. INSTALLATION

9.13.4.1. EXCAVATION, BACKFILL, COMPACTION AND GRADING

The applicable provisions of Section 9.10 shall apply.

9.13.4.2. CONSTRUCTION DETAILS

Sufficient length of main shall be exposed to allow for installation of the tapping sleeve and valve and the operation of the tapping machinery. The main shall be supported on concrete pedestals or bedding rock at sufficient intervals to properly carry its own weight, plus the weight of the tapping sleeve valve and machinery. Any damage to the main due to improper or insufficient supports shall be repaired at the CONTRACTOR's expense.

The inside of the tapping sleeve and valve, the outside of the main, and the tapping machine shall be cleaned and swabbed or sprayed with 10% liquid chlorine prior to beginning installation for water system pressure connections.

After the tapping sleeve has been mounted on the main, the tapping valve shall be bolted to the outlet flange, making a pressure tight connection. Prior to beginning the tapping operation, the sleeve and valve shall be leak tested at the specified test pressure to ensure that no leakage will occur.

For pressure connections through 12" diameter or less the minimum diameter cut shall be ½" less than the nominal diameter of the pipe to be attached. For 14"

through 20" installations the minimum diameter shall be 1-1/2" less; for larger taps the allowable minimum diameter shall be 2" to 3" less than the nominal diameter of the pipe being attached. After the tapping procedure is complete the CONTRACTOR shall submit the coupon to the CITY.

Restrained joint fillings shall be provided on the branch to prevent movement of the installation when test pressure is applied. Provisions of Section 9.12 shall apply.

DIVISION IV

GRAVITY SEWERS, FORCE MAIN

AND

PUMP STATIONS

SECTION 9.14 PIPE MATERIAL FOR GRAVITY SEWERS

Sec. 9.14.1. GENERAL

Pipe used in gravity sewer construction shall be polyvinyl chloride (PVC) or ductile iron pipe (DIP). Where reference is made to an ASTM, or AASHTO designation, it shall be the latest revision.

The CONTRACTOR shall be responsible for all materials furnished and storage of same, until the date of substantial completion. He shall replace at his expense all materials found to be defective or damaged in handling or storage. The CONTRACTOR shall, if requested by the CITY, furnish certificates, affidavits of compliance, test reports, or samples for check analysis for any of the materials specified herein. All pipe delivered to project site for installation is subject to random testing for compliance with the designated specifications.

Sec. 9.14.2. PIPE MATERIALS

9.14.2.1. PVC GRAVITY SEWER PIPE

PVC Gravity Sewer Pipe (4"-15"), ASTM D3034, SDR 35. Uniform minimum "pipe stiffness" at five (5) percent deflection shall be 46 psi. The joints shall be integral bell elastomeric gasket joints manufactured in accordance with ASTM D3212 and ASTM F477. Applicable UNI-Bell Plastic Pipe Association standard is UNI-B-4.

PVC Gravity Sewer Pipe (18"-27"), ASTM F679, SDR 35. Uniform Minimum "pipe stiffness" at five (5) percent deflection shall be 46 psi. The joints shall be integral bell elastomeric gasket joints manufactured in accordance with ASTM D3212 and STM F477. Applicable UNI-Bell Plastic Pipe Association standard is UNI-B-7.

All PVC pipe shall bear the NSF-DW seal. The minimum standard length of pipe shall be thirteen (13) feet.

Deep Burial gravity sewer pipe shall not exceed the depth limits set by the manufacturer. Pipe wall thickness shall be upgraded accordingly.

9.14.2.2. DIP GRAVITY SEWER PIPE

Ductile iron pipe shall conform to ANSI/AWWA A21.51/C150, class thickness designed per ANSI/AWWA A21.50/C150, with push on joints. An interior protective lining of "Protecto 401" epoxy, or equal, with a minimum dry film thickness of 40 mils. Piping with less than 3 feet of cover shall be ductile iron pipe.

9.14.2.3. PIPE MARKINGS

All pipe shall have a homing mark on the spigot provided by the manufacture. On field cut pipe, CONTRACTOR shall provide homing mark on the spigot in accordance with manufacturers recommendations. Pipe shall be light green in color or shall have a continuous 2" wide, light green stripe painted on top.

Sec. 9.14.3. JOINT MATERIALS

9.14.3.1. PVC PIPE

PVC sewer pipe joints shall be flexible elastomeric seals per ASTM D3212.

9.14.3.2. DUCTILE IRON PIPE

Ductile iron pipe and fitting joints shall be "push-on" or mechanical joints conforming to ANSI A21.11.

9.14.3.3. JOINTS FOR DISSIMILAR PIPE

Joints between pipes of different materials shall be made with a flexible mechanical compression coupling with No. 304 stainless steel bands. (See approved manufacturer's list in appendix.)

Sec. 9.14.4. FITTINGS

Unless otherwise specified, wye branches shall be provided in the gravity sewer main for service lateral connections. Branches shall be minimum six (6) inches inside diameter, unless otherwise approved by the CITY. All fittings, including adaptors, shall be of the same material as the pipe being installed.

Plugs for stub outs shall be of the same material as the pipe, and gasketed with the same gasket material as the pipe joint, or be of material approved by the CITY. The plug shall be secured to withstand test pressures specified in Section 9.18 of these specifications.

Sec. 9.14.5. INSPECTION AND TESTING

9.14.5.1 GENERAL

Each length of pipe shall bear the name or trademark of the manufacturer, the location of the manufacturing plant, and the class or strength classification of the pipe. The markings shall be plainly visible on the pipe barrel. Pipe which is not marked clearly is subject to rejection. All rejected pipe shall be promptly removed from the project site by the CONTRACTOR.

9.14.5.2. MISCELLANEOUS INSPECTION AND TESTING REQUIREMENTS

All pipe and accessories to be installed under this Contract shall be inspected and tested at the place of manufacture by the manufacturer as required by the Standard Specifications to which the material is manufactured.

Each length of pipe shall be subject to inspection and approval at the factory, point of delivery, and site of work. If requested by the CITY, a sample of pipe to be tested shall be selected at random by the CITY or the testing laboratory hired by the CITY

When the specimens tested conform to applicable standards, all pipe represented by such specimens shall be considered acceptable based on the test parameters measured. Copies of test reports shall be available before the pipe is installed in the project.

In the event that any of the test specimens fail to meet the applicable standards, all pipe represented by such tests shall be subject to rejection. The CONTRACTOR may furnish two additional test specimens from the same shipment or delivery, for each specimen that failed and the pipe will be considered acceptable if all of these additional specimens meet the requirements of the applicable standards. All such retesting shall be at the CONTRACTOR's expense.

Pipe which has been rejected by the CITY shall be removed from the site of the work by the CONTRACTOR and replaced with pipe which meets these specifications.

**SECTION 9.15 GRAVITY SEWER PIPE LAYING, JOINTING, AND MISCELLANEOUS
CONSTRUCTION DETAILS**

Sec. 9.15.1. SURVEY LINE AND GRADE

The CONTRACTOR shall set Temporary Bench Marks (TBM'S) at a maximum 500 foot interval. The CONTRACTOR shall constantly check line and grade of the pipe by laser beam method. In the event line and grade do not meet specified limits described hereinafter, the WORK shall be immediately stopped, the CITY notified, and the cause remedied before proceeding with the WORK.

Sec. 9.15.2. PIPE PREPARATION AND HANDLING

All pipe and fittings shall be inspected prior to lowering into trench to insure no cracked, broken, or otherwise defective materials are being used. The CONTRACTOR shall clean ends of pipe thoroughly and remove foreign matter and dirt from inside of pipe and keep clean during and after laying.

Proper implements, tools, and facilities shall be used for the safe and proper protection of the WORK. Pipe shall be lowered into the trench in such a manner as to avoid any physical damage to the pipe. Pipe shall not be dropped or dumped into trenches under any circumstances.

Sec. 9.15.3. SEWER PIPE LAYING

Laying of sewer pipe shall be accomplished to line and grade in the trench only after it has been dewatered and the trench has been prepared in accordance with specifications outlined in Division III. Refer to Section 9.15.4. for additional bedding requirements. Mud, silt, gravel and other foreign material shall be kept out of the pipe and off the jointing surface. All pipe laid shall be retained in position so as to maintain alignment and joint closure until sufficient backfill has been completed to adequately hold the pipe in place. All pipe shall be laid to conform to the line and grade shown on the PLANS.

Variance from established line and grade, at any point along the length of the pipe, shall not be greater than one thirty-second ($1/32$) of an inch per inch of pipe diameter and not to exceed one-half ($1/2$) inch, provided that any such variation does not result in a level or reverse sloping invert.

The sewer pipe, unless otherwise approved by the CITY, shall be laid up grade from point of connection on the existing sewer or from a designated starting point. The sewer pipe shall be installed with the bell end forward or upgrade. When pipe laying is not in progress the open end of the pipe shall be kept tightly closed with an approved temporary plug. Pipe laying shall not begin until approved temporary plug is on site.

All PVC pipe shall be installed in accordance with the pipe manufacturer's written recommendations as approved by the CITY. Laying of Ductile Iron Pipe shall conform to the specifications outlined in Section 9.24.4.7.

Sec. 9.15.4. TRENCH PREPARATION AND PIPE BEDDING

9.15.4.1. TRENCH EXCAVATION, DEWATERING, BEDDING MATERIAL, BACKFILL, COMPACTION, FILL AND GRADING

Applicable provisions of Section 9.10. shall apply. Also refer to STANDARD DETAILS.

9.15.4.2. PLACEMENT OF PIPE BEDDING MATERIAL

CONTRACTOR shall hand-grade bedding to proper grade ahead of pipe laying operation. Bedding shall provide a firm, unyielding support along the entire pipe length.

If without direction from the CITY, the trench has been excavated below the required depth for pipe bedding material placement, CONTRACTOR shall fill the excess depth with pipe bedding material to the proper grade.

CONTRACTOR shall excavate bell holes at each joint to permit proper assembly and inspection of the entire joint.

9.15.4.3. DEPTH OF BEDDING MATERIAL

CONTRACTOR shall provide pipe bedding material in accordance with the STANDARD DETAILS.

Sec. 9.15.5. GRAVITY PIPE AND WATER SEPARATION

Gravity sewers that are laid in the vicinity of pipe lines designated to carry potable or reuse water shall meet the conditions set forth in Section 9.24.3.

Sec. 9.15.6. PLUGS AND CONNECTIONS

Plugs for pipe branches, stubs or other open end which are not to be immediately connected shall be made of an approved material and shall be secured in place with a joint comparable to the main line joint.

Sec. 9.15.7 PIPE JOINTING

All pipe shall be installed to the homing mark on the spigot. The City shall be given an opportunity to check all joints in this manner before backfilling. Type of joint to be used will conform to the requirements of Sections 9.14.3. All pipe and jointing for gravity sewers shall be subject to the tests specified in Section 9.18.

SECTION 9.16. MANHOLES

Sec. 9.16.1. GENERAL

Manholes shall be leak-tight and constructed of pre-cast concrete units.

Sec. 9.16.2. PRE-CAST CONCRETE SECTIONS

9.16.2.1. GENERAL

Pre-cast manholes shall conform to specifications for Pre-cast Reinforced Concrete Manhole Sections, ASTM Designation C478, except as otherwise specified below.

9.16.2.2. MISCELLANEOUS REQUIREMENTS

The minimum wall thickness shall be as shown on the STANDARD DETAILS. Pre-cast manholes shall be constructed with a pre-cast monolithic base structure as shown on the STANDARD DETAILS. The minimum base thickness shall be as shown on the STANDARD DETAILS.

Concrete for manholes shall be Type II, 4000 psi at 28 days. Barrel, top and base sections shall have tongue and groove joints. All jointing material shall be cold adhesive preformed plastic or butyl rubber gaskets.

Pre-cast concrete top slabs shall be used where cover over the top of the pipe is less than 4 ft. Left rings or non-penetrating lift holes shall be provided for handling pre-cast manhole sections. Non-penetrating lift holes shall be filled with non-shrink grout after installation of the manhole sections.

Brush Blast Concrete Surfaces seen after form removal. Rub concrete surfaces with a 3 to 1, sand/cement grout to fill air holes. Remove excess grout from concrete surfaces.

Sections shall be cured by an approved method for at least 28 days prior to painting and shall not be shipped until at least 2 days after having been painted.

Apply two coats of water base epoxy to cleaned surfaces of joints and interiors of castings. The first coat shall be red in color. The second coat shall be grey in color. Each coat shall have a dry film thickness of 3 - 5 mils.

The date of manufacture and the name or trademark of the manufacturer shall be clearly marked on each pre-cast section.

Concrete surfaces shall have form oil, curing compounds, dust, dirt and other interfering materials removed by brush sand blasting and shall be fully cured prior to the application of any coatings.

Interior surfaces and joints of manholes shall have a protective water base epoxy coating.

9.16.2.3. INSPECTION

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

At the time of inspection, the sections will be carefully examined for compliance with the specified ASTM designation, and with the approved manufacturer's drawings. All sections shall be inspected for general appearance, dimension, "scratch-strength" blisters, cracks, roughness, soundness, etc. The surface shall be dense and close-textured.

Sec. 9.16.3. CASTINGS

Gray iron castings for manholes frames, covers, adjustment rings and other items shall conform to the ASTM Designation A 48, Class 30. Castings shall be true to pattern in form and dimensions and free of pouring faults and other defects which would impair their strength, or otherwise make them unfit for the service intended.

The seating surfaces between frames and covers shall be machined to fit true. No plugging or filling will be allowed. Lifting or "pick" holes shall be provided, but shall not penetrate the cover. Casting patterns shall conform to those shown or indicated on the STANDARD DETAILS. All manhole frames and covers shall be traffic bearing to meet AASHTO H-20 loadings. Frames shall be suitable for the future addition of a cast iron ring for upward adjustment of top elevation. In certain locations bolt down covers and gasketed covers shall be located as shown on the DRAWINGS (ie: flood prone areas).

Sec. 9.16.4. CONSTRUCTION DETAILS

9.16.4.1. BEDDING

Base sections shall be placed on bedding rock conforming to the requirements in

Section 9.10. The bedding rock shall be firmly tamped and made smooth and level to assure uniform contact and support of the pre-cast element. Refer to the STANDARD DETAILS for additional bedding details.

9.16.4.2. CAST IN PLACE BASES

Cast in place bases shall be utilized only when specifically approved by the CITY. Unless otherwise specified, cast-in-place bases shall be at least eight (8) inches in thickness and shall extend at least six (6) inches radially outside of the outside dimension of the manholes section. Reinforcement and connection to the riser sections shall be designed by the DEVELOPER's ENGINEER and submitted for approval.

9.16.4.3. PRE-CAST MANHOLES

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

The first pre-cast section shall be placed and carefully adjusted to true grade and alignment. All inlet pipes shall be properly installed so as to form an integral watertight unit. The sections shall be uniformly supported by the base structure, and shall not bear directly on any of the pipes.

Pre-cast sections shall be placed and aligned to provide vertical alignment with a 1/4-inch maximum tolerance per 5 feet of depth. The completed manhole shall be rigid, true to dimensions, and watertight.

9.16.4.4. EXCAVATION AND BACKFILLING

Requirements of Section 9.10. shall apply.

9.16.4.5. PLACING CASTINGS

Casting shall be fully bedded in mortar with adjustment brick courses placed between the frame and manhole. Bricks shall be a minimum two (2) and maximum four (4) courses. Mortar shall conform to ASTM C-270, type M, and the bricks shall be clay or concrete and conform to ASTM C-216, Grade SW, size 3 1/2" (W) x 8" (L) x 2 1/4" (H).

