

# ARTICLE 1

## GENERAL PROVISIONS

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The Standards set forth in this Manual are meant to provide minimum Standards for the design and construction of facilities which meet the following conditions:

- 1) Public and private facilities, to be constructed within the City's corporate limits.
- 2) Facilities to be dedicated to the City for ownership.
- 3) Facilities to become future additions to the City's utilities and transportation systems.

This Manual is not meant to be totally restrictive in nature; that is, it does not depict the only acceptable method of design. Rather, its purpose is to describe minimum acceptable Standards of construction and to promote uniformity. The individual requirements of the Manual shall be superseded by the requirements established for Specially Planned Areas, Historic and Traditional Neighborhood Districts and the Comprehensive Plan, where applicable.

Should any design be submitted which varies appreciably from the Standards set herein or uses materials other than those recommended, it must be accompanied by appropriate supporting documentation or engineering studies for review and is subject to the approval of the City Engineer or his Designee.

All plans submitted for review must be in conformance with all Federal, State and City regulations and codes. In no case shall minimum standards be less than those established by recognized governmental agencies, unless stated otherwise in these

Specifications.

Where a certain manufacturer is specified for a particular piece of equipment, non-specified product equals may be approved by the City Engineer or his Designee after submittal of request in writing and accompanied by supporting documentation. An approved Manufacturer's List is attached as part of this Manual to assist the Engineer and the Contractor.

Pre-application meetings are recommended and pre-Construction conferences are mandatory between the Owner/Developer, his Engineer, all utilities, and the City Staff when City facilities are involved.

**Section 1.02                    REFERENCE MATERIALS**

Unless otherwise stated, the most recent publications of the following organizations shall be referred to as required. Other publications may be used in the implementation of the Standards.

- A)     Water Pollution Control Federation (WPCF)
- B)     American Society for Testing Materials (ASTM)
- C)     United States Occupational Safety and Health Administration (USOSHA)
- D)     American Association of State Highway and Transportation Officials (AASHTO)
- E)     American National Standards Institute (ANSI)
- F)     American Water Works Association (AWWA)
- G)     National Fire Protection Association (NFPA)
- H)     National Science Foundation (NSF)
- I)     American Society of Civil Engineers (ASCE)
- J)     Florida Department of Transportation (FDOT)
- K)     Institute of Transportation Engineers (ITE)
- L)     Federal Highway Administration (FHWA)
- M)     American Asphalt Institute (AAI)
- N)     Portland Cement Association (PCA)

- O) American Concrete Institute (ACI)
- P) Underwriters Laboratories, Inc. (UL)
- Q) Insurance Services Office (ISO)

**Section 1.03                    PRE-CONSTRUCTION CONFERENCE**

It shall be required that a pre-construction conference between the Owner/Developer, his Engineer, his Contractor, all utilities, and the City Staff be held at least 5 days before commencement of any construction within the corporate limits of the City of Oviedo. All applicable City, State and Federal Agency permits are required prior to the pre-construction meeting.

**Section 1.04                    UTILITY COORDINATION**

It shall be up to the Owner/Developer to coordinate all utilities concerning development. All utilities shall be given notice prior to commencement of construction.

**Section 1.05                    UTILITY CONSTRUCTION**

Utility lines of any kind, including, but not limited to, traffic signal systems, street lighting, those of franchised utilities, electric power and light, telephone and telegraph, cable television, water, sewer, and gas, shall be constructed and installed beneath the surface of the ground unless it is determined by the City Engineer, and approved by City Council, that soil, topographical, or any other compelling conditions make the installation of such utility lines as prescribed herein unreasonable or impractical. It shall be the Owner's/Developer's responsibility to make the necessary arrangement with each utility in accordance with the utility's established policies. The underground installation of incidental appurtenances such as transformer boxes, pedestal mounted boxes for electricity, or similar service hardware necessary for the provision of electric and communication utilities may be required at the discretion of the City Engineer. When appropriate, all materials shall be Listed for the purpose for which it is used.

**Section 1.06                    START OF CONSTRUCTION**

The City Engineer or his Designee shall be notified, in writing, at least 5 days in advance of the proposed date of the beginning of construction. Any time that work is to stop for a period of time in excess of 5 working days, other than stoppage beyond the Contractor's control, and holidays, the City Engineer shall be notified in writing of such interruption. The Engineering Plans, as approved by the City, and all revisions shall be readily accessible to City personnel during all periods of activity. No activity shall be permitted without these documents on-site. Someone of responsible charge must be on-site during construction activities.

**Section 1.07            CONSTRUCTION COMPLETION**

All requirements stated in the LDC shall be complied with by the Owner/Developer prior to any occupancy of any private or public improvements.

**Section 1.08            OFF-SITE POLLUTION PROTECTION**

It shall be the Owner's/Developer's responsibility to provide, in accordance with the LDC, all associated Ordinances and State and Federal Agencies, downstream siltation protection during construction. In any event, it shall be the Owner's/Developer's responsibility to remove any downstream siltation prior to the time of final inspection. Air pollution, such as dust, shall also be controlled at all times.

**Section 1.09            INSPECTION**

1.09.01            Periodic

Representatives of the City shall periodically visit the project site to make a visual inspection of the progress of the work and methods of construction. Upon observation of work not done in accordance with the Plans and Specifications, the City will notify the Owner's/Developer's Contractor and the Owner/Developer or his Designee and request that the necessary corrections be made. All inspections shall be scheduled a minimum of 24 hours in advance.

1.09.02            Final

The City shall be notified when the project is complete. Upon receiving at least a 48 hour prior request, excluding weekends and holidays, for final inspection of the completed work, the City's representatives, together with the representatives of other interested agencies, shall perform the final inspection. The following submittals shall be required prior to Final Inspection: Payment for any failed material tests, all applicable Certifications of Completion and Record Drawings.

**Section 1.10            TRANSFER OF PRIVATE OWNERSHIP**

When transfer of private facilities to public ownership is desired and the City Engineer concurs, all such private facilities shall be brought up to the current City Standards at no cost to the City, in so far as construction and maintenance are concerned, before the City will accept such facilities. Proof of satisfactory completion of the facilities, approved construction plans as Record Drawings, the 2 year maintenance bond with itemized construction costs, Bill of Sale for improvements dedicated to the City, and the appropriate legal documents shall be furnished to the City Engineer prior to acceptance.

**Section 1.11            PROPERTY OWNERSHIPS**

All facilities to be owned and maintained by the City shall be located on City property,

within City rights-of-way, or in easements dedicated to the City for the uses intended.

**Section 1.12 PLANS AND SPECIFICATIONS**

1.12.01 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 inch or larger to permit photographic reproduction. Submittal of Specifications shall only be required when special facilities outside the scope of this Manual are proposed. All Plan sheets, manual sheets and the title page of submitted Specifications must be signed, sealed and dated by the Developer's Engineer.

1. 12.02 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 and wastewater systems. Main sizes shall be indicated on the Master Plan.

1. 12.03 Plan and Profile

All utilities including gravity sewers, all wastewater force mains, storm sewers and off-site water mains shall be drawn in plan and profile. On-site water mains may be shown in plan view only.

Whenever possible, on-site water 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) Plan and profile with elevations at 100 foot intervals, 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 outside of paved areas.
- 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 appurtenances.

- 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) Location(s) and general layout of wastewater pumping stations.
- N) Construction notes regarding cover, horizontal and vertical control, special construction requirements, and references to standard and special details.
- O) Point of Service for fire sprinkler system and location of fire department connection.

1. 12.04      Details

The Plans shall include all applicable Standards as identified in this Manual with appropriate Details. 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.

1. 12.05      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' horizontally and 1' to 5' vertically. Special details shall be of sufficiently large scale to show pertinent construction information.

1. 12.06      Complete Submittals

Plans for any review and submittal shall be complete. The Owner shall be responsible for payment of fees when the City provides reviews more extensive than reasonably expected due to the submittal being incomplete and/or inadequate.

## ARTICLE 2

### DEFINITIONS

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Except where specific definitions are used within a specific ARTICLE or Section of this resolution or the purpose of such Sections, the following terms, phrases, words, and their derivation shall have the meaning given herein when not inconsistent 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 Oviedo, Florida.

City Engineer - means the Engineer or other appointed officer of Oviedo, Florida, acting directly or through an assistant or other appointed representative, acting only within the scope of the particular duties assigned by the Land Development Code.

Construction Inspector - means the construction representative of the Director of Public Works or other field appointed representative, acting only within the scope of the particular duties assigned by the City Engineer.

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

Developer - means any person or legal entity who is responsible for any undertaking that requires an administrative or regulatory permit.

DIPRA - means Ductile Iron Pipe Research Association.

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

Engineer - means a Professional Engineer or engineering firm registered with the Florida State Board of Professional Engineers, other than direct employees of the City of Oviedo, retained to provide

professional engineering services for a project.

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; as well as the design of subsurface drainage systems and the improvement of soil properties and foundation conditions; as well as testing and evaluation of construction materials.

ISO - means Insurance Services Office. Any reference to ISO Standards shall be taken to mean the most recently published revision unless otherwise specified.

Landscape Architect - means a Registered Florida Landscape Architect who provides professional services related to the planning and development of land and incidental water areas, where the purpose of these consulting services is the preservation, conservation, enhancement, or determination of land uses, natural and man-made features, siting of buildings and structures, grounds and approaches, the setting of grades, contouring of land and water forms, determination of stormwater drainage, and irrigation systems. (From Florida Statute Chapter 481, Part II.)

LDC - means the Land Development Code of the City of Oviedo, Florida.

Listed - means equipment, materials, or services included in a list published by an organization acceptable to the authority having jurisdiction and concerned with evaluation of products or services that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states either that the equipment, material, or service meets identified standards or has been tested and found suitable for a specified purpose.

Manual - means this City of Oviedo Engineering Standards Manual.

MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD) - means the United States Department of Transportation Manual on Traffic Control Devices, latest edition, unless otherwise specified.

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.

OSHA - means the Federal Occupational Safety and Health Administration. Any reference to OSHA Standards shall be taken to mean the most recently published revision unless otherwise specified.

Owner - means any person or legal entity having sufficient proprietary interest to undertake development pursuant to the Land Development Code.

Plans - means Drawings as defined herein above.

Public Works Director - means the Engineer or other appointed officer of Oviedo, Florida, acting directly or through an assistant or other appointed representative, acting only within the scope of the particular duties assigned by the Land Development Code.

Specifications - means the specifications contained in this Manual.

Standards - means the minimum design Standards contained in this Manual.

Standard Specifications - means the Department of Transportation, State of Florida, Standard Specification for Road and Bridge Construction, latest edition, unless otherwise specified.

Substantially Completed - means that date when the work is completed in accordance with this Manual or the Projects Contract Documents, with the exception of the minor items identified during the inspection process. Upon substantial completion, the work can be utilized for the purposes for which it is intended if the public's health, safety, and welfare will not be endangered.

Typical City Details - means the detailed drawings in this Manual related to general civil engineering materials and installation.