Top of manhole castings located in pavement and sidewalks shall be set flush with grade. Top of manhole castings located outside these areas shall be provided with a concrete collar as noted on the STANDARD DETAILS.

9.16.4.6. CHANNELS

Manhole flow channels shall be as shown in the STANDARD DETAILS, with smooth and carefully shaped bottoms, built up sides and benching constructed using mortar and brick with no voids. Channels shall conform to the dimension of the adjacent pipe and provide changes in size, grade and alignment evenly. Cement shall be Portland Cement Type II only.

9.16.4.7. PIPE CONNECTIONS

Special care shall be taken to see that the openings through which pipes enter the structure are provided with watertight connections. Connections shall conform with ASTM C 023, "Standard Specifications for Resilient Connectors between Reinforced Concrete Manhole Structures and Pipes."

9.16.4.8. DROP MANHOLE CONNECTIONS

Drop manhole connections shall conform in all respects to details shown on the STANDARD DETAILS.

Sec. 9.16.5. CLEANING

All newly constructed manholes shall be cleaned of any accumulation of silt, debris, or foreign matter of any kind, and shall be free from such accumulations at the time of connection to existing City system.

Sec. 9.16.6 INSPECTION FOR ACCEPTANCE

No visible leakage in the manhole or at pipe connections will be permitted. All manholes shall be inspected by the CITY prior to acceptance. All manholes failing to meet the specification set forth in Section 9.16. above shall be reconstructed or replaced by the CONTRACTOR to comply with these specifications. Pressure grouting of manholes for repair shall not be accepted.

SECTION 9.16. MANHOLES

Sec. 9.16.1. GENERAL

Manholes shall be leak-tight and constructed of pre-cast concrete units.

Sec. 9.16.2. PRE-CAST CONCRETE SECTIONS

9.16.2.1. GENERAL

Pre-cast manholes shall conform to specifications for Pre-cast Reinforced Concrete Manhole Sections, ASTM Designation C478, except as otherwise specified below.

9.16.2.2. MISCELLANEOUS REQUIREMENTS

The minimum wall thickness shall be as shown on the STANDARD DETAILS. Pre-cast manholes shall be constructed with a pre-cast monolithic base structure as shown on the STANDARD DETAILS. The minimum base thickness shall be as shown on the STANDARD DETAILS.

Concrete for manholes shall be Type II, 4000 psi at 28 days. Barrel, top and base sections shall have tongue and groove joints. All jointing material shall be cold adhesive preformed plastic or butyl rubber gaskets.

Pre-cast concrete top slabs shall be used where cover over the top of the pipe is less than 4 ft. Left rings or non-penetrating lift holes shall be provided for handling pre-cast manhole sections. Non-penetrating lift holes shall be filled with non-shrink grout after installation of the manhole sections.

Brush Blast Concrete Surfaces seen after form removal. Rub concrete surfaces with a 3 to 1, sand/cement grout to fill air holes. Remove excess grout from concrete surfaces.

Sections shall be cured by an approved method for at least 28 days prior to painting and shall not be shipped until at least 2 days after having been painted.

Apply two coats of water base epoxy to cleaned surfaces of joints and interiors of castings. The first coat shall be red in color. The second coat shall be grey in color. Each coat shall have a dry film thickness of 3 - 5 mils.

The date of manufacture and the name or trademark of the manufacturer shall be clearly marked on each pre-cast section.

Concrete surfaces shall have form oil, curing compounds, dust, dirt and other interfering materials removed by brush sand blasting and shall be fully cured prior to the application of any coatings.

Interior surfaces and joints of manholes shall have a protective water base epoxy coating.

9.16.2.3. INSPECTION

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

At the time of inspection, the sections will be carefully examined for compliance with the specified ASTM designation, and with the approved manufacturer's drawings. All sections shall be inspected for general appearance, dimension, "scratch-strength" blisters, cracks, roughness, soundness, etc. The surface shall be dense and close-textured.

Sec. 9.16.3. CASTINGS

Gray iron castings for manholes frames, covers, adjustment rings and other items shall conform to the ASTM Designation A 48, Class 30. Castings shall be true to pattern in form and dimensions and free of pouring faults and other defects which would impair their strength, or otherwise make them unfit for the service intended.

The seating surfaces between frames and covers shall be machined to fit true. No plugging or filling will be allowed. Lifting or "pick" holes shall be provided, but shall not penetrate the cover. Casting patterns shall conform to those shown or indicated on the STANDARD DETAILS. All manhole frames and covers shall be traffic bearing to meet AASHTO H-20 loadings. Frames shall be suitable for the future addition of a cast iron ring for upward adjustment of top elevation. In certain locations bolt down covers and gasketed covers shall be located as shown on the DRAWINGS (ie: flood prone areas).

Sec. 9.16.4. CONSTRUCTION DETAILS

9.16.4.1. BEDDING

Base sections shall be placed on bedding rock conforming to the requirements in

Section 9.10. The bedding rock shall be firmly tamped and made smooth and level to assure uniform contact and support of the pre-cast element. Refer to the STANDARD DETAILS for additional bedding details.

9.16.4.2. CAST IN PLACE BASES

Cast in place bases shall be utilized only when specifically approved by the CITY. Unless otherwise specified, cast-in-place bases shall be at least eight (8) inches in thickness and shall extend at least six (6) inches radially outside of the outside dimension of the manholes section. Reinforcement and connection to the riser sections shall be designed by the DEVELOPER's ENGINEER and submitted for approval.

9.16.4.3. PRE-CAST MANHOLES

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

The first pre-cast section shall be placed and carefully adjusted to true grade and alignment. All inlet pipes shall be properly installed so as to form an integral watertight unit. The sections shall be uniformly supported by the base structure, and shall not bear directly on any of the pipes.

Pre-cast sections shall be placed and aligned to provide vertical alignment with a 1/4-inch maximum tolerance per 5 feet of depth. The completed manhole shall be rigid, true to dimensions, and watertight.

9.16.4.4. EXCAVATION AND BACKFILLING

Requirements of Section 9.10. shall apply.

9.16.4.5. PLACING CASTINGS

Casting shall be fully bedded in mortar with adjustment brick courses placed between the frame and manhole. Bricks shall be a minimum two (2) and maximum four (4) courses. Mortar shall conform to ASTM C-270, type M, and the bricks shall be clay or concrete and conform to ASTM C-216, Grade SW, size 3 1/2" (W) x 8" (L) x 2 1/4" (H).

Top of manhole castings located in pavement and sidewalks shall be set flush with grade. Top of manhole castings located outside these areas shall be provided with a concrete collar as noted on the STANDARD DETAILS.

9.16.4.6. CHANNELS

Manhole flow channels shall be as shown in the STANDARD DETAILS, with smooth and carefully shaped bottoms, built up sides and benching constructed using mortar and brick with no voids. Channels shall conform to the dimension of the adjacent pipe and provide changes in size, grade and alignment evenly. Cement shall be Portland Cement Type II only.

9.16.4.7. PIPE CONNECTIONS

Special care shall be taken to see that the openings through which pipes enter the structure are provided with watertight connections. Connections shall conform with ASTM C 023, "Standard Specifications for Resilient Connectors between Reinforced Concrete Manhole Structures and Pipes."

9.16.4.8. DROP MANHOLE CONNECTIONS

Drop manhole connections shall conform in all respects to details shown on the STANDARD DETAILS.

Sec. 9.16.5. CLEANING

All newly constructed manholes shall be cleaned of any accumulation of silt, debris, or foreign matter of any kind, and shall be free from such accumulations at the time of connection to existing City system.

Sec. 9.16.6 INSPECTION FOR ACCEPTANCE

No visible leakage in the manhole or at pipe connections will be permitted. All manholes shall be inspected by the CITY prior to acceptance. All manholes failing to meet the specification set forth in Section 9.16. above shall be reconstructed or replaced by the CONTRACTOR to comply with these specifications. Pressure grouting of manholes for repair shall not be accepted.

SECTION 9.17. SERVICE LATERALS

Sec. 9.17.1. GENERAL

A service lateral is a branch gravity sewer constructed from the main gravity sewer to the right-of-way line or to a point established by the CITY.

The general requirements for construction of gravity sewers in Sections 9-14 and 9-15 of these Specifications shall apply for service laterals unless they are inconsistent with the provisions of this section.

Service laterals and fittings shall be a minimum of 6 inches in diameter. All service laterals shall be less than 100 feet in length.

Sec. 9.17.2. MATERIALS

PIPE, FITTINGS, AND JOINTS

Pipe, fittings and joints shall be PVC or DI pipe and shall conform to the requirement for gravity sewer construction in Section 9-14 of these specifications.

Service laterals shall be connected to the wye, provided in the gravity sewer where such is available, utilizing approved fittings or adapters.

On existing mains where no wye is provided or cut-in suitable, connection shall be made by either a machine-made tap and saddle, or a cast-in-place manhole as referenced in Section 9.4.4.

Sec. 9.17.3. CONSTRUCTION DETAILS

9.17.3.1. GENERAL

Service lateral connections shall conform to these specifications and the STANDARD DETAILS. All necessary approvals for service sewer construction shall be obtained prior to beginning the work.

9.17.3.2. EXCAVATION AND BACKFILL

Excavation and backfilling for service sewers shall conform to the requirements of Section 9.10. and 9.15. , excepting that no backfill in excess of that required to hold the pipe in true alignment shall be placed prior to inspection.

9.17.3.3. PIPE LAYING AND JOINTING

Pipe laying and jointing, except as hereinafter provided, shall in general conform to the requirements of Section 9.15. During the pipe laying and jointing, the service lateral shall be kept free of any water, dirt or objectionable matter.

9.17.3.4. LINE AND GRADE

Pipe shall be laid with a minimum gradient of one foot per 100 feet. The CONTRACTOR shall establish such alignment and grade control as is necessary to properly install the service sewer. Pipe shall be laid in a straight line at a uniform grade between fittings.

Sec. 9.17.4. TERMINATION OF SERVICE LATERALS

Service laterals shall terminate at the right-of-way line in accordance with the STANDARD DETAILS. Water-tight factory made plug (s) shall be installed at the end of each service lateral.

Sec. 9.17.5. INSPECTION

Service sewers shall meet the inspection requirements specified in Section 9.14.

Sec. 9.17.6. RESTORATION, FINISHING AND CLEANUP

The CONTRACTOR shall restore all paved surface, curbing, sidewalks or other surfaces to their original condition in such manner as to meet the requirements established in Division III of these specifications. All surplus material and temporary structures, as well as all excess excavation shall be removed and the entire site shall be left in a neat and clean condition.

Sec. 9.17.7 LOCATION

The exact location of the termination point of each installed service lateral shall be marked by etching or cutting an "S" in the concrete curb. Where no curb exists, locations shall be adequately marked by a 4" x 4" x 18" concrete marker with "S" indented into the top of the marker, or other method approved by the CITY.

SECTION 9.18. TESTING AND INSPECTION FOR ACCEPTANCE OF GRAVITY SEWERS

Sec. 9.19.1. GENERAL

Before Gravity sewer testing can be done road base MUST be in place.

All gravity sewers shall be tested for alignment, deflection and integrity prior to acceptance. In addition, a leakage test shall be required for gravity sewers. The leakage testing shall be performed by the CONTRACTOR who shall be responsible for furnishing all necessary labor and equipment to conduct such testing. In unusual situations where the new sewer main must necessarily be connected to active service as it is being installed, alignment, deflection and integrity testing shall be witnessed by the CITY.

Sec. 9.18.2. TESTING FOR LEAKAGE

9.18.2.1. TYPE OF TEST

Gravity sewers shall be required to pass a leakage test before acceptance. Leakage tests shall be by the low-pressure air test as described below.

9.18.2.2. SELECTION OF TEST SECTIONS

Each section shall be tested between consecutive manholes.

9.18.2.3. PREPARATION AND COORDINATION FOR TESTING

The CONTRACTOR shall flush all sewers with water sufficient in volume to obtain free flow through each line. Flushing water and debris shall not enter any pump station wet well or existing sewer. Water will be pumped from the sewer system during flushing to an acceptable discharge location. A visual inspection shall be made and all obstructions removed.

The CONTRACTOR shall notify the CITY Inspector 48 hours prior to performing any leakage testing.

9.18.2.4. LEAKAGE TEST

Leakage testing shall be conducted in accordance with the procedure for "Recommended Practice For Low Pressure Air Testing of Installed Sewer Pipe" as established by the Uni-Bell PVC Pipe Association.

Sec. 9.18.3. INSPECTION FOR ALIGNMENT, DEFLECTION AND INTEGRITY

A television inspection shall be used to check for cracked, broken or otherwise defective pipe, and overall pipe integrity.

The first inspection will be within 30 days after the installation of the gravity sewer pipe, provided the road base is in place and the manhole rings and covers are to grade. The requirement of road base being in place shall be waived if the top of the sewer is 12 feet below the finished grade. In such cases, the video inspection shall be performed once the trench has been compacted up to the road base. A video inspection of the gravity sewer pipe may also be performed before the end of the one year warranty period.

If any video inspection reveals cracked, broken, or defective pipe, pipe misalignment, or sags in excess of 1/2" and in the case of PVC pipe a ring deflection in excess of 5%, the CONTRACTOR shall be required to repair or replace the pipeline. The CITY reserves the right to pass a mandrel through the PVC pipe to determine ring deflection.

Successful passage of the leakage test and/or the video inspection is required before acceptance by the CITY. Video inspection shall be provided on Digital Compact Disk (DVD) for review.

Prior to repair or replacement of failed sewer pipe, the method of repair or replacement shall be submitted to the CITY for approval. Pressure grouting of pipe or manholes shall not be considered as an acceptable method of repair. Repair clamps shall not be considered an acceptable method of repair.

SECTION 9.19. TESTING AND INSPECTION FOR ACCEPTANCE OF GRAVITY SEWERS

Sec. 9.19.1. GENERAL

Before Gravity sewer testing can be done road base MUST be in place.

All gravity sewers shall be tested for alignment, deflection and integrity prior to acceptance. In addition, a leakage test shall be required for gravity sewers. The leakage testing shall be performed by the CONTRACTOR who shall be responsible for furnishing all necessary labor and equipment to conduct such testing. In unusual situations where the new sewer main must necessarily be connected to active service as it is being installed, alignment, deflection and integrity testing shall be witnessed by the CITY.

Sec. 9.18.2. TESTING FOR LEAKAGE

9.18.2.1. TYPE OF TEST

Gravity sewers shall be required to pass a leakage test before acceptance. Leakage tests shall be by the low-pressure air test as described below.

9.18.2.2. SELECTION OF TEST SECTIONS

Each section shall be tested between consecutive manholes.

9.18.2.3. PREPARATION AND COORDINATION FOR TESTING

The CONTRACTOR shall flush all sewers with water sufficient in volume to obtain free flow through each line. Flushing water and debris shall not enter any pump station wet well or existing sewer. Water will be pumped from the sewer system during flushing to an acceptable discharge location. A visual inspection shall be made and all obstructions removed.

The CONTRACTOR shall notify the CITY Inspector 48 hours prior to performing any leakage testing.

9.18.2.4. LEAKAGE TEST

Leakage testing shall be conducted in accordance with the procedure for "Recommended Practice For Low Pressure Air Testing of Installed Sewer Pipe" as established by the Uni-Bell PVC Pipe Association.

Sec. 9.18.3. INSPECTION FOR ALIGNMENT, DEFLECTION AND INTEGRITY

A television inspection shall be used to check for cracked, broken or otherwise defective pipe, and overall pipe integrity.

SECTION 9.19. WASTEWATER FORCE MAINS

Sec. 9.19.1. GENERAL

These specifications cover the pipe, fittings, and accessory items used for wastewater force main systems.

Pipe used in wastewater force main systems shall be either Polyvinyl Chloride (PVC), or Ductile Iron Pipe (DIP). Above ground pipe and buried pipe with less than 30" of cover or 6" of clearance shall be ductile iron.

The CONTRACTOR shall be responsible for all materials furnished and stored, until the date of project completion. He shall replace at his expense all materials found to be defective or damaged in handling or storage. The CONTRACTOR shall, if requested by the CITY, furnish certificates, affidavits of compliance, test reports, or samples for check analysis for any of the materials specified herein. All pipe delivered to project site for installation is subject to random testing for compliance with the designated specifications.

Sec. 9.19.2. PIPE INSPECTION AND TEST

Requirements specified in Article 6 shall apply.

Sec. 9.19.3. PVC PIPE

9.19.3.1. PVC PIPE

Shall not be allowed; except on side streets and exclusive easements.

All PVC pipe of nominal diameter four (4) through twelve (12) inches shall be manufactured in accordance with AWWA standard C900. The PVC pipe shall have a minimum working pressure rating of 100 psi and shall have a dimension ratio (DR) of 25. Pipe shall have the same O.D. as ductile iron pipe.

9.19.3.2. JOINTS

PVC pipe shall be integral bell, push on, type joints.

9.19.3.3. FITTINGS

Fittings used with PVC pipe shall conform to Section 9.19.4.

Sec. 9.19.4. DUCTILE IRON PIPE AND FITTINGS

9.19.4.1. DUCTILE IRON PIPE

All ductile iron pipe of nominal diameter four (4) through fifty four (54) inches shall conform to ANSI/AWWA A21.51/C151. A minimum of pressure Class 150 pipe shall be supplied for all sizes of pipe unless a higher class pipe is specifically called out in the DRAWINGS, or required by the CITY.

9.19.4.2. FITTINGS

All fittings shall be mechanical joint ductile iron or gray iron conforming to ANSI/AWWA A21.10/C110, 250 psi minimum pressure rating, or ductile iron compact fittings four (4) through twelve (12) inches in accordance with ANSI/AWWA A21.53/C123.

9.19.4.3. JOINTS

Joints for ductile iron pipe shall be push-on or mechanical joints and joints for fittings shall be mechanical joints conforming to ANSI/AWWA A21.11/C111, unless otherwise called for on the DRAWINGS. Where called for on the Drawings, restrained or flanged joints shall be provided. Above ground joints shall be flanged with galvanized bolts, nut and washers. Flanged joints shall conform to ANSI Standard B16.1-124 LB. Restrained joints shall conform to Article 5 of these STANDARDS.

9.19.4.4. COATINGS AND LININGS

Where ductile iron pipe and fittings are to be below ground or installed in a casing pipe the coating shall be a minimum 1.0 mil thick in accordance with ANSI/AWWA A21.51/C151. Where ductile iron pipe and fittings are to be installed above ground, pipe, fittings and valves shall be thoroughly cleaned and given one field coat (minimum 1.5 mils dry thickness) of rust inhibitor primer.

Intermediate and finished field coats of Alkyd shall also be applied by the CONTRACTOR (minimum 1.5 mils dry thickness each coat). Primer and field coats shall be compatible and shall be applied in accordance with the manufacturers recommendations. (See approved manufacturers' list in appendix.) Final field coat color shall be as directed by the CITY.

All ducticle iron pipe and fittings shall have an interior protective lining of "Protecto 401" epoxy or equal with a minimum dry film thickness of 40 mils applied by the pipe manufacturer.

9.19.4.5. POLYETHYLENE ENCASEMENT

The pipe shall be polyethylene encased (8 mil) where shown on the DRAWINGS, in accordance with ANSI/AWWA A21.51/C105.

Sec. 9.19.5. PIPE HANDLING

Requirements specified in Section 9.24.2. shall apply.

Sec. 9.19.6. AIR AND VACUUM RELEASE VALVES

9.19.6.1. GENERAL

Wastewater force mains shall be equipped with air/vacuum release valves located at piping high points immediately upstream of dips, or other elevation declines. Valves shall be located in an enclosure as shown on the STANDARD DETAILS.

The valves shall be as described below.

9.19.6.2. WASTEWATER AIR/VACUUM VALVE

The valve body shall be of cast iron; the floats float guide and stem shall be of stainless steel. The valve shall be suitable for 100 psi working pressure. Valve shall have standard two (2) inch NPT inlet and outlet ports unless otherwise shown on the DRAWINGS. Provide back-flushing accessories.

Sec. 9.19.7. NOTIFICATION AND CONNECTION TO EXISTING MAINS

Sec. 9.19.8. VALVES

9.19.8.1. GENERAL

Valves smaller than 24" shall be resilient wedge gate valves.

Valves 24" and larger shall be resilient faced, eccentric plug valves.

Valves shall hold the test pressure, when applied in either direction.

9.19.8.2. VALVE CONSTRUCTION

9.19.8.2.1. Resilient Wedge Gate Valves shall be in accordance with AWWA C509.

- * Shall have fusion bond epoxy coating.
- * Shall have a synthetic rubber encapsulated gate.
- * Shall have oil impregnated bronze mechanical components, for permanent lubrication.

Above ground service - flanged, O.S. & Y, handwheel.

Buried service - mechanical joint, NRS and nut.

Submerged or otherwise inaccessible, above ground service - flanged, NRS, floor stand or suitable operator.

9.19.8.2.2. Resilient Faced Eccentric Plug Valves shall be in accordance with AWWA C-540 and C-507.

- * Shall have a synthetic rubber encapsulated plug.
- * Shall be permanently lubricated.
- * Shall have welded, highnickel content, seat overlay.

Above ground service - flanged, handwheel.

Buried service - mechanical joint, totally enclosed operator, nut with extension.

Submerged or otherwise inaccessible, above ground.

Service - flanged, totally enclosed operator, floor stand or suitable equal.

Sec. 9.19.9. VALVE BOXES

Sec. 9.19.10. SEPARATION OF FORCE MAINS AND WATER MAINS

Requirements 10 feet horizontally from pipes carrying raw wastewater or storm water.

Sec. 9.19.11. FORCE MAIN CONSTRUCTION

Requirements specified in Section 9.23.5. shall apply.

Sec. 9.19.12. HYDROSTATIC TESTS

Requirements specified in Section 9.24.5. shall apply except that all pipe sections to be tested shall be subjected to a hydrostatic pressure of 150 psi.

Sec. 9.19.13. FINAL CLEANING

Prior to final inspection and acceptance of the force main by the CITY, CONTRACTOR shall remove all parts of the system. Flushing and cleaning shall remove all accumulated foreign material from the sewer system.

Sec. 9.19.14. LOCATION AND IDENTIFICATION

All force mains shall be installed with a continuous, insulated 10 gauge solid copper wire (Tracer Wire) taped directly on top of the pipe for location purposes. Terminate insulated locator wires, capable of extending 12 inches above top of box, at each valve box pad.

All force mains shall be green in color or marked with a continuous stripe located within the top 90 degrees of the pipe. Said stripe shall be a minimum 2 inches in width and shall be green in color. Paint should be touch-dry before backfilling. Warning tape shall be placed 12 to 18 inches above all pipe.

SECTION 9.20. WASTEWATER PUMP STATION

Sec. 9.20.1. GENERAL

This Section includes the specifications for equipment, materials, site work, fences and appurtenances for the installation of wastewater pump stations.

Sec. 9.20.2. WET WELL AND VALVE SLAB

Wet well and valve slab shall be constructed as shown on the STANDARD DETAIL entitled “Lift Station”.

Sec. 9.20.3. ACCESS FRAMES AND COVERS

The wet well shall be furnished with aluminum access frames and covers. Equipment furnished shall include 1 ½" nominal diameter aluminum grab rail, stainless steel upper guide holder and level sensor cable holder. Doors shall be of aluminum checkered plate. The access cover and frame shall be sized as shown on the DETAILS.

Sec. 9.20.4. PUMPS AND CONTROLS

Pumps and miscellaneous accessories shall be as specified in Section (9.21.). Controls and miscellaneous accessories shall be as specified in Section 9.22.

Sec. 9.20.5. PIPING, VALVES AND ACCESSORIES

9.20.5.1. PIPING

In fluent piping to the wet well shall meet the requirements of Section 9.14. and 9.19. Flexible boot connection shall be provided at underground wall penetrations. All pipe inside the wet well and the valve vault shall be as shown on the STANDARD DETAIL entitled “Lift Station”.

9.20.5.2. VALVES

Valves shall meet the requirements of Section 9.19.8. (wastewater force mains) (valves)

9.20.5.3. CHECK VALVES

Check valves for ductile iron pipelines shall be swing type and shall meet the material requirements of AWWA C500. The valves shall be iron body, bronze mounted, single disc, 150 psi working water pressure, nonshock, and hydrostatically tested at 300 psi. Ends shall be 125 pound ANSI B16.1 flanges.

When there is no flow through the line the disc shall hang lightly against its seat in practically a vertical position. When open, the disc shall swing clear of the waterway. Check valves shall have bronze seat and body rings, extended bronze hinge pins and stainless steel nuts on the bolts of bolted covers.

Valves shall be so constructed that disc and body seat may easily be removed and replaced without removing the valve from the line. Valves shall be fitted with an extended hinge arm with outside lever and weight. If pump shut off head exceeds 77 feet, then an air cushioned assembly shall be installed.

9.20.5.4. PRESSURE GAUGES

Pressure gauges shall be installed on the discharge pipe as indicated on the STANDARD DETAILS. Each pressure gauge shall be direct mounted, stainless steel case, stainless steel sensing element, liquid filled, with a 4-1/2 inch diameter dial and furnished with a clear glass crystal window, shut-off (isolation) cock or valve. All gauges shall be weatherproofed. The face dial shall be white finished aluminum with jet black graduations and figures. The face dial shall indicate the units of pressure measured in psi, with a 0-60 psi range.

Pressure gauges shall not be installed until after the substantial completion date unless otherwise requested by the CITY.

Sec. 9.20.6 STANDBY POWER GENERATOR SYSTEM

9.20.6.1. GENERAL

A standby power generator system shall be installed at pump stations as required by Section 9.6.5. for electrical power during the loss of normal power.

9.20.6.2. GENERATOR SET

9.20.6.2.1. GENERAL

The generator set shall consist of a diesel engine directly coupled to an electric generator, together with the necessary controls and accessories to provide continuous electric power to the lift station for the minimum duration of a 48 hour failure of the normal power supply.

A complete engine generator system shall be furnished and installed with fuel transfer pump, fuel day tank, with a minimum storage capacity of 300 gallons and a maximum storage capacity of 400 gallons, battery, battery charger, muffler/radiator, control panel, remotely mounted automatic transfer switch (part of the control panel), and all other accessories required for an operational system. All materials and parts of the generator set shall be new and unused. Each component shall be of current manufacture from a firm regularly engaged in the production of such equipment.

The set shall be of a standard model in regular production at the manufacturer's place of business. Units and components offered under the Specifications shall be covered by the manufacturer's standard warranty on new machines.

9.20.6.2.2. REQUIREMENTS

The emergency generator set and accessories shall be of a type that complies with the latest edition of the National Electrical Code and all applicable state and local building codes.

The material and workmanship used in the manufacture of this equipment shall be of the highest quality consistent with the current standards for like equipment, and the equipments shall be manufactured in such a manner so as to conform to the latest applicable IEEE, ANSI, ISA, NEMA, and EEIA Standards.

The equipment supplier shall be liable for any latent defects due to faulty materials or workmanship in the equipment which may appear within one (1) year from the date of equipment start-up.

9.20.6.2.3. TESTS

Equipment shall be completely assembled and tested at the factory prior to shipment. Certified copies of the data obtained during these tests shall be submitted to the CITY.

Final tests shall be conducted at the site, after installation has been completed, in the presence of the CITY'S representative. The emergency generator manufacturer shall furnish a service representative to operate the engine during the tests, to check all details of the installation and to instruct the CITY'S representatives in proper equipment operation.

Field tests shall include operating the diesel generating set for eight (8) hours, carrying normal lift station loads. The CONTRACTOR shall refill the main fuel tank at the completion of the test.

9.20.6.2.4. RATINGS

The rating of the generator shall be as shown on the DRAWINGS. These ratings must be substantiated by the manufacturer's standard published curves. Special ratings shall not be acceptable. The set shall be capable of supplying the specified usable KW for the specified duration, including the power required for the pump start-up, without exceeding its safe operating temperature.

9.20.6.2.5. ENGINE

The engine shall be water cooled, four stroke cycle, compression ignition diesel. It shall meet specifications when operating on No. 2 domestic burner oil. The engine shall be equipped with fuel, lube oil and intake air filters; lube oil coolers, fuel transfer pump, fuel priming pump, and gear-driven water pump.

The engine and generator shall be torsionally compatible to prevent damage to either engine or generator.

An engine instrument panel shall be installed on the generator set in an approved location. The panel shall include oil and fuel pressure and water temperature gauges. A mechanically driven engine hour meter shall also be provided.

The engine governor shall be of the isochronous electronic type. Frequency regulation shall not exceed plus/minus 0.25% under steady state conditions. The engine shall start and assume its rated load within 10 seconds, including transfer time.

9.20.6.2.6. GENERATOR

The generator shall be a three-phase, 60 hertz, single bearing, synchronous type, built to NEMA Standards. Epoxy impregnated Class F insulation shall be used on the stator and the rotor.

The excitation system shall employ a generator-mounted volts per hertz type regulator. Voltage regulation shall be plus/minus 2% from no load to full load. Readily accessible voltage drop, voltage level and voltage gain controls shall be provided. Voltage level adjustment shall be a minimum of plus/minus 5%.

9.20.6.2.7. ENGINE GENERATOR CONTROL PANEL

A generator mounted NEMA 3R type 304, vibration isolated, 14 gauge stainless steel control panel shall be provided. Panel shall contain, but not be limited to, the following equipment:

Control Equipment: Control equipment shall consist of all necessary exciter control equipment, generator voltage regulators, voltage adjusting rheostat, speed control equipment and automatic starting controls, as required to satisfactorily control the engine/generator set. In addition an automatic safety shut down shall be provided for low oil pressure and/or high temperature conditions in the engine. An emergency shut down lever switch shall be provided on the air intake.

Metering Equipment: Metering equipment shall include 3-1/2 inch meters (dial or digital type frequency meter, 2 percent accuracy voltmeter, and ammeter and ammeter-voltmeter phase selector switch). The control panel shall also include the engine water temperature, lube oil pressure and hour meter.

Fault indicators: Individual press-to-test fault indicator lights for low oil pressure, high water temperature, low water level, over speed, over crank, and for day tank high and low fuel level shall be provided.

Function Switch: A four position function switch marked "Auto" "Manual". "Off/Rest" and "Stop" shall be provided.

9.20.6.2.8. BATTERY CHARGER

The battery charger shall be so designed that it shall not be damaged and shall not trip its circuit protective device during engine cranking or it shall be automatically disconnected from battery during cranking period. The charger shall be mounted in the emergency generator control panel. The charger shall have a 7 day/24 hour timer control.