## ARTICLE 3

### DESIGN STANDARDS

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The lands included within the development shall be suitable for the various purposes proposed and shall not be subject to poor drainage, erosion or other conditions detrimental to the health, safety and general welfare of the public. Further, no development plan shall be approved unless the City finds, after full consideration of all pertinent data, that the development can be served adequately with such normal public facilities and services as are suitable in the circumstances of the particular case. The Owner/Developer shall be responsible for the acquisition of all materials, installation and construction costs, and legal documentation for all on-site and off-site activities of the proposed development.

A Professional Engineer, registered in the State of Florida and qualified by virtue of training and experience to practice the engineering discipline involved, shall be employed to design all required improvements such as streets, traffic control, drainage structures, bridges, bulkheads, and sewer facilities, and to provide such professional services during construction as are generally considered to be part of a complete engineering service. Upon request, the Owner/Developer shall submit to the City Engineer signed documentation to this effect. All plans for improvements shall be prepared and sealed by such Engineer and approved by all appropriate regulatory agencies and the City prior to the commencement of the improvements. Street lighting for the development shall be prepared by the power company supplying service to the development. Florida Statute shall govern the preparation of all site plans and related engineering drawings submitted to the City.

### 3.01.01 Conformance with City Policy

The subdividing and/or development of any areas shall conform to the adopted general goals and objectives of the City with respect to the physical development of the City as set forth in various documents including, but not limited to:

- A) The Oviedo Comprehensive Plan.
- B) City policies and Services and Facilities as enunciated by applicable City Ordinances.
- C) The Land Development Code of the City of Oviedo.
- D) The Engineering Standards Manual.
- E) Ordinances of the City of Oviedo.

### 3.01.02 Use of Natural Features

The arrangement of structures, stormwater systems, lots and blocks, and the street system shall make the most advantageous use of topography and preserve mature trees, wetlands, and other natural features wherever possible.

### 3.01.03 Consideration of Soil and Flood Hazards

All land intended for use in a development plan for building sites must be able to be used safely for building purposes without danger from flood or other inundation, or from adverse soil or foundation conditions or from any other menace to health, safety, or public welfare. In particular, lands which are within the 100 year flood prone areas shall not be developed until proper provisions are made for protective flood control measures and water management facilities necessary for flood free development. No filling or grade level change shall be permitted which will reduce the flood storage volume available between the base flood elevation and the normal ground water elevation to adversely affect any surrounding area. Requirements for development within the 100 year flood plain are contained in the LDC. The Seminole County Soil Survey is to be used as a guideline in identifying soil properties and interpretations for various uses in terms of soil limitations and soil features adversely affecting a particular use.

The following Standards shall be followed in areas of low and very low potential soils:

- A) Soils with either very low potential or low potential for purposed uses, as identified in the Soil Survey, shall not be developed unless such soils are removed or modified to accommodate the intended use, as approved by the City Engineer.
- B) Public facilities shall not be constructed where the soil performance for said

public facility is of low or very low potential, except in cases of overriding public interest.

- C) Dedication shall not be accepted for public ownership or maintenance of utilities or roads constructed in areas where soil performance for said facilities is of low or very low potential.

#### 3.01.04 Special Considerations

Special consideration shall be given in the layout of streets, lots, blocks, buildings, and easements to the preservation of large and specimen individual trees as identified by the Oviedo Comprehensive Plan. Special consideration shall also be given to preserving natural drainage methods and natural topography and landscape. Special consideration shall be given to providing special screening, landscaped or natural buffers, or landscaped berms where developments abut non-compatible land uses in accordance with the LDC. Special consideration shall be given to conformance with streets and driveway spacing Standards in accordance with the LDC and this document. Special consideration shall be given during the development design process to not only make the site accessible to the public through the use of handicap parking and ramps, off-site sidewalks/bikeways, and interconnection of adjacent sites; but also where possible encourage the use of alternative mode of travel by providing transit stops and shelters, on-site sidewalks/bikeways, bike racks, and signed and marked reserved employee ride share parking spaces.

### **Section 3.02 STREETS AND OTHER PAVEMENTS**

#### 3.02.01 General

The design character, width, grade and location of all streets and bridges shall conform to the Standards in this Section and shall be considered in their relation to existing and planned streets, to topographical conditions, to public convenience and safety, and in their appropriate relation to the proposed uses of the land to be served by such streets. Whenever not modified by these Standards, the guidelines of the Manual of Uniform Minimum Standards for Design, Construction and Maintenance for Streets and Highways, (FDOT), and the Standards of the American Association of State Highways and Transportation Officials, referred to therein, shall be the minimum acceptable standard.

#### 3.02.02 Minimum Standards For Right-of-Way Improvement

- A) It is the intent of the City that every new residential lot or non-residential development shall construct its portion of the city wide pedestrian bikeway system. If a variance to these provisions is granted, the Owner/Developer shall execute a sidewalk agreement with the City to ensure the future installation of the facilities.
- B) Driveway Approaches: Driveway approaches shall be 3,000 psi concrete, at

least 6 inches thick, with break and exposed joints at property line. Sidewalk/bikepath shall be constructed with the driveway section. Exposed joints shall be installed at the tie-in point with sidewalks and curbing. Reinstallation to maintain a slope of ¼ inch per 1 foot horizontal.

C) Streets: Abutting rights-of-way shall be paved as hereinafter specified.

1) Design Specifications

Streets shall be classified based on the definitions and with consideration of vehicle trip generation ratios unless superseded by alternative ratios adopted by the City. Where the City has adopted a higher classification than the classification based on projected traffic volumes, the higher classification shall be used. All streets shall be designed in accordance with the Manual of Uniform Minimum Standards for Design, Construction and Maintenance for Streets and Highways (FDOT), LDC, and the following minimum specifications, except that greater requirements must be met when imposed by an agency having jurisdiction of a particular road. Horizontal alignments shall be based on a minimum design speed of 35 MPH except for local residential streets. Local residential streets shall have a minimum back of curb horizontal curvature of 50 feet without superelevation.

2) Minimum Street Grade Specifications

Percent Grade of Roadway

	Arterial	Collector	Local
<u>Centerline:</u>	<u>Street</u>	<u>Street</u>	<u>Street</u>
Maximum	10%	10%	10%
Minimum	0.50%	0.50%	0.50%

Slopes less than 0.50% shall require special approval by the City Engineer.

The minimum cross slope shall be 2% except in necessary transitions.

3) Intersection Design

a) Streets and driveways shall be laid out to intersect as nearly as possible at right angles (90°) or radial, however, in no case shall the angle of the intersection be less than 60°. Multiple intersections involving the juncture of more than 2 roadways and driveway approaches shall be prohibited. The gradient within 100 feet of the intersection and driveway shall not exceed 3%. The design shall comply with the Specifications contained in the Manual of Uniform Minimum Standards for

Design, Construction and Maintenance for Streets and Highways (FDOT).

- b) A minimum sight distance of 250 feet from any intersection shall be maintained on the intersecting streets. Greater distances may be required to satisfy FDOT and the Manual of Uniform Minimum Standards for Design, Construction and Maintenance for Streets and Highways (FDOT). In all cases, clear sight distance from any intersection shall be maintained on the adjoining streets.

4) Radii at Intersections

The minimum intersection radii of back of curb at all typical intersections approximating a right angle shall be as follows:

<u>Category</u>	<u>Minimum Radius</u>
Local to Local - Residential	25'
Local to Local - Non-Residential	35'
Local to Collector	35'
Local or Collector to Arterial	50'
Collector to Collector	30'

A deceleration lane and taper shall be required as outlined in ARTICLE 23 of this Manual. A minimum radius of 30 feet shall be provided at all intersecting right-of-way lines.

The design and construction of larger or smaller radii maybe required by the City Engineer or his Designee based upon the type of design vehicles and design speed of the roadway.

5) Pavement Specifications

Improvements designed as above shall be provided as required by the following schedule:

- a) For residential developments, improvements shall conform to STANDARD A.
- b) For all other developments, improvements shall conform to STANDARD B.
- c) Where the proposed development includes or abuts an existing full or half right-of-way street, said street shall also be improved as required to conform to the following Standards.
- d) When a modification to the width of an existing roadway is

necessary, a minimum of 1 inch of asphaltic concrete overlay with leveling shall be installed the full length and width of the entire affected section of the adjacent roadway.

STANDARD

- A B 1) Grading and centerline gradients shall be provided per plans approved by the City.
- 2) Curb and gutters shall be provided as follows:
  - A a) Standard 24 inch wide Miami Residential or FDOT Type F curb and gutter.
  - B b) Standard 24 inch wide FDOT Type F curb and gutter.
  - A B c) Standard Type A concrete curb shall be used on center medians and islands.
  - A B d) Density under curb and gutter shall be to a minimum density of 98% of the maximum density determined by AASHTO T-180.
- A B 3) Subbase shall be approved by the City Engineer as being suitable material prepared in accordance with Standards established by this Manual. Twelve inches shall be the minimum thickness unless otherwise stated in this ARTICLE.
- 4) Pavement base shall be improved as follows:
  - A B a) Arterial Streets:  
10 inch compacted limerock
  - B b) Collector and Commercial Streets:  
10 inch compacted limerock
  - A c) Local Streets:  
8 inch compacted limerock

Note: an equivalent type base material may be approved by the City Engineer if field situation dictates.
- 5) Wearing surface shall be improved as follows:
  - A B a) Arterial, Collector and Commercial Streets:  
1-¾ inch structure course and 1 inch friction course. Non-skid surfaces may be required. FDOT Type S-I asphaltic concrete shall be used unless otherwise approved by the City Engineer.

- A B b) Local Streets:  
1-¾ inch asphaltic concrete surface course or the equivalent as meeting Standards established by the City. Non-skid surfaces may be required. FDOT Type S-III asphaltic concrete shall be used unless otherwise approved by the City Engineer.
- A B 6) Grassing and mulching of flat areas, or sodding of swales, parkway medians, percolation areas, and planting strips shall be in accordance with City Standards. In no case shall mulching of driveways be permitted.
- A B 7) Street name signs, in accordance with City specifications, with appropriate block numbers, shall be installed on all public streets at all intersections, by the City, upon notification from the Developer in writing that the roads are complete. The Owner/Developer shall order and pay for all such signage, including installation cost, prior to issuance of any building permits. The signs shall be in place prior to the City's final acceptance of the roadway.
- A B 8) Street lighting shall be installed at the expense of the Developer, either by the Owner/Developer and 2 year up-front fees paid to the City. All utilities are to be installed underground. Poles shall not be placed in medians or directly adjacent to the roadway or within sidewalks/bikeways. Wherever practical, poles shall not be installed immediately adjacent to sidewalks/bikeways. The poles shall be placed either in an easement or adjacent to the right-of-way line to allow a minimum 5 foot clearance from the nearest edge of pavement. Location modification shall be specifically approved by the City Engineer prior to installation.
- A B 9) Traffic control devices such as signs and pavement markings and traffic signalization devices shall be installed by the Owner/Developer at the Owner's/Developer's expense within the project area and on abutting streets and highways in accordance with the MUTCD and as approved by the City Engineer. Modification requests shall be specifically approved by the City Engineer prior to installation.
- A B 10) For two years from City Council's project acceptance, the Owner/Developer shall warranty all constructed facilities in public rights-of-way and easements.