9.20.6.2.9. BATTERY

The battery shall be lead-acid type with sufficient capacity to provide 90 seconds total cranking time without recharging. The battery shall be adequately rated for the specific generator set. The battery shall be encased in hard rubber or plastic and shall be furnished with proper cables and connectors, together with rack and standard maintenance accessories. The battery shall be provided with a 48 month warranty for the replacement of the battery if found to be defective.

9.20.6.2.10. BASE AND MOUNTING

A suitable number of spring-type vibration isolators with a noise isolation pad shall be provided to support the set and its liquids.

9.20.6.2.11. UTILITY CONNECTIONS

All connections to the generator set shall be flexible.

9.20.6.2.12. COOLING SYSTEM

The generator set shall be equipped with an engine mounted radiator sized to maintain safe operation at 110 degree F maximum ambient at the pump station altitude. A blower type fan shall be used directing the air flow from the engine through the radiator. The entire cooling system shall be filled with 50% glycol-water solution.

9.20.6.2.13. FUEL SYSTEM

A main fuel oil storage tank with float switch and fuel level indication shall be furnished with a minimum storage capacity of 300 gallons and a maximum storage capacity of 400 gallons shall be installed by the CONTRACTOR. The emergency system shall include low fuel level contacts for remote alarm. If necessary to guard against loss of prime to pump, a check valve shall be mounted on pump intake. The emergency system shall include a float switch, fuel level gauge and standard control panel.

Fuel oil piping and any required day tanks, shall be furnished and installed by the CONTRACTOR. Fuel system shall meet all governing codes.

9.20.6.2.14 EXHAUST SYSTEM

The generator set supplier shall provide a critical-type silencer, with flexible exhaust fittings, properly sized and installed, according to the manufacturer's recommendation. The silencer shall be mounted so that its weight is not supported by the engine.

Exhaust pipe size shall be sufficient to ensure that measured exhaust back pressure does not exceed the maximum limitations specified by the generator set manufacturer. The exhaust system shall include a flexible, seamless, stainless steel connection between the engine exhaust outlet and the rest of the exhaust system. The exhaust system shall be a part of generator enclosure.

9.20.6.2.15. WEATHERPROOF ENCLOSURE

Enclosure and all other items shall be designed and built by engine manufacturer as an integral part of the entire generator set and shall be designed to perform without overheating in the ambient temperature specified.

Enclosure shall be constructed of 14 or 16 gauge sheet metal suitably reinforced to be vibration free in the operating mode.

Four hinged doors shall be provided to allow complete access without their removal.

Each door shall have at least two latch-bearing points.

Side and rear panels shall be completely and simply removable for major service access.

Roof shall be peaked to allow drainage of rain water.

Baked enamel finish with primer and finish coat shall be painted before assembly. All fasteners shall be rust resistant.

Unit shall have sufficient guards to prevent entrance by small animals. Padlocks shall be provided.

Batteries shall be designed to fit inside enclosure and alongside the engine. Batteries under the generator are not acceptable.

Unit shall have coolant and oil drains outside the unit to facilitate maintenance. Each drain line shall have a high quality valve located near the fluid source.

Fuel filter shall be inside the base perimeter and located so spilled fuel cannot fall on hot parts of engine or generator. A cleanable primary fuel strainer shall be used to collect water and sediment between tank and main engine fuel filter.

Crankcase fumes disposal shall terminate in front of the radiator to prevent oil from collecting on the radiator core and reducing cooling capacity.

9.20.6.2.16. AUTOMATIC TRANSFER SWITCH

The automatic transfer switch shall be part of the control panel.

The transfer switch shall be provided with the following features:

Complete protection, close differential voltage sensing relays monitoring all three phases (pick-up set for 95% of nominal voltage, drop-out set for 85% nominal voltage).

Voltage sensing relay on emergency source (pick-up set for 95% of nominal frequency).

Time delay on engine starting--adjustable from 1 second to 300 seconds (factory set at 3 seconds).

Time delay normal to emergency transfer--adjustable from zero second to 300 seconds (factory set at 1 second). The CONTRACTOR shall request time delay settings in accordance with the priority rating or their respective loads.

Time delay emergency to normal transfer--adjustable 30 seconds to 30 minutes (factory set at 5 minutes), and time delay bypass switch shall be provided on door of the switch cabinet.

Unload running time delay for emergency engine generator cooling down-adjustable from 0 to 5 minutes (factory set at 5 minutes) unless the engine generator control panel includes the cool down timer.

Program Control to periodically exercise the emergency engine-generator plant. The engine-generator should be exercised under load once a week for minimum time period of 60 minutes.

9.20.6.2.17. WARRANTY

Products shall be guaranteed to be free from defects in material and workmanship under normal use and service for a period of one (1) year after start-up.

Sec. 9.20.7 FLOW MONITORING SYSTEM

9.20.7.1. GENERAL

When indicated on the DRAWINGS or as required by Section 9.6.4., a flow monitoring system capable of indicating, recording, and totalizing wastewater flows shall be provided. The system shall include magnetic flowmeter/transmitter, electronic recording receiver, and miscellaneous related accessories as specified herein. It shall be the CONTRACTOR's responsibility to provide and install such equipment resulting in a completely operational flow monitoring system.

9.20.7.2. MAGNETIC FLOWMETER/TRANSMITTERS

The magnetic flowmeter shall be of the low frequency electromagnetic induction type and shall produce a DC pulsed signal directly proportional and linear to the liquid flow rate. The meter shall be designed for operation on 120 VAC \pm 10%, 60 Hz \pm 5% with a power consumption of less than 20 watts for sizes through 12-inches.

The metering tubes shall be constructed of stainless steel. All magnetic flowmeters shall be designed to mount directly in the pipe between ANSI Class 150 flanges and shall consist of a flanged pipe spool piece with laying length of at least 1-1/2 times the meter diameter. Meters shall be mounted according to manufacturers specifications, but, as a general rule, precautions must be taken to assure that the metering tube is filled at all times during measurement (i.e. do not mount meter at system high point). Meters shall have polyurethane liners with stainless steel electrodes.

The electronics portion of the magnetic flowmeter shall include both a magnet environment. A separate terminal strip for power connection shall be supplied. driver to power the magnet coils and a signal converter. The signal converter shall be integrally mounted. The converter shall include a separate customer connection section to isolate the electronics compartment and protect the electronics from the

The electronics shall be of the solid state, feedback type and utilize integrated circuitry.

The input span of the signal converter shall be continuously adjustable between 0-1 and 0-31 fps for both analog and frequency outputs. The converter shall not be affected by quadrature noise nor shall it require zero adjustment or special tools for start-up.

Input and output signals shall be fully isolated. The converter output shall be 4 to 20 mA DC into 0 to 900 ohms.

Meter shall be suitable for outdoors installation and shall be furnished complete with grounding rings and installation hardware including studs, nuts, gaskets, and flange adapter hardware.

The converter shall include an integral zero return to provide a constant zero output signal in response to an external dry contact closure.

Converter shall also include digital type switches for direct adjustment of scaling factor in engineering units along with integral calibration self-test feature to verify proper operation of the electronics.

The meter shall be hydraulically calibrated at a facility located in the United States and the calibration shall be traceable to the National Bureau of Standards. A computer printout of the actual calibration data giving indicated versus actual flows at a minimum of three (3) flow rates shall be provided with the meter. A certification letter shall accompany the computer printout of the calibration data for each meter referencing the meter's serial number. The accuracy of the metering system shall be 1% of rate from 10 to 100% of flow for maximum flow velocities of 3 to 31 feet per second.

Complete zero stability shall be an inherent characteristic of the meter system to eliminate the need to zero adjust the system with a full pipe at zero flow.

The meter housing shall be splash-proof and weather resistant design. The meter shall be capable of accidental submergence in up to 30 feet of water for up to 48 hours without damage to the electronics or interruption of the flow measurement.

9.20.7.3. ELECTRONIC RECORDING RECEIVER

The electronic recording receiver shall be of the solid state, null-balance, servo operated potentiometer type.

The instrument shall contain a differential amplifier, a TORQ-ER driver motor to position the pen, and a Flux Bridge contact less solid state position feedback device for balancing. The instrument shall be capable of receiving one process variable input. Inputs shall be provided with electrical isolation. The instrument shall accept an input signal of 4 to 20 mADC.

Electrical zero and span adjustments shall be provided. Power requirements shall be 120 VAC \pm 10%, 60 Hz. A power supply shall be provided for two-wire transmitters. Accuracy shall be + 0.5% of span, with repeatability of \pm 0.2% of span.

The receiver shall be provided with an indicating 5-inch segmental scale.

The electronic recording receiver shall be housed in a cast aluminum case suitable for panel mounting. The case shall have a gasketed door with glass window. A 12-inch circular chart shall be provided, with 7 day/rev. and chart rotation. An eight (8) digit electronic totalizing counter shall also be provided.

9.20.7.4. WARRANTY AND SERVICE

WARRANTY

Products shall be guaranteed to be free from defects in material and workmanship under normal use and service for a period of one (1) year after start-up.

SERVICE

Service shall be available for insitu repair of the products. Manufacturer's Repair personnel shall be based in Florida to insure a reasonable response time of not more than two (2) working days.

Sec. 9.20.8. CHAIN LINK FENCE

9.20.8.1. GENERAL

The CONTRACTOR shall furnish and erect the chain link fence and gate in accordance with these specifications and in conformity with the lines, grades, notes and typical sections shown on the DRAWINGS and the STANDARD DETAILS.

9.20.8.2. MATERIALS

The fabric, posts, fastenings, fittings and other accessories for chain link fence shall meet the requirement of AASHTO M 181 with the following changes:

1. The weight of coating of wire fabric shall be 1.2 ounces of zinc per square foot (Class B).
2. The galvanizing of steel materials shall be hot-dipped galvanized.
3. The weight of coating on posts and braces shall be 1.8 ounces of zinc per square foot, both inside and outside to meet the requirements of AASHTO M 111.

The base metal of the fabric shall be a good commercial quality 11.5 Gage Steel Wire. The fabric shall be of uniform quality, and shall be 6 foot high with a 2 inch mesh size.

All posts and rails shall be in accordance with the following schedule:

End, corner and pull posts - 2 3/8" O.D., Schedule .055.

Line posts and gate frames - 2" O.D., Schedule .065.

Gate Posts - 3" O.D., Schedule .065.

Post braces and top rail - 1 5/6" O.D., Schedule .055.

Tension wire shall be 0.177 inch coiled spring wire tensioned along the bottom of the fabric and shall be coated similarly to the wire fabric.

Miscellaneous fittings and hardware shall be zinc coated commercial quality or better steel or zinc coated cast or malleable iron as appropriate for the article. Post caps, designed to provide a drive fit over the top of the tubular post to exclude moisture, shall be provided.

9.20.8.3. INSTALLATION

POST SETTING

All post shall be set three (3) feet deep in concrete footings, 12" diameter for line posts, gate and corner posts.

After the post has been set, aligned and plumbed, the hole shall be filled with 2500 p.s.i. concrete. The concrete shall be thoroughly worked into the hole so as to leave no voids. The exposed surface of the concrete shall be crowned to shed water.

End, corner, pull and gate posts shall be braced to the nearest post with horizontal brace used as a compression member and a galvanized 3/8 inch steel truss rod and truss tightener used as a tension member. Corner posts and corner bracing shall be constructed at all changes of fence alignment of 30 degrees or more. All chain link fence shall be constructed with a top rail and bottom tension wire.

GATES

Swing gates shall generally be two 6-foot wide double hung gates as indicated on the STANDARD DETAILS and hinged to swing through 180 degrees from closed to open and shall be complete with latches, locking device, stops keeper, hinges, fabric and braces. Gates shall be the same height as the fence and the gate fabric shall be the same as the fence fabric.

Gate leaves less than 8 feet wide shall have truss rods or intermediate braces and gate leaves 8 feet or more in width shall have intermediate braces and diagonal truss rods or shall have tubular members as necessary to provide rigid construction, free from sag or twist.

PLACING FABRIC

The fabric shall not be placed until the posts have been permanently positioned and concrete foundations have attained adequate strength. The fabric shall be placed by securing one end and applying sufficient tension to remove all slack before making permanent attachments at intermediate points.

The fabric shall be fastened to all corner, end and pull posts by substantial and approved means. Tension for stretching the fabric shall be applied by mechanical fence stretchers.

Sec 9.20.9. REQUIRED SUBMITTALS

Submittals shall be provided to the CITY in triplicate (minimum) and include the following:

1. Shop and erection drawings showing all important details of construction, dimensions and anchor bolt locations.
2. Descriptive literature, bulletins, and/or catalogs of the equipment.
3. Data on the characteristics and performance of each pump. Data shall include guaranteed performance curves, based on actual shop tests of similar units, which show that they meet the specified requirements for head, capacity, efficiency, NPSHR, submergence and horsepower. Curves shall be submitted on eight and one-half (8 ½) inch by eleven (11) inch sheets, at as large a scale as is practical. Curves shall be plotted from no flow at shut off head to maximum manufacturer recommended pump capacity. Catalog sheets showing a family of curves will not be acceptable.
4. Complete layouts, wiring diagrams, elementary or control schematics, including coordination with other electrical control devices operating in conjunction with the pump control system. Suitable outline drawings shall be furnished for approval before proceeding with manufacture of any equipment. Standard preprinted sheets or drawings simply marked to indicate applicability will not be acceptable.
5. A drawing showing the layout of the pump control panel shall be furnished. The layout shall indicate all devices mounted on the door and in the panel shall be completely identified.
6. The weight of each pump.
7. Complete motor data shall be submitted including:
 - Nameplate identification
 - No-load current
 - Full load current
 - Full load efficiency
 - Locked rotor current
 - High potential test data
 - Bearing Inspection report

Sec. 9.20.10. ELECTRICAL GROUNDING SYSTEM

9.20.10.1. GENERAL

A grounding system shall be installed as per National Electrical Code, Local Codes and Ordinances. The DRAWINGS shall clearly show the Electrical Grounding System. An underground perimeter cable grounding system shall be installed with connections to at least the following equipment:

1. Wet Well Cover
2. Valve Vault Cover
3. Control Panel
4. Generator
5. Utility Company Transformer
6. Main Disconnect Switch
7. Fence

9.20.10.2. MATERIAL AND INSTALLATION

The DRAWINGS shall show details of material and installation to construct a completely functional and operational Electrical Grounding System.

Sec. 9.20.11 INSPECTION AND TESTING

A factory representative knowledgeable in pump operation and maintenance shall inspect and supervise a test run at the pumping station covered by this MANUAL. A minimum of one (1) working day shall be provided for the inspections. Additional time made necessary by faulty or incomplete WORK or equipment malfunctions shall be provided as necessary to meet the requirements in the MANUAL at no additional cost to the CITY. Upon satisfactory completion of the test run, the factory representative shall issue the required manufacturer's certificate.

The test run shall demonstrate that all items of the MANUAL have been met by the equipment as installed and shall include, but not be limited to, the following tests:

1. That all units have been properly installed.
2. That the units operate without overheating or overloading any parts and without objectional vibration.
3. That there are no mechanical defects in any of the parts.
4. That the pumps can deliver the specified pressure and quantity at all design points.
5. That the pumps are capable of pumping the specified material.
6. That the pump controls perform satisfactorily.