### 3.02.03 Additional Right-of-Way and/or Pavement Width

Whenever any street shows future need for improvement within the area to be developed, the appropriate right-of-way or pavement width, in conformance with minimum City Standards shall be required to be dedicated as outlined in LDC.

Half streets and substandard rights-of-way and pavement widths shall be prohibited. Where a previously dedicated incomplete or substandard street, improved or unimproved, abuts or is within a tract to be developed, the remainder of the right-of-way shall be dedicated and the full street improved according to City Standards.

#### 3.02.04 Access

Vehicular access shall be provided as follows and as outlined in the LDC.

- A) Minimum number of access points to adequately serve the development without decreasing the safety and capacity of the public rights-of-way. Joint-use driveways may be required by the City. All developments shall also be evaluated by the City of Oviedo Fire Rescue Department for emergency access.
- B) In order to provide ease and convenience for ingress and egress to private property, with maximum safety and the least interference to the traffic flow on public streets, the number and location of driveways for roadways with classification of collector and above, shall be regulated by the dedication of access rights to the City and by the LDC.
- C) Deceleration and acceleration lanes, left-turn lanes, bypass lanes, and tapers are required on all collectors and above unless exempted by the City Engineer. Median relocations and modifications or other design features may be required at the discretion of the City Engineer to protect and maintain the safe and efficient operation of the public rights-of-way.
- D) All buildings, when constructed, shall be accessible to fire department apparatus by way of access roadways with an all weather driving surface of not less than 20 feet of unobstructed width and a turning radius of 40 feet capable of supporting the imposed loads of fire apparatus. This access shall also have a minimum vertical clearance of 13 feet 6 inches. All hydrants shall remain serviceable during project construction, unless otherwise approved by the City of Oviedo Fire Rescue Department.
- E) Driveways shall be installed as depicted in ARTICLE 24 of this Manual.

#### 3.02.05 Paved Access to Nearest Paved Public Road

A development shall abut or have as its primary access onto a street designed and paved to City Standards. This street shall be upgraded by the Owner/Developer from the entrance of the development to the nearest public paved road of proper functional classification as determined by the City Engineer.

#### 3.02.06 Commercial/Industrial Driveways and Internal Circulation

- A) Vehicular circulation must be completely contained within the property. Vehicles located within one portion of the development must have access to all portions without using the adjacent street system.
- B) Acceptable plans must illustrate that proper consideration has been given to the surrounding street plan, traffic volumes, proposed street improvements,

vehicular street capacities, pedestrian movements, and safety.

- 1) Driveways directly accessing thoroughfares or accessing local streets adjacent to thoroughfares shall meet the design requirements of the LDC.
  - 2) Driveways accessing other local streets shall not intersect or be nearer than 50 feet (20 feet for residential) to the adjacent driveway without the approval of the City Engineer. Where possible, driveways shall be located a minimum of 200 feet (50 feet for residential) from public intersections. Measurement is based on nearest edge of pavement to nearest edge of pavement.
- C) Deceleration lane and tapers shall be required as outlined in ARTICLE 23 of this Manual.
- D) Appropriate special radii shall be designed, subject to the approval of the City Engineer for other than right-angle (90°) intersections.

**Section 3.03 EASEMENTS**

Easements shall be centered on rear or side-lot lines where necessary. Easements shall be provided as determined by the LDC. “Vehicular Access Easements” shall be located as approved by the City Engineer.

Where necessary for safety and convenience, “Construction Easements” of suitable width shall be required as determined by the City. No public easement shall be occupied without first obtaining a Right-of-Way Utilization Permit. When encroachment is desired, the applicant shall contact all utilities doing business within the City, prior to the City granting permit.

“Joint-Use Access Easements” shall be required, as necessary, to provide safe and adequate access to a site and for the protection of the capacity and safety of the adjacent roadway.

Any off-site easements, needed to make the system function, shall be included in the proposal for development and made a criteria for plan approval.

Easements for all facilities must be shown on construction drawings and approved by the City. The easement documents and rights-of-way deeds must be executed, accepted by the City, and recorded in the Public Records prior to issuance of a building permit. All easements for private developments shall be provided at no expense to the City.

**Section 3.04 SURVEY MONUMENTS**

Permanent Reference Monuments (PRMs) and Permanent Control Points (PCPs) shall

be placed as required by Florida Statutes. A letter from a registered Land Surveyor certifying that all monuments, PCPs, PRMs are in place as of the date of the project acceptance shall be required of all developments. The Contractor shall be responsible for re-establishing all disturbed survey markers and/or monuments. All survey work shall be performed in accordance with pertinent memoranda and shall comply with Minimum Technical Standards, as adopted by the Florida Board of Land Surveyors, pursuant to Florida Statutes.

**Section 3.05 CURBS AND GUTTERS**

All streets shall be paved and drained in accordance with FDOT Standard curb-and-gutter (or Miami curb in residential areas), unless otherwise specifically approved by the City Engineer. Curbing shall be used for stormwater conveyance, traffic control channelization, and the protection of landscaped areas.

The width of the curb and gutter shall be a minimum of 24 inches and shall be as outlined by this Manual. Simple vertical curbing within rights-of-way will not be acceptable to the City. Approved mountable median curb, of the FDOT type, may be used, as approved by the City Engineer. All curbing designed to handle water shall incorporate an approved gutter design.

No water valve boxes, meters, portions of manholes, or other appurtenances of any kind relating to any underground utilities shall be located in any portion of a curb-and-gutter section. The minimum allowable flow line grade of curbs and gutters shall be 0.40% except in intersections where flatter grades shall be allowable. Cross-street valley gutters shall not be allowed. Underdrains shall be installed in accordance with ARTICLE 17 of this Manual.

**Section 3.06 STORMWATER MANAGEMENT**

**3.06.01 General Requirements**

Protection of water resources is critical to the public health, safety, and welfare. Innovative approaches to stormwater management shall be encouraged and the concurrent control of erosion, sedimentation, and flooding shall be mandatory. No site alteration shall cause siltation of wetland, pollution of downstream wetlands, or reduce the natural retention or filtering capabilities of wetlands.

**3.06.02 Stormwater Management**

A complete stormwater management system shall be provided in all areas of the project and for handling stormwater runoff that flows into or across the project area from the outside, without undesired additional flooding of any other land. The system shall be designed for long life, low maintenance cost, and ease of maintenance by normal maintenance method. Soil types shall be considered and full development of the basin assumed for selection of proper runoff coefficients within the basins involved. Refer to ARTICLE 32 of this Manual for design specifications.

Should the proposed development area contain an existing natural watercourse drainageway, channel, etc., such natural watercourse and the vegetation inherent therewith shall be maintained and the proposed development designed so as to preserve same unless otherwise permitted.

3.06.03 Guidelines for Berms

Slopes are preferred to be 4:1 or less on berms and other applications. Slopes 3:1 shall be the maximum permissible slope, unless specifically addressed elsewhere in this Manual, but shall be stabilized with sod or other stabilizing material. Retaining walls require the approval of the City Engineer or his Designee and must be sealed by the Engineer for an walls exceeding 2 feet in height. Where berms or slopes are specifically addressed in other ARTICLES of this Manual, they shall conform to that ARTICLE.

**Section 3.07 DECORATIVE ENTRANCES**

Where a Owner/Developer is specifically permitted by the City to construct decorative landscaping within the right-of-way of any street, the Owner/Developer shall provide a maintenance agreement acceptable to the City for perpetual maintenance of such landscaping and shall provide for removal of such landscaping on order by the City for cause. The City shall not accept liability or responsibility for maintenance of landscaping in rights-of-way and shall be held harmless for any damage done to same in work performed by the City in such right-of-way. The design and maintenance of the landscaping shall comply with the City's set back regulations for fixed object hazards and for driver clear sight distance. Private signs are prohibited within public rights-of-way.

A minimum sight distance per the LDC must be maintained at all public road intersections including those with driveways. Structures are prohibited in the rights-of-way except as permitted by the City Engineer in accordance with the LDC.

**Section 3.08 OWNER/DEVELOPER CONTROL DURING CONSTRUCTION**

The Owner/Developer shall be required during the entire construction period to control, regulate, and maintain the development in such a manner as to prevent the accumulation of trash and debris, resulting from the Owner's/Developer's construction activities, on both the site and adjacent public and private property, which would detract from the enjoyment and pleasure in the natural scenic beauty of the City, and, in turn, injuriously affect the economic well-being of the public. The use of residential lots in nearby developments or Substantially Completed phases of the same development, under the ownership and control of said Owner/Developer, for the bulk storage of construction materials substantially unrelated to the development of those residential lots is prohibited. A development shall be deemed to be Substantially Completed when 70% of the planned units are completed and ready for occupancy, or are actually occupied.

**Section 3.09 EROSION CONTROL**

Seeding, mulching, sodding, and/or other acceptable methods shall be used to prevent erosion during all construction activities per requirements as specified in the LDC.

The Owner/Developer of commercial and residential lots shall be required to maintain curbs and gutters free of accumulations of sand and earth. Temporary siltation basins may be required during construction. Maintenance shall be provided by the Owner/Developer for the 2 year period of the maintenance period and for each lot until final inspection is passed. All actions to prevent erosion or pollution shall be done in accordance with this Manual.

3.09.01 Erosion Control Plan

If required by the City Engineer, the erosion control plans, details, and calculations shall document all the measures necessary to limit the transport of sediments outside the limits of the project to the volume and amount that existed prior to the commencement of construction. This condition shall be satisfied for both the total anticipated construction period at a minimum and for the 2.3 year frequency, 6 hour duration storm event. Provision must be made to preserve the integrity and capacity of check weirs, sediment basins, slope drains, grading patterns, etc. required to meet this provision throughout the life of the construction.

3.09.02 Stockpiling Material

No excavated material shall be stockpiled in such a manner that directs runoff directly off the project site or into any adjacent water body or stormwater collection. No building construction or landscaping materials shall be stored within public rights-of-way or on the streets.

3.09.03 Exposed Area Limitation

The surface area of open, raw, erodible soil exposed by clearing and grubbing operations or excavation and filling operations shall not exceed 10 acres. This requirement may be waived for large projects with an erosion control plan, which demonstrates that opening of additional areas will not significantly affect off-site deposit of sediments.

3.09.04 Inlet Protection

Inlets and catch basins shall be protected from sediment laden storm runoff until the completion of all construction operations that may contribute sediment to the inlet.

3.09.05 Temporary Seeding

Areas opened by construction operations that are not anticipated to be dressed and receive final grassing treatment within 30 days shall be seeded with a quick growing

grass species which will provide an early cover during the season in which it is planted, and will not later compete with the permanent grassing. The rate of seeding shall be 30 lb per acre.