Sec. 9.20.12. ACCESS ROADS AND QUALITY ASSURANCE

A minimum 10' wide, paved access road shall be provided from the nearest public roadway. Curb, if present, shall have a 15 foot cut for the access road.

Roadway shall include deeded easement or dedicated right-of-way.

- * stabilized (if necessary) subgrade: 12" min.
- * base course (limerock): 6" min.
- * asphaltic concrete surface, type S-1: 1 ½"

SECTION 9.21. SUBMERSIBLE WASTEWATER PUMPS

Sec. 9.21.1. GENERAL

The equipment covered by these specifications is intended to be standard pumping equipment of proven ability as manufactured by a reputable firm having at least five (5) years experience in the production of such equipment. The equipment furnished shall be designed, constructed, and installed in accordance with the best practices and methods, and shall operate satisfactorily when installed as shown on the DRAWINGS and STANDARD DETAILS.

All part shall be so designed and proportioned as to have liberal strength, and stiffness and to be especially adapted for the work to be done. Ample space shall be provided for inspection, repairs, and adjustment. All necessary foundation bolts, plates, nuts, and washers shall be furnished by the equipment manufacturer, and shall be of Type 304 stainless steel. Brass or stainless steel nameplates giving the name of the manufacturer, voltage, phase, rated horsepower, speed, and any other pertinent data shall be attached to each pump. The nameplate rating of the motors shall not be exceeded.

The pumps shall be capable of handling raw unscreened domestic wastewater and minimum 3" diameter solid sphere. Pump operation shall be controlled automatically by means of float-type liquid level sensors in the wet well. Pumps shall be mounted in the wet well as shown on the DRAWINGS and STANDARD DETAILS. (See approved manufacturer's list in appendix).

Pumps shall be field tested and certified by manufacturer's representative. Certifications and guarantees shall be supplied to the City before acceptance.

Sec. 9.21.2. PUMP CONSTRUCTION DETAILS

9.21.2.1. SHAFT

The pump shaft shall be of Series 300 or 400 stainless steel or carbon steel. When a carbon steel shaft is provided, the manufacturer shall demonstrate that any part of the shaft which will normally come in contact with the wastewater has proven to be corrosion resistant in this application. The shaft and bearings shall be adequately designed to meet the maximum torque required for any start-up or operating condition and to minimize vibration and shaft deflection. As a minimum, the pump shaft shall rotate on two (2) permanently lubricated bearings. The upper bearing shall be a single row ball bearing. The lower bearing shall be a two row angular contact ball bearing, if required to minimize vibration and provide maximum bearing life.

9.21.2.2. IMPELLER

The impeller shall be constructed of gray cast iron, ASTM A-48, class 30. All external bolts and nuts shall be of series 300 stainless steel. Each pump shall be provided with a replaceable metallic wear ring system to maintain pump efficiency. As a minimum one stationary wear ring provided in the pump volute or one rotating wear ring provide on the pump impeller shall be required. A two part system is acceptable.

9.21.2.3. MECHANICAL SEAL

Each pump shall be provided with a tandem double mechanical seal running in an oil reservoir, composed of two separate lapped face seals, each consisting of one stationary and one rotating tungsten carbide ring with each pair held in contact by a separate spring, so that the outside pressure assists spring compression in preventing the seal faces from opening. The compression spring shall be protected against exposure to the pumped liquid. Silicone carbide may be used in place of tungsten carbide for the lower seal. The pumped liquid shall be sealed from the oil reservoir by one face seal and the oil reservoir from the air-filled motor chamber by the other. The seals shall require neither maintenance nor adjustment, and shall be easily replaced. Conventional double mechanical seals with a single spring between the rotating faces, requiring constant differential pressure to effect sealing and subject to opening and penetration by pumping forces, shall not be considered equal to tandem seal specified and required.

9.21.2.4. BEARINGS

Motor shaft bearings shall have a minimum life of 40,000 hours, ANSI B-10.

9.21.2.5. GUIDES

A sliding guide bracket shall be an integral part of the pump casing and shall have a machined connecting flange to connect with the cast iron discharge connection, which shall be bolted to the floor of the wet well with stainless steel anchor bolts and so designed as to receive the pump discharge flange without the need of any bolts or nuts. Sealing of the pumps to the discharge connection shall be accomplished by a simple linear downward motion of the pump with the entire weight of the pumping unit guided by no less than two (2) 300 series seamless tubular stainless steel guides which will press it tightly against the discharge connection. No portion of the pump shall bear directly on the floor of the wet well and no rotary motion of the pump shall be required for sealing. Sealing at the discharge connection by means of a diaphragm or similar method of sealing will not be accepted as an equal to a metal to metal contact of the pump discharge and mating discharge connection specified and required. Approved pump manufacturers, if necessary to meet the above specification, shall provide a sliding guide bracket adapter. The design shall be such that the pumps shall be

automatically connected to the discharge piping when lowered into place on the discharge connection. The pumps shall be easily removable for inspection or service, requiring no bolts, nuts or fastenings to be removed for this purpose, and no need for personnel to enter the wet well. Each pump shall be fitted with a Type 304 stainless steel, lifting chain of adequate strength. A stainless steel cable, aircraft rating, shall be provided between the cable holder and the lifting chain.

Sec. 9.21.3. MOTORS

9.21.3.1. GENERAL REQUIREMENTS

All motor shall be built in accordance with latest NEMA, IEEE, ANSI and AFBMA Standards where applicable. Pump motors shall be housed in an air-filled, water-tight casing and shall have Class F insulated windings which shall be moisture resistant. Motors shall be NEMA Design B, rated 155 degrees C maximum. Pump motors shall have cooling characteristics suitable to permit continuous operation, in a totally, partially or non-submerged condition. The pump shall be capable of running continuously in a non-submerged condition under full load without damage, for extended periods. The motor shall be capable of a minimum of 10 starts per hour. If required by the CITY, before final acceptance, a field running test demonstrating this ability, with 24 hours of continuous operation under the above conditions, shall be performed for all pumps being supplied. Motors 25 horsepower and below shall be rated 230/460 volts, 3 phase. Motors greater than 25 horsepower shall be 460 volt, 3 phase.

9.21.3.2. HEAT AND MOISTURE SENSORS

Each motor shall incorporate a minimum of one ambient temperature compensated overheat sensing device and one moisture sensing device. These protective devices shall be wired into the pump controls in such a way that if excessive temperature or moisture is detected the pump will shut down. These devices shall be manual reset.

In lieu of moisture and temperature sensors, each pump motor shall have its motor winding insulation resistance monitored automatically by an automatic megger solid state electronics module. Each automatic megger must have an individual disconnect terminal plug, manual shut off switch, three lights to indicate 10 Mohm, 5 Mohm, and 1 Mohm, resistance values, two output circuits for external alarms, and two switches for manual testing. The power source shall be 110 VAC fused at 0.24 AMP. The test voltage shall be 500-700 volts d.c. The automatic megger shall monitor the motor resistance only when the motor is off and shall activate an alarm system when the motor resistance drops to 1 Mohm.

9.21.3.3. CABLES

Cables shall be designed specifically for submersible pump applications and shall be properly sealed. A type CGB water-tight connector with a neoprene gland shall be furnished with each pump to seal the cable entry at the control panel.

Sec. 9.21.4. PUMPS AND CONTROL SYSTEM

Refer to Section 9.22. For control system specifications.

Sec. 9.21.5. SHOP PAINTING

Before exposure to weather and prior to shop painting, all surfaces shall be thoroughly cleaned, dry and free from all mill-scale, rust, grease, dirt and other foreign matter. All pumps and motors shall be shop coated with a corrosion resistant paint proven to withstand an environment of raw wastewater. All nameplates shall be properly protected during painting.

Gears, bearing surfaces, and other similar surfaces obviously not to be painted shall be given a heavy shop coat of grease or other suitable rust-resistant coating. This coating shall be maintained as necessary to prevent corrosion during periods of storage and erection and shall be satisfactory to the CITY up to the time of the final acceptance test.

Sec. 9.21.6. HANDLING

All parts and equipment shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the units and equipment are ready for operation. Finished surfaces of all exposed pump openings shall be protected by wooden planks, strongly built and securely bolted thereto. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.

Sec. 9.21.7. WARRANTY

The pump manufacturer shall warrant the units being supplies to the CITY against defects in workmanship and material for a period of five (5) years or 10,000 hours, whichever comes first. Warranty shall begin at time of start-up.

Sec. 9.21.8. TOOLS AND SPARE PARTS

One (1) set of all special tools required for normal operation and maintenance shall be provided. All such tools shall be furnished in a suitable steel tool chest complete with lock and duplicate keys.

The manufacturer shall furnish the following spare parts for each size pump supplied:

1. 1 - upper bearing.
2. 1 - lower bearing.
3. 1 - set of upper and lower shaft seals.
4. 1 - set of "O-Rings" or gaskets required for replacement of bearings and seals.
5. 1 - set impeller wear rings.
6. 1 - shaft sleeve (if applicable).
7. 1 - cable cap (if applicable).

Spare parts shall be properly packaged and labeled for easy identification without opening the packaging and suitably protected for long-term storage under humid conditions. Spare parts and tools shall be delivered to the CITY at or prior to the time of pump station start-up.

SECTION 9.22 PUMP STATION ELECTRICAL POWER AND CONTROL SYSTEM

Sec. 9.22.1. GENERAL

This section specifies the electrical power and control system requirements for wastewater pump stations. These requirements apply to duplex pump panels. Similar requirements shall apply when more than two pumps are involved except for the quantity of control equipment and panel size shall be increased accordingly. The manufacturer of the control panel shall provide data to indicate that the manufacturer has a minimum of 3 years experience in the building of pump control panels.

A pump station control panel shall be provided for each wastewater pump station. (See approved manufacturers' list in appendix.) The control panel shall respond to liquid level float switches to automatically start and stop pumps as well as sound an alarm upon high wet well levels. The control panel shall operate submersible pumps at the power characteristics stipulated. The control function shall provide for the operation of the lead pump under normal conditions. If the incoming flow exceeds the pumping capacity of the lead pump, the lag pump (s) shall automatically start to handle the increased flows. As the flow decreases, pumps shall be cut off at elevation as shown on the PLANS. Pumps shall alternate positions as lead pump at the end of each cycle. A failure of the alternator shall not disable the pumping system. The alternator shall include a safe, convenient method of manual alternation and also have provisions to prevent automatic alternation without disturbing any wiring. Should the "pump off" regulator fail, the system shall keep the station in operation and provide a visual indication of the regulator failure.

The control panel shall consist of main circuit breakers and generator breaker with mechanical interlock, an emergency power receptacle, a circuit breaker and magnetic starter for each pump motor, and 5 ampere, 120 volt circuit breakers as required. All pump control operations shall be accomplished by a float type liquid level control system with all control components mounted in one common enclosure. Control switches shall provide means to operate each pump manually or automatically. When operated in the automatic mode, the control assembly shall provide means to manually select or automatically alternate the position of the "lead" and "lag" pumps after each pumping cycle.

A float type liquid level control system shall continuously monitor wet well liquid level and control operation of the low-level cutoff for the pumps and shall operate off a 24 volt circuit.

Sec. 9.22.2. PANEL CONSTRUCTION

The duplex pump panel shall be housed in a NEMA 3R, Type 304, 14 Gauge stainless steel enclosure with 30% extra mounting space for additional equipment. Enclosure shall have provisions for padlocking the door and a dead front inner door unit for mounting controls. All exterior hardware and hinges shall be stainless steel. There shall be permanently affixed to the interior side of the exterior enclosure door both a nameplate and a 10" X 12" pocket for log sheet storage.

The nameplate shall contain the following information, voltage, phase, rated horsepower, speed, date manufactured and pump and control panel manufacturer's name, address and telephone number, pump data, including impeller data, operating point and head. KW input, and amps at the operating point and at least two other points on the pump curve.

The control panel enclosure shall be Underwriters Laboratories (UL) 50 type 3 R listed.

Sec. 9.22.3. POWER SUPPLY AND MAIN DISCONNECT

Power supply to the control panel shall be 480 volt, 3 phase, 4 wire. Minimum service shall be 480 volt, 3 phase, 4 wire. Minimum service shall be 100 AMP. Single phase power shall not be accepted.

Nonfusible safety service main disconnects shall be installed at all stations. Disconnect should be installed ahead of the meter. LED power available indicators shall be supplied on all legs.

Sec. 9.22.4. CIRCUIT BREAKERS

9.22.4.1. MAIN BREAKERS

The panel shall have an inter-lock system between the normal power main breaker and the emergency breaker to ensure only one breaker is in the "on" position at a time. Both breakers shall be equal in size. (See approved manufacturers' list in appendix.)

9.22.4.2. CIRCUIT BREAKERS

All circuit breakers shall be heavy duty molded case breaker. The handle on the circuit breakers shall be operational through the inner door. (See approved manufacturers' list in appendix.)

Sec. 9.22.5. MOTOR CIRCUIT PROTECTORS

Each pump motor shall be protected by a 3-pole motor circuit protector. (See approved manufacturers' list in appendix.) The Motor Circuit Protector shall be operated by a toggle-type handle and shall have a quick-make, quick-break over center switching mechanism that is mechanically trip-free from the handle so that the contacts cannot be held closed against a short circuit and abnormal currents which cause the Motor Circuit Protection to trip. Tripping shall be clearly indicated by the handle automatically assuming a position midway between the normal ON and OFF positions. All latch surfaces shall be ground and polished. All poles shall be so constructed that they open, close, and trip simultaneously. Motor Circuit Protector must be completely enclosed in a high-strength glass polyester molded case. Ampere ratings shall be clearly visible. Contacts shall be of non-welding silver alloy. Arc extinction must be accomplished by means of arc chutes. A manual pushtotrip button shall be provided for manual exercising of the trip mechanism. Each pole of these Motor Circuit Protector's shall provide instantaneous short circuit protection by means of an adjustable magnetic-only element.

Sec. 9.22.6. MOTOR STARTER AND SELECTOR SWITCHES

The panel shall contain the motor starters. The motor starter shall be across the line magnetic starter with individual overload protection on each power leg with reset installed through the inner door unit. (See approved manufacturers' list in appendix.) Local Power Company Regulations shall govern.

Selector switches shall be installed on the face of the inner door unit. Selector switch shall be a heavy duty oil tight "Hand-Off-Auto" three position switch to control the operation mode of each pump motor starter.

Sec. 9.22.7. PUMP ALTERNATOR

An eight pin plug-in solid state alternator (see approved manufacturers' list in appendix) shall be provided to change the pump starting sequence on each pumping cycle. A three position alternator test switch shall be provided to control the alternation operation. Switch positions to include the "Auto" to provide normal automatic sequence, "Off" position to disable alternator, and "test" position with a spring return to allow the alternating of the pump sequence to check alternator operation.

Sec. 9.22.8. LIGHTS AND ALARMS

9.22.8.1. INDICATOR LIGHTS

There shall be installed on the face of the inner door unit, heavy duty oil tight indicator lights.

9.22.8.2. HIGH LEVEL ALARM

A vapor proof red light and horn shall be mounted on top of the panel for high level alarm. Also, there shall be an alarm silence pushbutton on the inner door and a silence relay which will silence the horn and automatically reset when these signals are restored to normal. The pushbutton shall be heavy duty oil tight. The red light shall be the screw-on type.

9.22.8.3. MOTOR HIGH TEMPERATURE AND LEAK INDICATION

Motor high temperature and leak detection shall be provided. Upon high temperature or leak detection, contacts will close, energizing panel mounted lights on the inner door and sending 120 VAC signal to the RTU to signal pump failure. Manual resets will be provided on the inner door.