3.09.06        Temporary Seeding and Mulching

Slopes steeper than 6:1 that fall within the category established in 3.09.05 above, shall be mulched an additional 2 inches, loosely measured, with mulch material cut into the soil of the seeded area to a total depth of 4 inches.

3.09.07        Temporary Grassing

The seeded or seeded and mulched area(s) shall be rolled and watered as required to assure optimum growing conditions for the establishment of a good grass cover.

3.09.08        Temporary Regrassing

If, after 14 days, the temporary grassed areas have not attained a minimum of 75% good grass cover, the area will be reworked sufficiently to establish the desired vegetative cover.

3.09.09        Maintenance

All features of the project designed and constructed to prevent erosion and sediment shall be maintained during the life of the construction so as to function as they were originally designed and constructed.

3.09.10        Permanent Erosion Control

The erosion control facilities of the project shall be designed to minimize the impact on off-site facilities. All stormwater discharge from the project limits shall be routed through detention basins to trap suspended sediments. Discharge facilities from these basins shall be provided with a skimming device to trap floatable debris.

3.09.11        Permanent Seeding

All areas which have been disturbed by construction shall, as a minimum, be fertilized and seeded. The fertilizer shall be of 12-8-8 proportions and shall be uniformly spread at a rate of 400-500 lb per acre and mixed with the soil to a uniform depth of 4 inches. Included with the fertilizing operation will be the application of amendments, if necessary, such as dolomitic limestone or aluminum sulfate to correct the pH factor to within the limits of 6.0-7.0. The grass seed shall be uniformly spread at the rate of 100 lb per acre while the soil is moist. The grass seed mixture shall be of 20 parts bermuda and 80 parts bahia, with the addition of 30 parts rye in the winter season.

3.09.12 Permanent Seeding and Mulching

In addition to the minimum requirements of 3.09.11 above, slopes of from 6:1 to 4:1 inclusive shall be mulched an additional 2 inches, loosely measured, with mulch material cut into the soil of the seeded area to a total depth of 4 inches.

3.09.13 Permanent Sodding

All retention/detention basins shall be solid sodded within their limits. All exposed areas within public rights-of-way shall be solid sodded. Other areas with slopes steeper than 4:1 shall be solid sodded.

3.09.14 Strip Sodding

Strip sod shall be placed adjacent to all curbs, walks and pavements.

3.09.15 Regrassing

All grassed areas shall be maintained to assure a good stand and sufficient ground cover to minimize erosion. If, after 60 days, an adequate ground cover has not been established, the area will be regrassed.

3.09.16 Additional Fertilization

Grassed areas not accepted within 90 days of their completion shall be refertilized at an application rate of 250 lb per acre.

**Section 3.10 PHASED DEVELOPMENT**

Each phase of any development shall be capable of standing on its own as if subsequent areas planned for development are not developed.

**Section 3.11 TRAFFIC CONTROL DURING CONSTRUCTION**

The Owner/Developer shall prohibit public traffic from using newly constructed roadways until they are accepted and approved to be opened by the City Engineer or his Designee. Barricades and other safety devices shall remain in place until such time as deemed appropriate to remove them, or until such time as the hazard to health and safety of the general public has been reduced to minimal acceptable standards.

The Owner/Developer shall be required to provide work zone traffic control during construction within the public rights-of-way until approval is given by the City Engineer or his Designee to remove the controls as established in accordance with the MUTCD.

**Section 3.12 RESIDENTIAL DEVELOPMENT**

Residential Developers and Builders shall follow the erosion and sediment control principles and practices above and the following during construction on individual lots:

- A) Silt fences/barriers shall be installed on lot lines adjacent to pond, natural, and conservation areas to minimize erosion. Silt fences/barriers shall also be installed as needed to prevent erosion/flooding of adjacent built-out lots and streets.
- B) During construction, streets shall be kept free of excessive dirt and construction debris. Hay bales, sand bags or other approved erosion and sediment control devices shall be installed and maintained at stormwater inlets. Streets shall not be used for storage of construction materials. Containers shall be provided for holding trash and construction debris.
- C) Prior to final acceptance, erosion and sediment control provisions (sodding and seeding/mulching) on adjacent vacant lots shall be restored. Erosion and sediment control precautions shall be taken where erosion and/or washouts can be anticipated, particularly along side lot lines. All construction debris and excess dirt shall be removed from adjacent vacant lots (including those across the street).

**Section 3.13 TRAFFIC SIGNAL PRE-EMPTION SYSTEM**

All traffic signals shall be equipped with an Opticom Traffic Signal Pre-Emption System. The system shall be usable by a vehicle approaching from all intersection directions. Before installation, the system plans shall be reviewed and approved by the City of Oviedo Fire Rescue Department and Seminole County's Traffic Engineering.

## ARTICLE 4

### EXCAVATION, TRENCHING, AND BACKFILLING

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This ARTICLE covers excavation, backfill, fill and grading associated with utility trench and structural construction. 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, conduits, pipes, roadways and paving; all backfilling, fill and required borrow; grading; disposal of surplus and unsuitable materials; and all related work such as sheeting, bracing and water handling.

<b>Section</b>	<b>4.02</b>	<b><u>SOIL BORINGS AND SUBSURFACE INVESTIGATIONS</u></b>
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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.

<b>Section</b>	<b>4.03</b>	<b><u>EXISTING UTILITIES</u></b>
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The 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.

The City shall not be responsible for uncharted or incorrectly charted water and wastewater mains or other utilities. It is the Contractor's responsibility to ensure that

such facilities exist at the presumed point prior to commencing construction.

**Section 4.04 MATERIALS**

4.04.01 General

Materials for use as bedding and backfill 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.

4.04.02 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.

4.04.03 Common Fill

Common fill shall consist of mineral soil, substantially free of clay, organic material, loam, wood, trash and other objectionable material which may be compressible or which cannot be compacted properly. Common fill shall not contain stones larger than 6 inches in any dimension, asphalt, broken concrete, masonry, rubble, or other similar materials. It shall have physical properties such that it can be readily spread and compacted during filling. Additionally common fill shall be no more than 12% by weight finer than the No. 200 mesh sieve unless finer material is approved for use in a specific location by the City.

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

4.04.04 Select Common Fill

Select common fill shall be as specified above from common fill, except that the material shall contain no stones larger than 1½ inches in largest dimension, and shall be no more than 5% by weight finer than the No. 200 mesh sieve.

4.04.05 Bedding Rock

Bedding rock shall be 3/16 inch to ¾ inch washed and graded stone (FDOT #67). This stone shall be graded so that 90% to 100% will pass a ¾ inch screen and 95% to 100% will be retained on a No. 8 screen. No stones larger than 1 inch in any dimension shall be accepted.

**Section 4.05 SHEETING AND BRACING IN EXCAVATIONS**

4.05.01 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, brace and maintain cofferdams consisting of 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.

4.05.02 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 1 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 shall 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 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 failure to exercise the 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 necessary extent the Contractor deems it desirable for the 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 the Contractor's own expense so as to provide the necessary clearances and dimensions.

**Section 4.06                    DEWATERING, DRAINAGE AND FLOTATION**

4.06.01                    General

The Contractor shall excavate, construct and place all pipelines, concrete work, fill, and bedding rock, in-the-dry. In addition, the Contractor shall not make the final 24 inches of excavation until the water level is a minimum of 1 foot below proposed bottom of excavation. For purposes of these Specifications, “in-the-dry” is defined to be within 2% of the optimum moisture content of the soil. The City reserves the right to ask the Contractor to demonstrate that the water level is a minimum of 1 foot below proposed bottom of excavation before allowing the construction to proceed.

Discharge water shall be clear with no visible soil particles. 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. 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.

4.06.02                    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 wellpoints 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. Wellpoints 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 backfilling and construction, water levels shall be measured in observation wells located as directed by the City.

Continuous pumping shall be required as long as water levels are required to be below natural levels.

**Section 4.07            EXCAVATION**

4.07.01            General

Excavation consists of removal, storage and disposal of material encountered when establishing 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, for convenience, or through failure to properly dewater the excavation or disturbs the subgrade before dewatering is sufficiently complete, the Contractor may be directed by the City to excavate below grade and refill the excavation using select common fill or bedding rock.

Slope 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 stability of the material excavated. Sides and slopes shall be maintained in a safe condition until completion of backfilling.

Contractor shall stockpile satisfactory excavated materials at a location approved by the City until required for backfill or 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.

4.07.02            Excavation For Structures

All such excavations shall conform to the elevations and dimensions shown on the Drawings within a tolerance of plus or minus 0.10 foot 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.

#### 4.07.03 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 dry and in all respects acceptable to the City.

Excavation shall not exceed normal trench width as specified in the Typical City Details attached as part of this Manual. Any excavation which exceeds the normal trench width shall require special backfill requirements as determined by the City.

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

Where the pipes are to be laid directly on the trench bottom, the lower part of the trenches shall not be excavated to grade by machinery. The last of the material being excavated shall be done manually in such a manner that will give a shaped bottom, true to grade, so that pipe can be evenly supported on undisturbed material, as specified in the Typical City Details attached as part of this Manual. Bell holes shall be made as required.

### **Section 4.08 BEDDING AND BACKFILL**

#### 4.08.01 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 layers by a backhoe or other approved method, unless otherwise specified. 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 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, obstructions and deleterious materials. Contractor shall plow strip or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with the existing surface. When existing ground surface has a density less than that specified 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.

Before compaction, material shall be moistened or aerated as necessary to provide the optimum moisture content. 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 this Manual. Backfill or fill material shall not be placed on surfaces that are muddy, frozen or contain frost or ice.

#### 4.08.02 Bedding And Backfill For Structures

Bedding rock shall be used for bedding under all structures as specified in the Typical City Details attached as part of this Manual. 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. Structural fill shall be used as backfill against the exterior walls of the structures. Fill shall be compacted sufficiently in accordance with these Specifications. If compaction is by rolling or ramming, material shall be wet down as required.

Backfilling shall be carried up evenly on all walls of an individual structure. No backfill 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 1 foot above the bottom of the pipes. Structural fill in such areas shall be placed for a distance of not

less than 3 feet either side of the center line of the pipe in level layers not exceeding 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 shall 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.

#### 4.08.03      Bedding And Backfill For Pipes

Bedding for pipe shall be as shown on the plans and as specified in the Typical City Details attached as part of this Manual. 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 practical after the pipe has been laid, jointed and inspected as specified in the Typical City Details attached as part of this Manual.

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 1 foot above the top of the pipe. The filling shall be carried up evenly on both sides. Compaction shall be in accordance with this Manual.

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 this Manual.

### **Section      4.09      COMPACTION**

#### 4.09.01      General

The Contractor shall control soil compaction during construction to provide the percentage of maximum density specified. The Contractor shall provide the City copies of all soils testing reports, prepared by a Geotechnical/Soils Engineer, demonstrating compliance with these Specifications.

When an existing trench bottom has a density less than that specified under these Specifications, the Contractor shall break up the trench bottom surface, pulverize, moisture-condition to the optimum moisture content, and compact to required depth and percentage of maximum density.

#### 4.09.02 Percentage Of Maximum Density Requirements

Fill or undisturbed soil from the bottom of the pipe trench to 1 foot above the pipe shall be compacted to a minimum density of 98% of the maximum dry density as determined by AASHTO T-180.

Backfill from 1 foot above utility pipes to grade shall be compacted to a minimum density of 98% of the maximum dry density as determined by AASHTO T-180.

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

#### 4.09.03 Compaction Tests

One compaction test location shall be required for each 300 linear feet of pipe and for every 100 square feet of backfill around structures as a minimum. The City may determine that more compaction tests are required to certify the installation depending on field conditions. The locations of compaction tests within the trench shall be in conformance with the following schedule:

- A) One test at the spring line of the pipe.
- B) At least one test for each 12 inch layer of backfill within the pipe bedding zone for pipes 24 inches and larger.
- C) One test at an elevation of 1 foot above the top of the pipe.
- D) One test for each 2 feet of backfill placed from 1 foot above the top of the pipe to finished grade elevation.

If, based on the Geotechnical/Soils Engineer testing reports and inspection, fill which has been placed is below specified density, Contractor shall provide additional compaction and testing prior to commencing further construction.

### **Section 4.10 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. After grading, 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 pipelines that may be uncovered or damaged until such lines have been relocated.

**Section 4.11                    MAINTENANCE**

Contractor shall protect newly 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.

Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, Contractor shall scarify surface and reshape and compact to required density prior to further construction.

**Section 4.12                    INSPECTION AND QUALITY ASSURANCE**

4.12.01                    Inspection

Contractor shall examine the areas and conditions under which excavating, filling and grading are to be performed, and not proceed with the work until unsatisfactory conditions have been corrected.

Contractor shall examine existing grade prior to commencement of work and report to the City if elevations of existing grade vary from elevations shown on Drawings.

4.12.02                    Quality Assurance

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

The City shall provide quality control testing during construction to ensure compliance with these Specifications.

Contractor shall allow the testing service to inspect and approve fill materials and fill layers before further construction is performed. The Contractor shall be given copies of all test results. Contractor shall be financially responsible for all failed and/or substandard material testing.

## ARTICLE 5

### UTILITY LINE INSTALLATION REQUIREMENTS

Index	5.01	<a href="#"><u>JACK AND BORE OPERATIONS</u></a>
	5.02	<a href="#"><u>PRESSURE PIPE RESTRAINT</u></a>
	5.03	<a href="#"><u>PRESSURE CONNECTION</u></a>

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Section	5.01	<b><u>JACK AND BORE OPERATIONS</u></b>
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5.01.01	<u>General</u>
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The installation of a casing pipe by the method of jacking and boring shall be covered by these Specifications. The overall work scope shall include, but not be limited to, jacking and boring pits and equipment, sheeting, steel casing pipe, skid, steel straps, coatings, location signs as required, miscellaneous appurtenances, and restoration to complete the entire work as specified in the Typical City Details attached as part of this Manual. Jack and bore operations shall be performed within the right-of-way and/or easements shown on the Drawings.

5.01.02	<u>Pipe Material</u>
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A) Steel Casing

Steel casings shall conform to the requirements of ASTM A-139 (straight seam pipe only) Grade "B" with a minimum yield strength of 35,000 psi. The casing pipes shall have the minimum nominal diameter and wall thickness as shown on the following table:

<u>Carrier Pipe Nominal Diameter</u>	<u>Casing Outside Diameter</u>	<u>Casing Wall Thickness</u>
4"	14"	.250"
6"	16"	.250"
8"	18"	.250"
10"	20"	.250"
12"	24"	.250"
16"	28"	.312"
18"	30"	.312"
20"	34"	.375"
24"	36"	.375"

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. Welds shall be airtight and continuous over the entire circumference of the pipe and shall not increase the outside pipe diameter by more

than ¾ inch.

B) Carrier Pipe

The carrier pipe shall be minimum class 50 ductile iron pipe with restrained joints. Ductile iron pipe shall comply with the specification outlined in this Manual.

5.01.03 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.

5.01.04 Other Jurisdictions

For casing pipe crossings under roadways, railroads, or other installations not within the jurisdiction of the City, the Contractor shall comply with the regulations of said authority in regard to design, specifications and construction.

5.01.05 Workmanship

- A) The jack and bore operations shall be done simultaneously with continuous installation until the casing pipe is in final position. Correct line and grade shall be carefully maintained. Add-on sections of casing pipe shall be full-ring welded to the preceding length, development water-tight total pipe strength joints. The casing installation shall produce no upheaval, settlement, cracking, movement or distortion of the existing roadbed or other facilities. Following placement of the carrier pipe within the steel casing, masonry plugs are to be installed at each open end. Casing pipe and welds shall be asphaltic coated using Koppers 300M or equal with a minimum thickness of 20 mils.
- B) Casing pipe holes shall be mechanically bored through the soil by a cutting head on a continuous auger mounted inside the pipe. The auger shall extend a minimum distance beyond the end of the pipe casing to preclude formation of voids outside of the pipe shell.
- C) Required jacking and boring pits or shafts shall be excavated and maintained to the minimum dimension. Said excavations shall be adequately barricaded, sheeted, braced and dewatered as required.

5.01.06 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.

5.01.07      Work Coordination

It shall be the Contractor's responsibility to perform the jack and bore 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 at no additional cost to the City.

5.01.08      Dewatering

Dewatering through the casing during construction shall not be permitted. All dewatering methods shall be approved by the City before construction work begins.

5.01.09      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. Casing spacers shall be bolt on style split shells made of either T-304 stainless steel or fusion coated steel (a minimum 0.010 inch thick coating of PVC shall be provided over the entire band). The shell shall be lined with a PVC liner 0.090 inch thick with 85-90 Durometer. All nuts and bolts shall be high strength, low alloy meeting AWWA C-III. Runners shall be made of a high molecular weight polymer with inherent high abrasion resistance and a low coefficient of friction.

5.01.10      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.

5.01.11      Miscellaneous Requirements

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 C-206 and AWS D-7.0 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.

The annular space between the carrier pipe and casing shall be filled with clean sand, if required. Masonry plugs are to be installed at each open end of the casing. Plugs shall be suitable for restraining the earth load while allowing drainage of the casing.

**Section 5.02            PRESSURE PIPE RESTRAINT**

5.02.01            General

Pressure pipe fittings and other items requiring restraint shall be braced with restraining assemblies as specified in this Manual.

All pressure pipe and fittings shall be restrained as specified in this Manual, preventing movement of lines under pressure at bends, tees, caps, valves, hydrants etc. Use of thrust blocks for pressure pipe and fittings 16 inches and larger shall not be allowed. Ductile iron pressure pipe and fittings 12 inches and smaller may be restrained following the criteria established in this Manual.

5.02.02            Thrust Block Construction

Thrust blocks shall not be typical and shall only be used when the City Engineer deems it a hardship or good engineering standards deem it necessary because restraining assemblies are impractical or insufficient. If thrust blocks are used, a thrust block table meeting City standards shall be provided. Where undisturbed trench walls are not available for thrust blocking, the Contractor shall furnish additional concrete or install suitable pipe harnesses or ties designed and manufactured specifically for this purpose. Additional concrete, harnesses and/or ties shall be approved by the Engineer and the City. Fittings shall be protected by polyethylene film, minimum 8 mil thick, prior to placing concrete thrust block.

Concrete for thrust blocking shall have a minimum compressive strength of 3,000 psi. Concrete shall be placed against undisturbed material and shall not cover joints, bolts or nuts, or interfere with the removal of any joint. Wooden side forms shall be provided for thrust blocks where trench conditions require. Thrust blocks shall be properly set and adequately cured prior to pressurizing the system.

5.02.03            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 the joints shall be capable of holding against withdrawal for line pressures 50% above the normal working pressure. Mechanical joint ductile iron pipe retainer glands shall not be permitted. 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 rest 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 lengths of restrained joint ductile iron pipe shall be determined by the Engineer and shown in a tabular form as depicted on the “Restrained Pipe Table” in the Typical City Details attached as part of this Manual. All calculation shall be based on the method outlined in the publication entitled “Thrust Restraint Design for Ductile Iron Pipe”, latest edition (DIPRA).

Wherever two 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 two 45° bends will be considered as though a 90° bend were located midway between the two 45° bends.

#### 5.02.04 Mechanical Restraining Devices

Mechanical restraining devices as specified herein may be substituted for the restrained “Locked-Type” joints manufactured by the ductile iron pipe and fitting manufacturer. The required lengths of restrained joint ductile iron pipe shall be determined by the Engineer and shown in a tabular form as depicted on the “Restrained Pipe Table” in the Typical City Details attached as part of this Manual.

Mechanical joint restraint shall be incorporated in the design of the follower gland and shall include a restraining mechanism which, when actuated, imparts multiple wedging action against the pipe, increasing its resistance as the pressure increases. Flexibility of the joint shall be maintained after burial. Glands shall be manufactured of ductile iron conforming to ASTM A-536. Restraining devices shall be of ductile iron heat treated to a minimum hardness of 370 BHN. Dimensions of the gland shall be such that it can be used with the standardized mechanical joint bell and tee-head bolts conforming to ANSI A-21.11 and ANSI/AWWA C-153/A-21.53. Twist-off nuts shall be used to insure proper actuating of the restraining devices.

The mechanical joint restraint device shall have a working pressure of at least 250 psi with a minimum safety factor of 2 to 1.

**Section 5.03                    PRESSURE CONNECTION**

5.03.01                    General

Installations of pressure connections 4 inches and larger shall be made in accordance with this Section.

5.03.02                    Tapping Sleeves

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” taps shall utilize mechanical joint sleeves.

A)                    Mechanical Joint Sleeves

Sleeves shall be cast of gray-iron or ductile-iron and have an outlet flange with the dimensions of the Class 125 flanges shown in ANSI B-16.1 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/AWWA C-III/A-21.11. Sleeves shall be capable of withstanding a 200 psi working pressure.

B)                    Steel Tapping Sleeves

Sleeves shall be fabricated of stainless steel. 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 C-III (ANSI A-21.11). Gasket shall be a full circumferential gasket be vulcanized natural or synthetic rubber.

5.03.03                    Tapping Valves

Tapping valves shall meet the requirements of this Manual 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.

5.03.04                    Notification and Connection to Existing Mains

All connections to existing mains shall be made by the Contractor only after the connection procedure and work scheduling has been reviewed and approved by the City. The Contractor shall submit a written request to the City a minimum of 5 working days prior to scheduling said connections. In this request, the Contractor shall outline the following:

- A)                    Points of Connection, fittings to be used, and method of flushing and disinfection if applicable.

B) Estimated construction time for said connections.

All connections shall be made only on the agreed upon date and time. If the Contractor does not initiate and complete the connection work in the agreed upon manner, the Contractor shall be required to reschedule the said connection by following the procedure outlined above. The Contractor shall not operate any valves in the system.