Sec. 9.22.9. EMERGENCY POWER RECEPTACLE

This item shall only be required on stations that do not have a permanent standby generator system. The panel shall have external mounted generator receptacle of the required size (See approved manufacturer's list).

Sec. 9.22.10. ADDITIONAL REQUIREMENTS

9.22.10. 1. WIRING

All power wires shall be THW or THWN 75 Degree C insulated stranded copper conductors and shall be approximately sized for the given load application. All control circuit wire shall be type THW; Size 14, stranded type. All wiring within the enclosure shall be neatly routed by the use of slotted type wiring duct with snap on type covers.

Wiring on the rear of the inner door shall be neatly bundled with nylon ties and include sufficient loop across the hinges to prevent wire damage, with each end of conductor marked (I.D.), Color: Red, 24 volt; white, neutral; black, 120 volts.

9.22.10. 2. TERMINAL POINTS

Terminal points of all strips shall be permanently identified. All terminal numbers and identifying nomenclature shall correspond to and be shown on electrical diagrams. All wiring shall be permanently shown on electrical schematic diagrams.

9.22.10. 3. ENGRAVED NAMEPLATES

All circuit breakers, control switches, indicator pilot lights and other control devices shall be identified with permanently affixed legend plates and lamicoïd-type engraved nameplates where applicable.

9.22.10. 4. SURGE PROTECTORS

Surge protectors shall be included and wired to protect motors and control equipment from lightning induced line surges. Surge protectors shall have a response time of picoseconds and be capable of dissipating high levels of line side surge energy, without damage to pump station equipment and controls. All surge protectors shall be U.L. approved and installed per respective power company requirements and manufacturer's specifications, primary surge protectors shall be attached to the main disconnects.

9.22.10. 5. ELAPSED TIME METERS

Elapsed time meters shall be 115 volt not-reset type and shall totalize pump running time in hours and tenths of hours to 99999.9 hours.

9.22.10. 6. CONVENIENCE RECEPTACLE

On the face of the inner door unit, there shall be installed a 15 AMP 120 volt, duplex convenience receptacle. It shall be provided with it's own single pole, 15 AMP circuit breaker for protection. Ground fault interrupt type shall be required.

9.22.10. 7. CONTROL TERMINAL BLOCKS

Control terminal blocks shall be of the clamp screw type, rated for 600 volts. Amperage rating shall accommodate the control circuit amperage. The minimum number of terminals provided shall be 30 single stacked or 20 double stacked.

9.22.10. 8. CONTROL POWER TRANSFORMERS

There shall be a control power transformer with a minimum size of 3 KVA to provide 120 VAC power for: coils for starters, 15A duplex receptacle, indicator pilot lights, alarm horn, alarm light, pump alternator, elapsed time meters etc. The secondary side shall have one leg fused and the other grounded. This control power transformer is required only on 480 volt control panels.

The signal required by the float switches and relays shall be 24 VAC. This shall be provided by a 24 VAC control power transformer properly sized with a fused secondary.

9.22.10. 9. CONTROL RELAY

The level control relays shall operate from 24 VAC. They shall be enclosed, plug-in 8 pin type with octal-style screw terminal sockets.

9.22.10.10. ELECTRICAL SCHEMATIC

There shall be permanently affixed to the interior side of the exterior enclosure door an electrical schematic diagram and a copy supplied to CITY personnel at start-up. The schematic diagram shall include the rated amperage and voltage for all components.

9.22.10.11. PHASE MONITOR

For all 240 volt stations an eight pin plug-in type phase monitor shall be provided for protection of electrical components due to phase loss. Adequate dummy pin protection shall be provided to prevent accidental interchanging of the eight pin phase monitor with the eight pin alternator. All 480 volt stations shall have surface mount type phase monitors. Both types of phase monitors shall have 2 sets of normally open contacts and 2 sets of normally closed contacts.

9.22.10.12 AREA LIGHT

Provide a mercury vapor area lighting fixture with on/off switch, 175 watt minimum. Mount lighting fixture to control panel support post as shown on the STANDARD DETAIL entitled "Lift Station".

9.22.10.13 DIALERS

Provide an auto dialer.

Sec. 9.22.11. TESTING, SERVICE AND WARRANTY

9.22.11. 1. TESTING

After fabrication in the control panel manufacturer's plant, an operational test shall be performed to check out the entire panel before delivery. Three phase source voltage to which the panel is intended for shall be used for the testing.

9.22.11. 2. SERVICE

The control panel manufacturer shall maintain a service organization in the area that is available for service.

9.22.11. 3. WARRANTY

The manufacturer shall furnish a five (5) year warranty against defects in materials and workmanship covering parts and labor on all items supplied under this section from time of start -up of the lift station.

DIVISION V

WATER DISTRIBUTION

SECTION 9.23 PIPE MATERIAL FOR WATER MAINS AND SERVICE CONNECTIONS

Sec. 9.23.1. GENERAL

These specifications cover the pipe, fittings, and accessory items used for water distribution systems.

Pipe used in water distribution systems shall be either polyvinyl chloride pipe (PVCP), or ductile iron pipe (DIP). Above ground pipe and buried pipe with less than 30" of cover, or 6" of clearance shall be ductile iron pipe.

The CONTRACTOR shall be responsible for all materials furnished and storage of same, until the date of substantial completion. He shall replace at his expense all materials found to be defective or damaged in handling or storage. The CONTRACTOR shall, if requested by the CITY, furnish certificates, affidavits of compliance, test reports, or samples for analysis; for any of the materials specified herein. All pipe delivered to project site for installation is subject to random testing for compliance with the designated specifications.

Sec. 9.23.2. PIPE INSPECTION AND TESTING

Requirements specified in section 9.14.5. shall apply.

Sec. 9.23.3. PVC PIPE

9.23.3.1. PVC PIPE

All PVC pipe of nominal diameter four (4) through twelve (12) inches shall be manufactured in accordance with AWWA standard C900, latest edition. The PVC pipe shall have a minimum working pressure rating of 150 psi and shall have a dimension ratio (DR) of 18. Pipe shall be the same O.D. as ductile iron pipe.

9.23.3.2. JOINTS

PVC pipe shall be integral bell, push-on type joints.

9.23.3.3. FITTINGS

Fittings used with PVC pipe shall conform to section 9.23.4.

Sec. 9.23.4. DUCTILE IRON PIPE AND FITTINGS

9.23.4.1. DUCTILE IRON PIPE

All ductile iron pipe of nominal diameter four (4) through fifty four (54) inches shall conform to ANSI/AWWA A21.51/C151. A minimum of Class 50 pipe shall be supplied for all sizes of pipe unless specifically called out in the DRAWINGS, or required by the CITY.

9.23.4.2. FITTINGS

Any fittings required shall be mechanical joint ductile iron or gray iron conforming to ANSI/AWWA A21.10/C110, 250 psi minimum pressure rating, or ductile iron compact fittings four (4) through twelve (12) inches in accordance with ANSI/AWWA A21.53/C153.

9.23.4.3. JOINTS

Joints for ductile iron pipe shall be push-on or mechanical joints conforming to ANSI/AWWA A21.11/C111. Where called for in the plans, restrained or flanged joints shall be provided. Above ground joints shall be flanged with galvanized bolts, nuts and washers. Flanged joints shall conform to ANSI Standard B 16.1-125 LB. Restrained joints shall conform to Section 34.2 of these standards.

9.23.4.4. COATINGS AND LININGS

Where ductile iron pipe and fittings are to be below ground or installed in a casing pipe the exterior coating shall be a minimum 1.0 mil thick in accordance with ANSI/AWWA A21.51/C151. Where ductile iron pipe and fittings are to be installed above ground, pipe, fittings and valves shall be thoroughly cleaned and given one field coat (minimum 1.5 mils dry thickness) of rust inhibitor primer. Intermediate and finished field coats of Alkyd shall also be applied by the CONTRACTOR (minimum 1.5 mils dry thickness each coat).

Primer and field coats shall be compatible and shall be applied in accordance with the manufacturers recommendations. (See approved manufacturers' list in appendix.) Final field coat color shall be as directed by CITY.

All ductile iron pipe and fittings shall have an interior protective lining of cement-mortar with a seal coat of asphaltic material in accordance with ANSI/AWWA A21.4/C104.

9.23.4.5. POLYETHYLENE ENCASEMENT

The pipe shall be polyethylene encased (8 mil) where shown on the DRAWINGS or required by the CITY in accordance with ANSI/AWWA A21.51/C105.

Sec. 9.23.5. SERVICE PIPE, STOPS, FITTINGS, AND SERVICE SADDLES

9.23.5.1. SERVICE PIPE

All service lines shall be 1", 1-1/2" or 2" blue, PC200, DR9, polyethylene tubing conforming to specifications in AWWA C901. Larger service pipe shall be PVC or DIP as specified in sections 50.3 and 50.4 respectively.

9.23.5.2. STOPS

Corporation stops shall be 1", 1-1/2" or 2" brass, equipped with connections compatible with the polyethylene tubing and threaded in accordance with specifications in AWWA C800. Curb stops shall be lockable and sized to match the meter size and conform to the specifications in AWWA C800 and AWWA C901. Larger services shall have resilient wedge gate valves as specified in section 9.25.2.

9.23.5.3. FITTINGS

Fittings shall be brass, cast and machined in accordance with specifications in AWWA C800 with compatible polyethylene tubing connections.

Direct taps into ductile iron pipe, to accommodate corporation stops up to 1" are allowable if the DIP wall thickness is adequate to allow a minimum of three threads. Refer to AWWA C151, Appendix A, Table A.2.

SECTION 9.24. PIPE INSTALLATION FOR WATER MAINS

Sec. 9.24.1. GENERAL

Pipe shall be installed in accordance with the manufacturer's specifications and instructions for the type of pipe used and applicable AWWA standards, such as C600, unless otherwise stated in these specifications.

Sec. 9.24.2. PIPE HANDLING

All types of pipe shall be handled in such manner as will prevent damage to the pipe or coating. Accidental damage to pipe or coating shall be repaired to the satisfaction of the CITY or be removed from the job. When not being handled, the pipe shall be supported on timber cradles or on properly prepared ground, graded to eliminate all rock points and to provide uniform support along the full length. When being transported, the pipe shall be supported at all times in a manner which will not permit distortion or damage to the lining or coating. Any unit of pipe that, in the opinion of the CITY, is damaged beyond repair by the CONTRACTOR shall be removed from the site of the work and replaced with another unit.

Joint gaskets shall be stored in clean, dark dry location until immediately before use.

Dirt or other foreign material shall be prevented from entering the pipe or pipe joint during handling or laying operations and any pipe or fitting that has been installed with dirt or foreign material in it shall be removed, cleaned and re-laid. At times when pipe laying is not in progress, the open ends of the pipe shall be closed by a water-tight plug.

Sec. 9.24.3. SEPARATION OF WATER MAINS AND SEWERS

9.24.3.1. GENERAL

Water mains that are laid in the vicinity of pipe line designated to carry storm water, raw wastewater or reclaimed water (wastewater effluent) shall meet the horizontal and vertical separations specified in section 9.24.3.3.

9.24.3.2. HORIZONTAL SEPARATION

NORMAL CONDITIONS: Water mains shall be located at least 10 feet horizontally from pipes carrying raw wastewater, and 3 feet horizontally from pipes carrying reclaimed water and storm water, whenever possible; the distance shall be measured from edge of pipe to edge of pipe.

UNUSUAL CONDITIONS: When local conditions prevent the minimum required horizontal separation, a water main may be laid closer to a pipe carrying storm or wastewater provided that the sewer pipe is ductile iron.

9.24.3.3. CROSSING OF WATER MAINS AND SEWER PIPES

Normal Conditions: Water mains shall be above the sewers whenever they cross any sanitary sewer, storm sewer, sewage force main or reuse force main.

A vertical separation of at least 18 inches shall be maintained between the top of the sewer and the bottom of the water main.

Unusual Conditions: Sewers shall have one full length of ductile iron pipe centered at the point of crossing so that the joints will be equidistant and as far as possible from the water main.

Sec. 9.24.4. TRENCH PREPARATION AND PIPE BEDDING

9.24.4.1. TRENCH PREPARATION AND PIPE BEDDING

Applicable provisions of Section 9.10. shall apply. Also refer to STANDARD DETAILS.

9.24.4.2. PIPE PREPARATION AND HANDLING

All pipe and fittings shall be inspected prior to lowering into trench to insure no cracked, broken, or otherwise defective materials are being used. CONTRACTOR shall clean ends of pipe thoroughly and remove foreign matter and dirt from inside of pipe and keep clean during and after laying.

CONTRACTOR shall use proper implements, tools, and facilities for the safe and proper protection of the WORK. CONTRACTOR shall lower pipe into the trench in such a manner as to avoid any physical damage to the pipe and shall remove all damaged pipe from the jobsite. Care shall be taken to not drop or dump pipe into trenches under any circumstances.

9.24.4.3. TRENCH DEWATERING AND DRAINAGE CONTROL

Specifications from Section 9.10. shall apply. CONTRACTOR shall prevent water from entering the trench during excavation and pipe laying operations to the extent required to properly grade the bottom of the trench and allow for proper compaction of the backfill. Pipe shall not be laid in water.

9.24.4.4. SURVEY LINE AND GRADE

Pipe shall be laid to the lines and grades shown on the PLANS. The CONTRACTOR shall provide line and grade stakes at a 100 foot maximum. Spacing and at all line and/or grade change locations. CONTRACTOR shall provide Temporary Bench Marks at maximum 1000 foot intervals. The minimum pipe depth shall be three (3) feet below the elevation of the edge of pavement of the road surface whichever is greater.

9.24.4.5. PIPE LAYING IN TRENCH

CONTRACTOR shall prevent foreign material from entering the pipe while it is being placed in the trench. CONTRACTOR shall remove all foreign material from the pipe or joint ring before the next pipe is placed. Pipe shall be lowered into trench and installed, one piece at a time. During laying operations, CONTRACTOR shall keep debris, tools, clothing, or other materials out of the pipe.

9.24.4.6. LAYING PVC PIPE

All PVC pipe shall be installed in accordance with standards set forth in the UNI-BELL "Handbook of PVC pipe design and construction" unless such standards conflict with this MANUAL in which case this MANUAL shall apply.

9.24.4.7. LAYING DUCTILE IRON PIPE

All ductile iron pipe shall be installed in accordance with AWWA C600 unless such standards conflicts with this MANUAL in which case this MANUAL shall apply. CONTRACTOR shall cut pipe only as necessary to comply with alignment shown on the PLANS. Flame cutting of pipe shall not be allowed.

CONTRACTOR shall provide special tools and devices, such as special jacks, chokers, and similar items required for proper installation. Lubricant for the pipe gaskets shall be furnished by the pipe manufacturer, for potable water piping.

The pipe shall be polyethylene encased (8 mil) where shown on the DRAWINGS in accordance with ANSI/AWWA A21.51/C105.

9.24.4.8. LAYING OF PIPES ON CURVES

Long radius curves, either horizontal or vertical, are prohibited.

9.24.4.9. PIPE RESTRAINT

Requirements specified in Section 9.12. shall apply.

9.24.4.10. BEDDING AND BACKFILL FOR PIPES

Requirements specified in Section 9.12. shall apply.

Sec. 9.24.5. HYDROSTATIC TESTS

9.24.5.1. GENERAL

Before Hydrostatic testing can be done road base MUST be in place.