#### 5.03.05 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 pressure tested at 150 psi to ensure that no leakage will occur.

For pressure connections through 12 inch diameter or less the minimum diameter cut shall be ½ inch less than the nominal diameter of the pipe to be attached. For 14 inch through 20 inch installations the minimum diameter shall be 1½ inches less; for larger taps the allowable minimum diameter shall be 2 to 3 inches 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.

For pressure connections to wastewater force mains the tapping valve shall be placed horizontally. After the tapping procedure is complete a plug valve shall be attached to the tapping valve. The tapping valve shall be left in the open position prior to backfilling. Adequate restrained joint fittings shall be provided to prevent movement of the installation when test pressure is applied. Provisions of this Manual shall apply.

## ARTICLE 6

### CLEARING AND GRUBBING

<b>Index</b>	<b>6.01</b>	<b><u><a href="#">GENERAL</a></u></b>
	<b>6.02</b>	<b><u><a href="#">CLEARING AND GRUBBING</a></u></b>
	<b>6.03</b>	<b><u><a href="#">DISPOSAL OF UNSUITABLE MATERIALS</a></u></b>

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<b>Section</b>	<b>6.01</b>	<b><u>GENERAL</u></b>
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The work covered by this ARTICLE consists of clearing and grubbing and the removal of the resultant products and debris within the areas of the rights-of-way, easements, retention areas, and all other construction areas. Dust control is mandatory. All appropriate permits shall be obtained prior to start of activity. Existing trees and other vegetation that are designated to remain shall be protected in accordance with the LDC.

<b>Section</b>	<b>6.02</b>	<b><u>CLEARING AND GRUBBING</u></b>
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Clearing and grubbing shall consist of the removal and disposal of all timber, brush, stumps, roots, grass, weeds, sawdust, rubbish, buildings, septic tanks, pipe, foundations, and all other deleterious material resting on or protruding through the surface of the excavated areas. All wells with no future use shall be abandoned in accordance with Florida Department of Environmental Protection and local water management district regulations.

In all areas of roadway construction and embankment, trees, stumps, roots, and other deleterious materials shall be removed to a depth of not less than 2 feet below the subgrade.

<b>Section</b>	<b>6.03</b>	<b><u>DISPOSAL OF UNSUITABLE MATERIALS</u></b>
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Unsuitable material shall be the property of the Owner/Developer, and materials shall be disposed of in accordance with current City, County, State, and Federal Regulations.

## ARTICLE 7

### EARTHWORK

<b>Index</b>	<b>7.01</b>	<b><u>GENERAL</u></b>
	<b>7.02</b>	<b><u>EXCAVATION</u></b>
	<b>7.03</b>	<b><u>UNSUITABLE MATERIAL</u></b>
	<b>7.04</b>	<b><u>SUITABLE MATERIAL</u></b>
	<b>7.05</b>	<b><u>DISPOSAL OF EXCESS MATERIAL</u></b>
	<b>7.06</b>	<b><u>PLACING EMBANKMENT</u></b>
	<b>7.07</b>	<b><u>SHOULDERS, DITCHES, AND SLOPES</u></b>

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**Section 7.01 GENERAL**

The work covered by this ARTICLE consists of excavation and embankment required for roadway, ditches, channel changes and other works.

Unless otherwise provided, this ARTICLE shall include all excavation, shaping, filling, sloping and finishing necessary for the construction, preparation, and completion of all embankments, subgrades, shoulders, ditches, slopes, gutters, intersections, approaches, private entrances, and other works all in accordance with the required alignment, grade, and cross sections shown on the plans or as directed, by the City Engineer or his Designee.

**Section 7.02 EXCAVATION**

While the excavation is being done and until the work is finally accepted, the Contractor shall take the necessary steps to protect the work to prevent loss of material from the construction area due to the action of wind or water. During construction, the area shall be maintained in such condition that it will not constitute a hazard and shall be well drained at all times.

**Section 7.03 UNSUITABLE MATERIAL**

Where muck, rock, clay, organic, or other materials within the limits of the construction area is, in the opinion of the City Engineer, unsuitable, the Contractor shall excavate to a depth approved by the City Engineer or his Designee and then backfill with suitable material in an approved manner, shaping to conform to the required cross section.

**Section 7.04 SUITABLE MATERIAL**

Suitable material excavated from existing City right-of-way shall be hauled to a designated location within the City. Location to be designated by City Engineer

**Section 7.05 DISPOSAL OF EXCESS MATERIAL**

Excess material shall be disposed of in accordance with current City, County, State of Florida, and Federal regulations.

**Section 7.06 PLACING EMBANKMENT**

Embankments shall be constructed of suitable materials placed in successive level layers not more than 12 inches in thickness, loosely measured, for the full width of the embankment, for the full length of the embankment, and compacted to a minimum density of 98% of the maximum density value as determined by AASHTO T-180.

**Section 7.07 SHOULDERS, DITCHES, AND SLOPES**

When the work includes surfacing or paving, the earthwork, including the slopes and all drainage structures, shall be Substantially Completed before the construction of the base course and pavement is started.

During the construction of the pavement, a shoulder at least 3 feet wide shall be maintained in place to properly support the edges of the pavement or curb. Before final acceptance by the City, the earth shoulders, slopes, and side ditches shall be completed and shaped to a surface which is within 0.1 foot above or below the true surface shown on the plans; except that, adjacent to pavement, curb, or sidewalk/bikepath, the shoulders shall be shaped to match the edge of the pavement, curb or sidewalk/bikepath. The shoulder line shall not vary more than 0.3 foot horizontally from the true lines shown on the plans.

All earth work within 5 feet of the roadway must be compacted to a minimum density of 98% of the maximum dry density as determined by AASHTO T-180.

## ARTICLE 8

### SUBBASE

<b>Index</b>	<b>8.01</b>	<b><u><a href="#">DESCRIPTION</a></u></b>
	<b>8.02</b>	<b><u><a href="#">SUBBASE REQUIREMENTS</a></u></b>
	<b>8.03</b>	<b><u><a href="#">STABILIZATION</a></u></b>
	<b>8.04</b>	<b><u><a href="#">CONSTRUCTION</a></u></b>
	<b>8.05</b>	<b><u><a href="#">TESTING</a></u></b>

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#### **Section 8.01 DESCRIPTION**

Subbase shall be defined as that portion of the roadbed immediately below the base course or pavement including below the curb and gutter, the limits of which will ordinarily include those portions of the roadbed shown in the plans. The limits of the subbase shall be considered to extend outward to 12 inches beyond the base. On roadways where curbs are utilized, the subbase shall extend to 12 inches beyond the back of curb.

#### **Section 8.02 SUBBASE REQUIREMENTS**

Before the following items are constructed, subbase material is required as specified:

- A) Stabilize top 12 inches to Florida Bearing Value 75.
- B) Compact to a minimum density of 98% of the maximum density determined by AASHTO T-180 for top 12 inches.

#### **Section 8.03 STABILIZATION**

The stabilizing material shall be high bearing value soil, sand-clay, limerock, shell, or other material approved by the City Engineer and shall meet the physical requirements of FDOT.

#### **Section 8.04 CONSTRUCTION**

The surface of the subbase shall conform to the lines and grades as defined on the construction plans to a tolerance of 0.05 foot. If surface exhibits plastic deformations during compaction, the existing wet material shall be removed and replaced by dry material. The method of aeration may be used if permitted by the City Engineer.

**Section 8.05 TESTING**

Refer to ARTICLE 14 of this Manual for testing and quality control requirements.

## ARTICLE 9

### SOIL CEMENT BASE

<b>Index</b>	<b>9.01</b>	<b><u><a href="#">DESCRIPTION</a></u></b>
	<b>9.02</b>	<b><u><a href="#">USE OF SOIL CEMENT APPROVAL</a></u></b>
	<b>9.03</b>	<b><u><a href="#">DESIGN MIX</a></u></b>
	<b>9.04</b>	<b><u><a href="#">MATERIALS</a></u></b>
	<b>9.05</b>	<b><u><a href="#">EQUIPMENT</a></u></b>
	<b>9.06</b>	<b><u><a href="#">CONSTRUCTION METHODS</a></u></b>
	<b>9.07</b>	<b><u><a href="#">OPENING TO TRAFFIC</a></u></b>
	<b>9.08</b>	<b><u><a href="#">MAINTENANCE</a></u></b>
	<b>9.09</b>	<b><u><a href="#">INSPECTION</a></u></b>

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<b>Section</b>	<b>9.01</b>	<b><u>DESCRIPTION</u></b>
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The work specified in this ARTICLE shall consist of the construction of a soil cement base course composed of soil and Portland cement uniformly mixed, moistened, compacted, finished and cured in accordance with these Specifications, and shall conform to the lines, grades thicknesses and typical cross sections shown on the plans. The base shall be designed to have a minimum in-situ strength of 350 psi. Seven day laboratory design compressive-strength shall be a minimum of 500 psi for mixed in-place and 450 psi for plant mixed.

<b>Section</b>	<b>9.02</b>	<b><u>USE OF SOIL CEMENT APPROVAL</u></b>
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The use of soil cement is generally not permissible and shall not be used without the City Engineer's permission. The City Engineer shall only consider the use of soil cement under conditions when normal base material functions may fail due to field conditions. Additional information supporting the request for and the use of soil cement may be required.

<b>Section</b>	<b>9.03</b>	<b><u>DESIGN MIX</u></b>
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	<b>9.03.01</b>	<b><u>Minimum Requirements</u></b>
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Processing of the base shall not be started until the soil cement design mix, which has been prepared by a registered Geotechnical/Soils Engineer, for the particular soil has been submitted to and approved by the City Engineer or his Designee. The following shall be the minimum items included with the mix design submittal:

- A) Cement content.
- B) Optimum moisture content.

- C) Minimum and maximum moisture content.
- D) Seven laboratory compressive strength.
- E) Anticipated 7 day field compressive strength.
- F) Method of application and timing (including total time from batching to completion).
- G) Other information as requested.

9.03.02        Notification

Construction of the soil cement base shall not proceed without 72 hour notice to the Engineering Inspection Division of the City of Oviedo.

**Section        9.04            MATERIALS**

9.04.01        Portland Cement

Portland Cement shall be Type I or Type I-P and shall comply with the Standard Specifications for Portland Cement ASTM C-145. Cement which is partially set, lumpy or caked shall not be used. One cubic foot of Portland Cement shall be considered to weigh 94 lbs.

9.04.02        Water

Water shall be clean and free from substance deleterious to the hardening of the soil cement.

9.04.03        Soil

Only soils which have proven themselves to produce a high quality soil cement base shall be acceptable. New sources of soil cement material must be approved by the City Engineer prior to use.