Hydrostatic tests shall consist of pressure test and leakage test. Hydrostatic tests shall be conducted on all newly laid pressure pipes, joints and valves including all service lines to the curb stops. Air testing of pressure pipes will not be permitted under any circumstance. Tests may be made on sections not exceeding 2,000 feet, or between valves, whichever is less. CONTRACTOR shall furnish all necessary equipment and material, make all taps, and furnish all closure pieces in the pipe as required. Equipment to be furnished by the CONTRACTOR shall include graduated containers, pressure gauges, hydraulic force pumps, and suitable hoses and piping. The CITY will monitor and approve a satisfactory test.

The CONTRACTOR may conduct hydrostatic tests after the trench has been partially backfilled with the joints left exposed for inspection for his informational purposes only. The hydrostatic tests for acceptance shall only be conducted after the trenches have been completely backfilled and compacted as specified.

9.24.5.2. TESTING CRITERIA

All pipe sections to be pressure tested shall be subjected to a hydrostatic pressure of 150 psi. The duration of each pressure test shall be for a period of 2 hours. If during the test, the integrity of the tested line is in question, the CITY may require a 6 hour pressure test. The basic provisions of AWWA C-600 shall be applicable.

9.24.5.3. PROCEDURE FOR PRESSURE TEST

Each section of pipe to be tested, as determined by the CITY, shall be slowly filled with water and the specified test pressure shall be applied by means of a pump connected to the pipe in a satisfactory manner. Before applying the specified test pressure, all air shall be expelled from the pipe. To accomplish this, taps shall be made, and appropriate valves installed to ensure bleeding of all air from the main. If defective pipes, fittings, valves, or hydrant are discovered in consequence of this pressure test, all such items shall be removed and replaced by the CONTRACTOR with sound material and the test shall be repeated until satisfactory results are obtained. Provisions of AWWA C600, where applicable, shall apply.

9.24.5.4. PROCEDURE FOR LEAKAGE TEST

After completion of the pressure test, a leakage test shall be conducted to determine the quantity of water lost by leakage under the specified test pressure. Applicable provisions of AWWA C600 shall apply.

Allowable leakage in gallons per hour for pipeline shall not be greater than that determined by the formula: $L = \frac{SD(P)^{1/2}}{133,200}$

Note: L = Allowable leakage in gallons per hour.
S = Length of pipe tested, in feet.
D = Nominal diameter of the pipe in inches.
P = Average test pressure during leakage test in pounds per square inch gauge.

Leakage is defined as the quantity of water to be supplied in the newly laid pipe or any valved section under test, which is necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled. Should any test of pipe laid disclose leakage greater than that allowed, CONTRACTOR shall locate and replace or repair the defective joints, pipe or valve until the leakage from subsequent testing is within the specified allowance.

Sec. 9.24.6 DISINFECTION OF WATER MAINS

9.24.6.1. GENERAL

Before being placed in service, all new water mains shall be chlorinated in accordance with the specifications below and the procedures outline in AWWA C-651 "Standard Procedure for Disinfecting Water Mains".

9.24.6.2. FLUSHING

Sections of pipe to be disinfected shall first be flushed (full diameter) to remove any solids or contaminated material that may have become lodged in the pipe. If no hydrant is installed at the end of the main, then a blow-off valve shall be provided large enough to develop a velocity of at least 2.5 feet per second in the main.

All taps required for chlorination or flushing purpose or for temporary or permanent release of air shall be provided for by the CONTRACTOR as a part of the construction of water mains. After the disinfection, all such taps shall be sealed to the satisfaction of the CITY.

9.24.6.2.1. DISINFECTION CRITERIA

Before being placed into service, all new mains and repaired portions of, or extensions to existing mains shall be chlorinated so that the initial chlorine residual is no less than 50 mg/1 and that a chlorine residual of not less than 25mg/1 remains in the water after standing 24 hours in the pipe.

9.24.6.4. FORM OF APPLIED CHLORINE

Chlorine may be applied as a liquid chlorine (gas-water mixture), or a mixture of water and high-test calcium hypochlorite. CONTRACTOR shall assume responsibility for safe handling of chlorine and shall meet requirements of OSHA and other regulatory agencies for safe handling of chlorine.

9.24.6.5. POINT OF APPLICATION

The preferred point of application of the chlorinating agent is at the beginning of the pipe line extension or any valved section of it, and through a corporation stop inserted in the pipe.

The water injector for delivering the chlorine-bearing water into the pipe should be supplied from a tap made on the pressure side of the gate valve controlling the flow into the pipe line extension. Alternate points of applications may be used when approved or directed by the CITY.

9.24.6.6. OPERATION OF CITY VALVES

Valves shall be manipulated by the CITY personnel so that the strong chlorine solution in the line being treated will not flow back into the line supplying the water.

9.24.6.7. RETENTION PERIOD

Treated water shall be retained in the pipe at least 24 hours. After this period, the chlorine residual at pipe extremities and at other representative points shall be at least 25 mg/1.

9.24.6.8. CHLORINATING VALVES AND HYDRANTS

In the process of chlorinating newly laid pipe, all valves or other appurtenances shall be operated while the pipe line is filled with the chlorinating agent and under normal operating pressure.

9.24.6.9. FINAL FLUSHING AND TESTING

Following chlorination, all treated water shall be thoroughly flushed from the newly laid pipe at its extremity until the replacement water throughout its lengths shows upon test, a free chlorine residual not in excess of that normally carried in the system. Chlorinated water shall not be discharged to surface water.

After flushing, water samples collected on 2 successive days from the treated piping system, as directed by the CITY, shall show acceptable bacteriological results.

All bacteriological testing shall be witnessed by the CITY, after 48 hour notice at the expense of the contractor and proper chain of custody procedures must be followed.

Copies of testing results and all related correspondence with the Florida Department of Environmental Protection (FDEP) shall be copied to the CITY.

9.24.6.10. REPETITION OF FLUSHING AND TESTING

Should the initial treatment result in an unsatisfactory bacterial test, the original chlorination procedure shall be repeated by the CONTRACTOR until satisfactory results are obtained.

Sec. 9.24.7. NOTIFICATION AND CONNECTION TO EXISTING MAINS

Requirements specified in Section 9.13. shall apply.

Sec. 9.24.8. WATER SERVICE PIPING AND CONNECTION

Water service piping and connection shall be installed as indicated in the STANDARD DETAILS. The location of all service lines shall be as shown on the DRAWINGS and shall be either single, dual or multiple service. On curbed streets the exact location for each installed service shall be marked by etching or cutting a "W" in the concrete curb. Where no curb exists, locations shall be adequately marked by a 4" x 4" x 18" concrete marker with "W" indented in top

Sec. 9.24.9. LOCATION AND IDENTIFICATION

All water mains shall be installed with a continuous, insulated 10 gauge solid copper wire (tracer wire) taped directly on top of the pipe for location purposes. Terminate insulated locator wires, capable of extending 12 inches above top of box, at each valve box pad.

All water mains shall be blue in color or marked with a continuous stripe located within the top 90 degrees of the pipe. Said stripe shall be a minimum 2 inches in width and shall be blue in color. Paint should be touch-dry before backfilling. Provide warning tape 12" to 18" above all water mains.

SECTION 9.25. VALVES, HYDRANTS AND ACCESSORIES FOR WATER MAINS

Sec. 9.25.1. GENERAL

All valves and appurtenances shall be products of firms who are fully experienced and qualified in the manufacture of the particular equipment to be furnished. The equipment shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these SPECIFICATIONS as applicable.

Sec. 9.25.2. RESILIENT WEDGE GATE VALVES

9.25.2.1. GENERAL

All valves shall be Resilient Wedge Gate Valves

9.25.2.2. VALVE CONSTRUCTION

Resilient Wedge Gate Valves shall be in accordance with AWWA C509.

- * Shall have fusion bond epoxy coating.
- * Shall have a synthetic rubber encapsulated gate.
- * Shall have oil impregnated bronze mechanical components, for permanent lubrication.
- * If actuating nut deeper than four (4) feet it must have actuating nut extension..

Above ground service - flanged, OS & Y, handwheel. Buried Service - mechanical joint, NRS, nut w/extension.

Submerged or otherwise inaccessible, above ground service - flanged, NRS, floor stand or suitable operator.

Sec. 9.25.3. (Section has been removed)

Sec. 9.25.4. VALVE INSTALLATION

All valves shall be inspected upon delivery in the field to insure proper working order before installation. They shall be set and jointed to the pipe in the manner as set forth in the AWWA Standards for the type of connection ends furnished. All valves and appurtenances shall be installed true to alignment and rigidly supported. Any damage to the above items shall be repaired to the satisfaction of the CITY before they are installed.

Flanged joints shall be made with hot dipped galvanized bolts, nuts and washers. Mechanical joints shall be made with mild corrosion resistant alloy steel bolts and nuts. All exposed bolts shall be painted the same color as the pipe.

Sec. 9.25.5. VALVE BOXES

All buried valves shall have cast-iron three piece valve boxes. Valve boxes shall be provided with suitable heavy bonnets and shall extend to such elevation at or slightly above the finished grade surface as shown on the STANDARD DETAILS. The barrel shall be two-piece, sliding type, having 5 1/4 inch shaft. The upper section shall have a flange at the bottom having sufficient bearing area to prevent settling and shall be complete with cast iron covers. Barrel extensions for deep valves shall be ductile iron or cast iron pipe. Covers shall have "WATER" cast into the top for all water mains. The actuating nuts for deeper valves shall be extended to come up to within 6" of finished grade as shown on the STANDARD DETAILS.

Care shall be taken while constructing valve boxes to ensure that valve stems are vertical and the cast iron box has been placed over the stem with base bearing on compacted fill and top flush with final grade. Boxes shall have sufficient bracing to maintain alignment during backfilling. CONTRACTOR shall remove any sand or undesirable fill from valve box prior to final inspection.

9.25.5.1. VALVE IDENTIFICATION

A 3" diameter cast bronze disc engraved with identification data as shown on the STANDARD DETAILS shall be provided for each buried valve.

Bronze disc shall be cast into the concrete valve box pad as shown on the STANDARD DETAILS.

Sec. 9.25.6. AIR RELEASE VALVES

The air release valves for use in water mains shall be installed where shown on the DRAWINGS and as shown on the STANDARD DETAILS. The valves shall have a cast iron body and cover, and a stainless steel float. Valves shall be provided with a vacuum check to prevent air from reentering the line.

Sec. 9.25.7. FIRE HYDRANTS

9.25.7.1. MATERIAL

Fire hydrants shall have 5-1/4 inch valve opening and shall comply with AWWA Standard C502 for fire hydrants for water works service, unless in conflict with MANUAL in which case this manual shall apply. Each hydrant shall have 6 inch mechanical joint ends with harnessing lugs ("dog-ears") and shall open by turning to the left (counter-clockwise). Fire hydrant shall be of ample length for 3-1/2 foot depth of bury. It shall be provided with two 2-1/2 inch hose nozzles and one 4-1/2 inch pumper nozzle, all having National Standard hose threads. Nozzles shall have caps attached by chains. Operating nuts shall be AWWA Standard (pentagonal, measuring 1-1/2 inch point to flat). Fire hydrants shall be equipped with "O-Ring" packing. Fire hydrant shall be provided with weep hole. Fire hydrant shall be equipped with break - away flanges. Shear bolts shall not be acceptable. (See approved manufacturers' list in appendix.)

9.25.7.2. PAINING

All iron parts of the hydrant both inside and outside shall be painted, in accordance with AWWA C-501. All inside surfaces and the outside surfaces below the ground line shall be coated with asphalt varnish. They shall be covered with two coats, the first having dried thoroughly before the second is applied.

The outside of the hydrant above the furnished ground line shall be thoroughly cleaned and thereafter painted with one coat of paint of a durable composition, and one additional coat of compatible paint, the color of which is to be determined by the Fire Department under whose jurisdiction the fire hydrant becomes the responsibility.

9.25.7.3. CONSTRUCTION DETAILS

Hydrants shall be plumb and shall be set so that the lowest hose connection is, at least, eighteen (18) inches above the surrounding finished grade. All hydrants shall be inspected in the field upon delivery to the job to insure proper operation before installation. The resetting of existing hydrants and moving and reconnecting of existing hydrants shall be handled in a manner similar to a new installation. Hydrant shall be constructed in accordance with the STANDARD DETAILS.

9.25.7.4. LOCATION

Fire hydrants shall be located in the general location as shown on the DRAWINGS. Final field location of all hydrants shall be as approved by the CITY. All hydrants shall be located no less than five (5) and no more than ten (10) feet from the edge of pavement of the adjacent roadway and no less than five (5) feet from any physical feature which may obstruct access or view of any hydrant unless otherwise approved by the CITY.

APPENDIX “A”

**PROJECT ACCEPTANCE
CERTIFICATE**

Appendix 'A'

PROJECT ACCEPTANCE CERTIFICATE

PROJECT NAME: _____

PROJECT LOCATION: _____

PROJECT OWNER: _____

ENGINEER OF RECORD: _____

ADDRESS: _____

PHONE: () _____ FAX: () _____

UTILITIES CONTRACTOR: _____

ADDRESS: _____

PHONE: () _____ FAX: () _____

FL UNDERGROUND LICENSE NUMBER:

PROJECT TYPE: Residential: Single-family _____ Multi-family _____

Commercial: _____

IMPACT FEES:

Sewer Reservation: Calculated by: _____ Gallonage _____ Date Paid _____

Sewer Impact: Calculated by: _____ Gallonage _____ Date Paid _____

Water Impact: Calculated by: _____ Gallonage _____ Date Paid _____

Line Extensions: Water _____ Sewer _____ Force Main _____

Hydraulic Shares: \$ _____ /Gallon Water Calculated by: _____
\$ _____ /Gallon Sewer Calculated by: _____
\$ _____ /Gallon Force Main Calculated by: _____
\$ _____ /Gallon Reuse Calculated by: _____

Projects Due Hydraulic Shares:

_____ \$/Gal _____ Amount _____
_____ \$/Gal _____ Amount _____
_____ \$/Gal _____ Amount _____

Trunkline Agreement: No _____ Yes _____ DEP Agreement Number: _____

List of Trunklines UPDATED: N/A _____ Yes _____ By: _____

COMMENTS FOR IMPACT FEE SECTION:

DEP Water Permit Number: _____ Date Rec. _____ Exp. Date _____

DEP Sewer Permit Number: CS49- _____ Date Rec. _____ Exp. Date _____

Wastewater Treatment Facility _____ Plant ID# _____

CONSTRUCTION PLAN REVIEW:

Master Plan Concurrency review: By: _____ Date: _____

Hydraulic Review: Water: N/A _____ By: _____ Date: _____

Sewer: N/A _____ By: _____ Date: _____

Back-flow Preventor(s) Reviewed for size, type and approved make: N/A _____

By: _____ Date: _____

Industrial Waste Requirements Review: By: _____ N/A _____

Type Required: Grease Trap _____ # required _____ Size required _____

Gas/Oil _____ # required _____ Size required _____

Sand Int. _____ # required _____ Size required _____

Other, specify requirements

Original Submittal Received: _____ Approved _____ Date comments sent _____ By: _____

2nd Submittal Received: _____ Approved _____ Date comments sent _____ By: _____

Reviewing Engineer: _____ Reviewing Inspector: _____

APPROVED: _____ As Noted: _____ By: _____ Date: _____

*Gravity Sewer Uni-Bell Low Air Pressure Testing: N/A _____

Witnessed by: _____ Date: _____

*Gravity Sewer System Lamping Inspection: N/A _____

*Gravity Sewer System Televising: N/A _____

Witnessed by: _____ Date: _____

*Gravity Sewer Manhole Inspection: N/A _____

Witnessed by: _____ Date: _____

*Industrial Waste Inspection: N/A _____

Type: Grease Trap _____ Oil/Gas _____ Sand Interceptor _____ Other _____

Size _____ Inspected By: _____ Date: _____

*Lift Station Inspection and Start-up: N/A _____

Site: Inspected By: _____ Date: _____

Pump and Controls Start-up: Witnessed By: _____ Date: _____

*Force Main Hydrostatic Pressure Test: N/A _____

Witnessed By: _____ Date: _____

*Water Distribution System Hydrostatic Pressure Test: N/A _____

Witnessed By: _____ Date: _____

*Water Distribution System Disinfection: N/A _____

Witnessed By: _____ Date: _____

*Water Distribution system Bacteriological Sampling: N/A _____

Performed By: _____ Date: _____

*Back-flow Preventors Inspected and Tested: N/A _____

of Back-flow(s) on job: _____ Performed by: _____ Date: _____

*Walk-thru Final Inspection:

Conducted By: _____ Date: _____

Conducted By: _____ Date: _____

Water Distribution Systems: N/A _____ OK _____ See Punch List _____

Sanitary Sewer Collection Systems: N/A _____ OK _____ See Punch List _____

Sanitary Force Main System: N/A _____ OK _____ See Punch List _____

Lift Station: N/A _____ OK _____ See Punch List _____

Industrial Waste: N/A _____ OK _____ See Punch List _____

Back-flow Preventors: N/A _____ OK _____ See Punch List _____

Punch List: Yes _____ No _____

Comments: _____

***Project Job File:**

Sub-Files All Present: Finance: _____ Engineering: _____ Construction: _____

Permitting: _____ Contract/Agreement: _____ Acceptance: _____

Sub-Files Reviewed for Proper Document Insertion:

By: _____ Date: _____

***Acceptance Check-List:**

Project Billings:

_____ Date Paid: _____

_____ Date Paid: _____

_____ Date Paid: _____

_____ Date Paid: _____

Hydrant Meter Issued: Yes _____ No _____

Hydrant Meter Returned: Yes _____ No _____

Letter to DEP Stating connection to Existing Trunkline System By:

Date: _____ N/A _____

Density Test Reports: Sewer: _____ Water: _____ Force Main: _____

Lift Station:

Certification of Cost: Yes _____ No _____

Maintenance Bond: Yes _____ N/A _____

Easements Recorded: N/A ___ By Plat: _____ Blanket Easement: _____ Legal Description: _____

Agreement for Service: N/A _____ Water: _____ Sewer: _____

Record Documents:

Water Distribution Systems: Record Drawings: _____ CAD Disc: _____ N/A _____

Sanitary Sewer Collection System: Record Drawings: _____ CAD Disc: _____ N/A _____

Sanitary Sewer Force Main Systems: Record Drawings: _____ CAD Disc: _____ N/A _____

*Acceptance Certificate Attachments:

Inspection and Test Results: Water Hydrostatic Pressure Test: _____ N/A _____

Force Main Hyerostatic Pressure Test: _____ N/A _____

Sanitary Manhole Inspection: _____ N/A _____

Sanitary Low-Air Pressure Test: _____ N/A _____

Sanitary Line-Lamping Inspection: _____ N/A _____

Sanitary Line Television Inspection: _____ N/A _____

Back-flow(s) Inspection and Test: _____ N/A _____

Industrial Waste Inspection: _____ N/A _____

DEP Clearance for Use: Water: _____ N/A _____

Sewer: _____ N/A _____

**** PROJECT ACCEPTED BY THE CITY OF HAINES CITY ****

Project Name: _____

Water Clearance Only:*** _____ Date: _____
Signature of the Director (or Designee)

*** All Applicable Acceptance Certificate Attachments for Water System Must be Present.

Complete Project Acceptance _____ Date: _____
Signature of the Director (or Designee)

ALL PERTINENT BLOCKS WILL BE INITIALED AND/OR DATED

“CHECK MARKS SHALL NOT BE USED”

APPENDIX “B”

LIST OF MATERIAL

AND

APPROVED MANUFACTURES

I. WASTEWATER MAIN MATERIALS

<u>ITEM</u>	<u>MANUFACTURERS</u>	<u>PART NO. OR DISCRPTION</u>
AIR RELEASE / VACUUM RELIEF VALVES AND FORCE MAIN	<ol style="list-style-type: none"> 1. Apco 2. Val-matic 	443 with attachments minimum VM-801-ABW
CASING SPACERS (POLY)	<ol style="list-style-type: none"> 1. BWM 2. CASCADE 3. PSI 	BWM-SS-8 (4" to 20") BWM-SS-12 (24" to 36") CCS-12" Width Min. C12G-2
CHECK VALVES (4" & LARGER)	<ol style="list-style-type: none"> 1. Kennedy 2. M & H 3. Mueller 4. Clow 5. American Flow Control 	D.I. body, rubber seat, weighted lever, fusion bond, epoxy coated
EPANSION JOINTS	<ol style="list-style-type: none"> 1. Mercer 2. Metraflex 3. EBBA Iron 	
FITTING M.J.	<ol style="list-style-type: none"> 1. Union 2. U.S. Pipe 3. NAPPCO 4. American Ductile Iron Pipe 5. Tyler 	
FREEZE PROTECTION VALVE	<ol style="list-style-type: none"> 1. Conbraco 	1. 40-000-FPV1
STANDARD MANHOLE FRAME AND COVER	<ol style="list-style-type: none"> 1. U.S. Foundry 	1. USF #663-AB-M
<u>LOCKABLE</u> MANHOLE FRAME AND COVER	<ol style="list-style-type: none"> 1. U.S. Foundry 	1. USF #663 RING & AB/M COVERS BWT
MANHOLE JOINTING MATERIAL	<ol style="list-style-type: none"> 1. K.T. Snyder Co. Inc. 2. Conseal 	

<u>ITEM</u>	<u>MANUFACTURERS</u>	<u>PART NO. OR DISCRPTION</u>
MANHOLE SURFACE COATING PAINTING: AERIAL PIPING AND FITTINGS		Water Based Epoxy
A. FIELD PROMER B. FINISH (EXTERIOR)		Alkyd Metal Primer Alkyd Gloss Enamel
PIPE (DI)		Pressure Class 150 Minimum Interior coating "Protecto" 401' or equal.
PIPE FORCEMAIN		1. C900, DR minimum 2. HDPE Driscipline 4000 series, DR II
PIPE (PVC) GRAVITY		SDR 35 minimum
GATE VALVES, RESILIENT WEDGE		Fusion Bond Epoxy Coated
RESTRAINED JOINTS	1. Romac Grip Ring 2. EBAA Iron 3. Uniflange	
TAPPING SLEEVES, FABRICATED STEEL		Fusion Bond Epoxy Coated
TAPPING SLEEVES, MJ	1. U.S. Pipe 2. Mueller 3. Tyler 4. American Flow Control 5. M & H 6. Clow	
TAPPING VALVES, RESILIENT WEDGE		Fusion Bond Epoxy Coated
VALVE BOXES	1. Tyler	
VAULT FRAME AND COVER FOR AIR RELEASE / VACUUM RELEF VALVES	1. U.S. Foundry	1. USF #663-AB-M

II. WASTEWATER PUMP STATION METERIALS

<u>ITEM</u>	<u>MANUFACTURERS</u>	<u>PART NO. OR DISCRIPTION</u>
GENERATOR CIRCUIT BREAKER	1. Square D 2. Westinghouse	
GENERATOR SYSTEMS (DIESEL)	1. Generac 2. Onan (Cummins) 3. Caterpillar 4. Tradewinds	
MOTOE AUTOMATIC MEGGER	1. Automeg	
PRESSURE GAUGES	1. Ashcroft 2. H.O. Trerice Co.	
SUBMERSIBLE PUMPS	1. Wemco 2. Davis EMU 3. KSB 4. Hydro Matic	
WETWELL ACCESS	1. U.S. Foundry	
FRAMES AND COVERS	1. Bilco Co.	
CONTROL PANELS	1. Sta-Con, Inc. 2. Quality Control, Inc.	
ALARM HORN (AH)	1. Edwards 2. Wheelock	1. 870-N5 2. 31T-115-R
ALARM LIGHT (AL)	1. American Electric 2. Red Dot	1. F32552 2. 866 B
CONTROL CIRCUIT BREAKER	1. Square D	1. QOU120
CONTROL CIRCUIT TRANSFORMER	1. Square D	1. EO-18
DUPLEX RECEPTACLE GFI (DR)	1. Square D 2. Hubbel	1. GFSR-115-IC 2. GF-5262I
ELAPSE TIME METER (ETM)	1. Engler 2. Hecon	1. AC-200-10NG7 2. TO621134

<u>ITEM</u>	<u>MANUFACTURERS</u>	<u>PART NO. OR DISCRPTION</u>
EMERGENCY	1. Square D	
ENCLOSURE	1. Hoffman 2. Tanco	
FUSE (F)	1. Bussmann 2. Gould-Shawmut	
FLASHER (FL)	1. Sta-Con, Inc. 2. SSAC	1. 008-24-13SP 2. FS-126
FLOAT REGULATOR (FR)	1. Roto-Float	
GENERATOR RECEPTACLE (GR)		
1. 230V, 100A, 3P, 4W	1. Russell-Stroll	1. JRSB1044FR
2. 230/460V, 200A, 3P, 4W	2. Russell-Stroll	2. JRSBZ044FR
INSIDE DROP BOWL	1. Reiner / Duran Inc.	
MAIN SILENCE BUTTON (HSS)	1. Westinghouse 2. Square D	1. PB1AAH 2. 9001-SKR-1U
MAIN CIRCUIT BREAKER (MCB)	1. Square D	
MAIN CIRCUIT TRANSFORMER (MCT)	1. Square D	1. 500 SV43F
MOISTURE AND TEMPERATURE FAILURE LIGHT (MT)	1. Dialco 2. Littlefuse	1. 803-1710 2. 930407X
MOTOR CIRCUIT BRAKER (MB)	1. Square D	
MOTOR STARTER (MS)	1. Westinghouse 2. Square D	1. A-200 2. D-8536
OVERLOAD HEATER (OL)	1. Westinghouse 2. Square D	
PHASE MONITOR	1. Diversified	1. SLA-230-ASA (230 Volt) 2. SLA-440-ASA (460 Volt)

<u>ITEM</u>	<u>MANUFACTURERS</u>	<u>PART NO. OR DISCRIPTION</u>
PILOT LIGHT (PL)	1. Dialco 2. Littlefuse	1. 803-1710 2. 93047X
PUMP AUTOMATIC ALTERNATOR (PAA)	1. Diversified	1. ARA-120-ACA
RELAY (R)	1. Potter Burmfield	1. KRPA-11AN 2. 22 Series
RESISTOR 5 watt, 2500 ohm	1. Rockwood	
RUN INDICATOR	1. Dialco 2. Littlefuse	1. 803-1710 2. 930407X
SURGE PROTECTOR (LA)	1. Volt-Guard	1. VGX
TERMINAL STRIP (TS)	1. Marathon 2. Square D 3. Phoenix	1. Series 200 2. 9070-GR6 3. UKK B3

III. WATER AND REUSE MAIN MATERIALS

<u>ITEM</u>	<u>MANUFACTURERS</u>	<u>PART NO. OR DISCRPTION</u>
AIR RELEASE VALVES	1. Apco 2. Val-matic	S-200A (2" NPT) Series 38 (Model #38.2)
AUTOMATIC FLAUSH DEVICE	1. Hydro-Guard	HG-1
WATER SAMPLING STATION	1. GIL Industries	EH101-30
CASING SPACERS (POLY)	1. BWM 2. CASCADE 3. PSI	BWM-SS-8 (4" to 20") BWM-SS-12 (24" to 36") CCS-12" Width Min. C12G-2
CORPORATION STOPS	1. Ford 2. McDonald	1. G-1000-4, FB-1000-7 2. 4701-22, 40701B-22
CURB STOP	1. Ford 2. McDonald 3. Mueller	1. Single Service: KV43-342W, KV43-444W, B1323W, B13344W Double Service / Branch: UV43-32W-75, UV43-42-75 Water Sampling Station: B41-343 2. Single Service: 4602-22, 6101MW Double Service: 09U2AW 3. Single Service: 1" H14258, ¾" B234351R, 1" B24351R Double Service / Branch: H15363-03, H15363
EXPANSION JOINTS	1. Mercer 2. Metraflex 3. EBBA Iron	

<u>ITEM</u>	<u>MANUFACTURERS</u>	<u>PART NO. OR DISCRIPTION</u>
FIRE HYDRANTS	<ol style="list-style-type: none"> 1. Mueller 2. Kennedy 3. American Flow Control 4. M & H 5. AVK 	<ol style="list-style-type: none"> 1. Super Centurion 250 2. Guardian K-81A 3. WB67 4. Model # 129 5. Series 2780
FITTINGS D.I.	<ol style="list-style-type: none"> 1. Union 2. U.S. Pipe 3. Nappco 4. American Ductile Iron Pipe 5. Tyler 	
GATE VALVES,	<ol style="list-style-type: none"> 1. Clow 	Fusion Bond Epoxy Coated
RESILIENT WEDGE	<ol style="list-style-type: none"> 1. U.S. Pipe 2. American Flow Control 3. M & H 4. Kennedy 5. Mueller 6. AVK 	Series 25
HYDRA-STORZ	<ol style="list-style-type: none"> 1. Hydra-Shield 	5" Quick Connect: HYST/50ST/45NH Connector Storz Blind Cap: ADPT/50ST/BC-ORG
HYDRANT PAINT	Dupli-Color Dupli-Color	CS101 Chrome Spray Paint DE1620 Chevy Orange Spray Paint
LOCKSEAL STUD (EXTRA LONG)	SUNSTATE METER	Part# 93210142
LOCKSEAL STUD (WITH SEAL)	SUNSTATE METER	Part# RFLSH

<u>ITEM</u>	<u>MANUFACTURERS</u>	<u>PART NO. OR DISCRIPTION</u>
PIPE (DI)		Pressure Class 150
PIPE (PVC)		C900, DR18 Minimum HDPE Driscopipe
POLYETHYLENE TUBING	1. Endot Pure Blue 2. Vanguard	
RESTRAINED JOINTS	1. Romac Gripring 2. EBBA Iron Inc. 3. Uniflange	
SERVICE SADDLES	1. Smith Blair	Double Strap
TAPPING SLEEVES, FABRICATED STEEL		Fusion Bond Epoxy Coated
TAPPING SLEEVES, M.J.	1. U.S. Pipe 2. Mueller 3. Tyler 4. American Flow Control 5. Clow 6. M & H	
TAPPING VALVES, RESILIENT WEDGE		Fusion Bond Epoxy Coated
TRACER WIRE	1. Underground Feeder	10 Gauge UF Solid
SHAFT CATHODIC TEST BOX	1. Bingham & Taylor	P200 NFG Test
VALVE BOXES	1. Tyler	
VAULT FRAME AND COVER	1. U.S. Foundry	1. USF #663-AB-M
WIRE CONNECTORS	1. Buchanon	

END OF APPENDIX "B"