9.04.04        Soil Cement Mix Types

Central mixed plant materials:

- A) Only a central mixed material from an approved commercial source shall be acceptable for use as a base material for improvements to be dedicated to the City of Oviedo.
- B) In place mixed materials shall only be an option for an Owner/Developer on private property or for improvements not being dedicated to the City. The Owner/Developer shall provide to the City a certification from the

Geotechnical or Project Engineer stating that the results of all testing of the mixed in place materials are satisfactory.

**Section 9.05 EQUIPMENT**

Soil cement may be constructed with any machine, combination of machines or equipment that will produce the results meeting the requirements for soil pulverization, cement application, mixing, uniform depth control, water application, incorporation of materials, compaction, finishing and curing, as required by these Specifications.

**Section 9.06 CONSTRUCTION METHODS**

9.06.01 Responsibility

The Contractor is responsible for completing the project in accordance with plans and Specifications and with experienced competent supervision.

9.06.02 Preparation

Before construction operations are begun, the area to be paved shall be graded and shaped as required to construct the soil cement base in conformance with the grades, lines, thicknesses and typical cross section shown on the plans. Additional soil needed, if any, shall be placed as directed. Unsuitable and/or yielding soil or material shall be removed and replaced with acceptable soil.

9.06.03 Delivery of Materials

All soil cement deliveries shall be accompanied by a batch time stamped on the delivery ticket by means of a mechanical time clock. Batch time shall be an accurate time of concrete batch and delivery truck departure from the batch plant.

9.06.04 Application of Water and Moist Mixing

Immediately after and/or during the mixing of soil and cement, and before beginning the compaction, the moisture content of the soil cement mixture shall be determined by the laboratory and, if required, water shall be applied uniformly in quantities required to obtain proper moisture content. After the final application of water, mixing shall be continued until the water is distributed uniformly through the full depth of the mixture.

When water application and mixing has been completed, the percentage of moisture in the mixture and in unpulverized soil lumps, based on oven-dry weights, shall not be more than 2 percentage points above the specified optimum moisture content, and shall not be less than that quantity which will cause the soil cement mixture to become unstable during compaction and finishing.

#### 9.06.05 Compaction

Prior to beginning of compaction, the mixture shall be in a loose condition for its full depth. The loose mixture shall then be uniformly compacted until the entire depth of the mixture is compacted to a minimum density of 98% of the maximum density in accordance with AASHTO T-180 as determined in the field on representative samples of soil cement mixture obtained from the roadway at the time compaction begins. During the compaction operations, shaping may be required to obtain the required grades and cross section. The maximum time allowed between the last moist mixing and compaction shall be 60 minutes.

#### 9.06.06 Finishing

After the mixture has been initially compacted, the surface of the soil cement shall be shaped to the required lines, grades and cross section. During the shaping operations, the surface shall be lightly scarified to loosen any imprints left by the compacting or shaping equipment, when deemed necessary. The resulting surface shall then be compacted to the specified density with a pneumatic tire roller. Rolling shall be supplemented by broom-dragging, if required.

The moisture content of the surface material must be maintained at not less than its specified optimum moisture content during finishing operations. Surface compaction and finishing shall be done in such a manner as to produce a smooth, dense surface, free of surface compaction planes, cracks, ridges or loose material. Surface-finishing methods may be varied, provided a smooth, dense surface, free of surface compaction planes is produced. The moisture and density requirements shall be determined by the methods prescribed in AASHTO T-180.

#### 9.06.07 Surface Requirements (Scalping or Hard-Planing)

After compaction and finishing have been completed, and not later than the beginning of the next calendar day after the construction of any section of the base, the surface shall be tested with a template cut to the required crown and/or with a 15 foot straight edge laid parallel to the centerline. All irregularities greater than ¼ inch shall be immediately corrected with a blade adjusted to the lightest cut, which will insure a surface that does not contain depressions greater than ¼ inch under the template or the straight-edge. The material removed shall be wasted. Additional wetting during and after this final shaping operation shall be required to keep the base continuously moist.

#### 9.06.08 Prime/Curing

The curing material shall be applied immediately after the completion of finishing operations. The finished soil cement shall be kept continuously wet until the curing material is placed. After the soil cement has been finished as specified herein, it shall be protected against drying for 7 days by the application of bituminous coating.

Prime and curing materials shall conform to ARTICLE 11 of this Manual. Covering the application of bituminous materials, including but not limited to: materials, equipment, cleaning of the base, weather limitations, application of prime coat and application of tack coat.

9.06.09            Construction Joints

Prior to the beginning of each day's construction, a straight transverse construction joint shall be formed by cutting back into the completed work to form a true vertical face.

9.06.10            Thickness

During various stages of construction, test holes or trenches shall be dug in the mixture to determine the thickness. After the base is completed test holes shall be dug or cored at intervals of not more than 300 feet, or at closer intervals if necessary, and the thickness of the base shall be determined from measurements made in these test holes.

Where the base is deficient in thickness by more than ½ inch, the area of deficient base shall be removed and replaced by base of the required thickness, at the Contractor's expense. Except, at the City Engineer's discretion, such deficient base thickness may be left in place if the deficiency can be made up in asphaltic surface course.

**Section        9.07            OPENING TO TRAFFIC**

The Contractor shall not be permitted to drive heavy equipment over the completed sections. Light weight pneumatic-tired equipment may be permitted after the surface has hardened sufficiently to prevent the equipment from marking the surface and provided the protection and curing specified are not impaired. Completed section may be opened to light traffic after 24 hours, provided the surface has hardened sufficiently to prevent marking by traffic and has been inspected by the City Engineer or his Designee. An application of sand shall only be done prior to opening to construction traffic.

**Section        9.08            MAINTENANCE**

The Contractor shall maintain the base to a true and satisfactory surface until the wearing surface is constructed. Should any repairs or patching be necessary, they shall extend to the full depth of the base and shall be made in a manner that will assure restoration of a uniform base course conforming to the requirements of these Specifications. The bituminous curing coating shall be maintained until the wearing surface is constructed.

**Section 9.09                    INSPECTION**

After a minimum of 7 days have elapsed and prior to applying the asphalt wearing surface, a detailed engineering inspection of the base shall be performed by the City Engineer or his Designee, Geotechnical/Soils Engineer, and Contractor. This inspection of the hardened soil cement base is required prior to approval for paving, to assure that the soil cement base has set-up satisfactorily and that no soft areas or surface scabs exist which may need repair. Prior to commencing paving operations, all deficiencies shall be corrected and approved by the City Engineer or his Designee.

## ARTICLE 10

### LIMEROCK BASE

<b>Index</b>	<b>10.01</b>	<b><u><a href="#">GENERAL</a></u></b>
	<b>10.02</b>	<b><u><a href="#">MATERIALS</a></u></b>
	<b>10.03</b>	<b><u><a href="#">EQUIPMENT</a></u></b>
	<b>10.04</b>	<b><u><a href="#">TRANSPORTING LIMEROCK</a></u></b>
	<b>10.05</b>	<b><u><a href="#">SPREADING LIMEROCK</a></u></b>
	<b>10.06</b>	<b><u><a href="#">COMPACTING AND FINISHING BASE</a></u></b>
	<b>10.07</b>	<b><u><a href="#">PRIME/CURING</a></u></b>
	<b>10.08</b>	<b><u><a href="#">TESTING SURFACE</a></u></b>
	<b>10.09</b>	<b><u><a href="#">TESTS</a></u></b>
	<b>10.10</b>	<b><u><a href="#">DEFICIENCIES</a></u></b>
	<b>10.11</b>	<b><u><a href="#">OPENING TO TRAFFIC</a></u></b>
	<b>10.12</b>	<b><u><a href="#">MAINTENANCE</a></u></b>

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<b>Section</b>	<b>10.01</b>	<b><u>GENERAL</u></b>
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The work specified in this ARTICLE consists of the construction of a base course composed of limerock. It shall be constructed on the prepared subgrade in accordance with these Specifications and in conformity with the lines, grades, notes, and typical cross sections shown on the plans. Where so shown on the plans, the base shall be constructed in 2 courses. Where the plans do not specify double-course base, the base may be constructed in either 1 or 2 courses.

<b>Section</b>	<b>10.02</b>	<b><u>MATERIALS</u></b>
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The material used shall be obtained from a FDOT certified mine (pit).

<b>Section</b>	<b>10.03</b>	<b><u>EQUIPMENT</u></b>
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This work may be performed with any machine, combination of machines, or equipment that will produce the specified results.

<b>Section</b>	<b>10.04</b>	<b><u>TRANSPORTING LIMEROCK</u></b>
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The limerock shall be transported to the point where it is to be used over rock previously placed and dumped on the end of the preceding spread. In no case shall rock be dumped directly on the subgrade. The Contractor may seek relief from this requirement when the subgrade is to be adequately stabilized, as approved by the City Engineer.

**Section 10.05 SPREADING LIMEROCK**

The limerock shall be spread uniformly. All segregated areas of fine or coarse rock shall be removed and replaced with well-graded rock.

For double-course base, the rock shall be spread in 2 courses, and the thickness of the first course shall be approximately ½ the total thickness of the finished base, or enough additional to bear the weight of the construction equipment without disturbing the subgrade.

**Section 10.06 COMPACTING AND FINISHING BASE**

For double course base, the first course shall be bladed if necessary to secure a uniform surface, and shall be compacted to the density specified below, immediately prior to spreading the second course. No other finishing of this course is required.

After spreading is completed, the entire surface shall be scarified and shaped so as to produce the exact grade and cross section after compaction. For double course bases, this scarifying shall extend to a depth sufficient to penetrate slightly the surface of the first course.

Proper moisture condition shall be maintained uniformly throughout the material during the compaction operation. The material shall be compacted to a minimum density of 98% of the maximum density obtainable under AASHTO T-180. Where the base is being constructed in one course and the specified thickness is more than 6 inches, the density specified above shall be obtained in both the bottom half and top half of the base. During final compacting operations, if blading of any areas is necessary to obtain the true grade and cross section, the compacting operations for such areas shall be completed prior to making the density determinations on the finished base.

The surface shall be “hard-planed” with a grader immediately prior to the application of the prime coat to remove the thin-glazed or cemented surface, leaving a granular or porous condition that will allow free penetration of the prime material. The materials planed from the base shall be removed from the base area.

If, at any time, the subgrade material should become mixed with the base course material, the Contractor shall excavate and remove the mixture, reshape and compact the subgrade, and replace the materials removed with clean base material, which shall be shaped and compacted as specified above.

**Section 10.07 PRIME/CURING**

Once limerock has been finished as specified herein, it shall be protected by the application of a bituminous coating. The bituminous material shall be applied as soon as possible after the completion of finishing operations. The Prime/Curing

material shall be in accordance with ARTICLE 11 of this Manual.

**Section 10.08 TESTING SURFACE**

The finished surface of the base course shall be checked with a templet cut to the required cross section and with a 15 foot straight edge laid parallel to the centerline of the road or other approved testing devices. All irregularities greater than  $\pm 1/4$  inch shall be corrected by scarifying and removing or adding rock, as may be required, after which the entire areas shall be recompacted as specified herein.

**Section 10.09 TESTS**

Testing shall be done in accordance with ARTICLE 14 of this Manual.

**Section 10.10 DEFICIENCIES**

If deficiencies in the density occur, the base shall be reworked and re-compacted until the density tests conform to these Specifications.

Any deficiencies in thickness of base greater than  $1/2$  inch shall require that the entire base be reworked to conform to the original line and grade and specifications as shown on the original plans. Except, at the City Engineer's discretion, such deficient base thickness may be left in place if the deficiency can be made up in asphaltic surface course.

**Section 10.11 OPENING TO TRAFFIC**

The Contractor shall not be permitted to drive heavy equipment over the completed sections. Light weight pneumatic-tired equipment may be permitted after the surface has hardened sufficiently to prevent the equipment from marking the surface and provided the protection and curing specified are not impaired. Completed section may be opened to light traffic after 24 hours, provided the surface has hardened sufficiently to prevent marking by traffic and has been inspected by the City Engineer or his Designee. An application of sand shall only be done prior to opening to construction traffic.

**Section 10.12 MAINTENANCE**

The Contractor shall maintain the base to a true and satisfactory surface until the wearing surface is constructed. Should any repairs or patching be necessary, they shall extend to the full depth of the base and shall be made in a manner that will assure restoration of a uniform base course conforming to the requirements of these Specifications. The bituminous curing coating shall be maintained until the wearing surface is constructed.

## ARTICLE 11

### PRIME AND TACK COATS FOR BASE COURSES

<b>Index</b>	<b>11.01</b>	<b><u><a href="#">GENERAL</a></u></b>
	<b>11.02</b>	<b><u><a href="#">MATERIALS</a></u></b>
	<b>11.03</b>	<b><u><a href="#">EQUIPMENT</a></u></b>
	<b>11.04</b>	<b><u><a href="#">CLEANING THE BASE</a></u></b>
	<b>11.05</b>	<b><u><a href="#">WEATHER LIMITATIONS</a></u></b>
	<b>11.06</b>	<b><u><a href="#">APPLICATION OF PRIME COAT</a></u></b>
	<b>11.07</b>	<b><u><a href="#">APPLICATION OF TACK COAT</a></u></b>

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<b>Section</b>	<b>11.01</b>	<b><u>GENERAL</u></b>
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The work specified in this ARTICLE consists of the application of bituminous material, on a previously prepared base, in accordance with these Specifications and in conformity with the lines, grades, dimensions, and notes shown on the plans.

<b>Section</b>	<b>11.02</b>	<b><u>MATERIALS</u></b>
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The materials used shall be as follows:

11.02.01	<b><u>Prime Coat</u></b>
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- A) Cutback Asphalt, Grade RC-SS-1, SS-1H, Special MS-Emulsion, diluted at the ratio of 6 parts emulsified asphalt to 4 parts water.
- B) Cutback Asphalt, Grade RC-70.

11.02.02	<b><u>Tack Coat</u></b>
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- A) Asphalt Cement, Viscosity Grades AC-20 or AC-30.
- B) Emulsified Asphalt, Grade RS-2, SS-1, SS-1H, Special MS-Emulsion, diluted at the ratio of 6 parts emulsified asphalt to 4 parts water.

For the prime and tack coat, any one of the specified bituminous materials may be used at the option of the Contractor, unless a specific type and grade is called for on the plans.

<b>Section</b>	<b>11.03</b>	<b><u>EQUIPMENT</u></b>
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This work may be performed with any machine, combination of machines, or equipment that will produce the specified results.

**Section 11.04 CLEANING THE BASE**

Before any bituminous material is applied, all loose material, dust, and foreign material, which might prevent proper bond with existing surface, shall be removed for the full width of the application. Particular care shall be taken to clean the outer edges of the strip to be treated in order to insure that the prime or tack coat will adhere. Where the prime or tack coat is applied adjacent to curb and gutter or valley gutter, such concrete surfaces are to be protected and kept free of bituminous materials.

**Section 11.05 WEATHER LIMITATIONS**

No bituminous material shall be applied when the temperature of the air is less than 40° F in the shade, or when the weather conditions or the condition of the existing surface is unsuitable.

**Section 11.06 APPLICATION OF PRIME COAT**

The surface to be primed shall be clean and free of standing water. For limerock bases the glazed finish shall be removed, leaving a granular or porous condition that will allow free penetration of bituminous material. The temperature of the prime material shall be between 100° F and 150° F. The actual temperature shall be that which will insure uniform distribution. The material shall be applied by means of a pressure distributor. The amount of bituminous material applied shall be not less than 0.10 gallon per square yard for limerock base and not less than 0.15 gallon per square yard for soil cement, or shell base. The amount to be applied will be dependent on the character of the surface and shall be sufficient to coat the surface thoroughly and uniformly, with no excess. Where asphaltic pavement abuts concrete curbing, the vertical abutting edge shall receive a uniform coating of tack applied so as to avoid puddles, etc.

A light uniform application of clean sand shall be applied prior to opening the primed base to traffic, in which case the sand shall be rolled with a traffic roller. If warranted by traffic conditions, the application shall be made only on one-half of the width of the base at one time, care being taken to secure the correct amount of bituminous materials at the joint.

The base shall be sufficiently moist in order to obtain maximum penetration of the asphalt.

**Section 11.07 APPLICATION OF TACK COAT**

Where a bituminous surface is to be laid and a tack coat is required, it shall be applied as herein specified. On newly constructed base courses, the application of the tack coat, when required, shall follow the application of the prime coat, immediately prior to placing the wearing surface. In general, a tack coat shall not be required on primed bases, except in areas which have become excessively dirty

and cannot be cleaned, where the prime has cured and lost bonding effect, or where the prime coat has worn away. The tack coat shall be applied with a pressure distributor. The bituminous material shall be heated to a suitable consistency as designed or as stated in Section 11.06. The bituminous material shall be applied at the rate between 0.02 gallon and 0.08 gallon per square yard. The tack coat shall be applied sufficiently in advance of the laying of the wearing surface to permit drying, but shall not be applied so far in advance or over such an area as to lose its adhesiveness as a result of being covered with dust or other foreign material and shall be kept free from traffic until the wearing surface is laid.

## ARTICLE 12

### ASPHALTIC CONCRETE SURFACE COURSE

<b>Index</b>	<b>12.01</b>	<b><u><a href="#">GENERAL</a></u></b>
	<b>12.02</b>	<b><u><a href="#">ASPHALTIC CONCRETE MIXES</a></u></b>
	<b>12.03</b>	<b><u><a href="#">MECHANICAL SPREADING and SCREEDING EQUIPMENT</a></u></b>
	<b>12.04</b>	<b><u><a href="#">CONSTRUCTION METHODS</a></u></b>
	<b>12.05</b>	<b><u><a href="#">FINISHED SURFACE REQUIREMENTS</a></u></b>
	<b>12.06</b>	<b><u><a href="#">SUBMITTALS</a></u></b>

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#### **Section 12.01 GENERAL**

The work specified in this ARTICLE consists of the application of asphaltic concrete surface course. This course shall be composed of a mixture of aggregates and, if necessary, mineral filler and asphalt cement to produce the desired stability as hereinafter described, properly laid upon a prepared base in accordance with these Specifications and in conformity with the lines, grade, thickness and typical cross section shown on the plans. This work shall include the conditioning of the existing surface or base. Skid resistant surfaces shall be installed as required by the City Engineer.

#### **Section 12.02 ASPHALTIC CONCRETE MIXES**

Asphaltic concrete mixes shall meet the following Specifications when called for in the plans and specifications:

Type	Job Mix Specification	Min/Avg Compacted (Max Lift)	Minimum Marshall Stability	Application
Type S-1	Current FDOT Specification	1½" (2")	1,000 lb	Wearing Course
Type S-3	Current FDOT Specification	1¼" (2")	1,000 lb	Wearing Course
Type III	Current FDOT Specification	1¼" (2")	1,000 lb	Wearing Course
Type II	Current FDOT Specification	-- (2")	500 lb	Leveling Course
Type FC-1	Current FDOT Specification	¾" (1")	500 lb	Friction Course
Type FC-2	Current FDOT Specification	⅜" (⅝")	N/A	Friction Course
Type FC-3	Current FDOT Specification	⅜" (⅝")	N/A	Friction Course
Type FC-4	Current FDOT Specification	⅝" (1")	500 lb	Friction Course

All thicknesses mentioned in these Specifications and/or shown on the project Drawing shall be an average thickness computed as follows:

The minimum thickness allowed shall be ¼ inch less than the required average thickness. Thickness in excess of ¼ inch of the required average thickness shall be computed at the design thickness plus ¼ inch in computing the average thickness.

The thickness of the pavement shall be determined from the length of core, at least 2 inches in diameter, taken at random points on the cross section and along the roadway. Each core shall represent a section not longer than 250 feet. The average thickness shall be determined from the measured thicknesses.

If the Contractor believes that the number of cores taken is insufficient to properly indicate the thickness of the pavement, additional cores can be requested at locations designated by the Contractor. These and any additional costs shall be born by the Contractor.

When the deficiency in thickness is in excess of ¼ inch, the Contractor shall correct the deficiency either by replacing the full thickness for a length extending at least 50 feet from each end of the deficient area, or (when permitted by the City Engineer or his Designee) by overlaying. Normally an overlay shall not be permitted in a concrete curb section.

**Section 12.03            MECHANICAL SPREADING and SCREEDING EQUIPMENT**

Bituminous pavers shall be self-contained, self-propelled and steerable. It shall be equipped with a receiving and disbursing hopper capable of holding a minimum quantity of 5 cubic yards of bituminous plant mix material permitting a uniform spreading operation. The hopper shall be equipped with a conveyor distribution system to place the mixture uniformly in front of the screed.

The paver shall also be equipped with a heated mechanical screed or strike-off assembly. The screed or strike-off shall be capable of adjustment to regulate the depth of material spread and shall produce a finished surface of the required evenness and texture, without tearing, shoving, or gouging the mixture.

**Section 12.04            CONSTRUCTION METHODS**

The mixture shall be spread on the designated surface only when the surface previously prepared is intact, firm, properly cured and dried, and only when the air temperature in the shade and away from artificial heat is above 40° F and rising.

The mixture shall be delivered on the road in ample time to permit the spreading, rolling and surface testing during daylight hours. The temperature of the mixture at the time of spreading shall be between 260° and 310° F and shall not exceed

340° F at the plant.

Material shall be delivered to the job site with sufficient frequency that the paving operation can continue without interruption.

Depressions which may develop after the initial rolling shall be remedied by removing the mixture laid and adding new material to bring such depressions to a true surface. Such portions of the completed course that are defective in surface planeness, compaction or composition, or that do not comply with the requirements of these Specifications shall be removed and replaced with suitable mixture properly laid in accordance with these Specifications.

Vertical construction joints shall be constructed prior to the commencement of the ongoing paving operation. All cold joints shall be prepared according to the FDOT Specifications. The vertical surface of all existing asphaltic concrete mixes, at cold joints, shall be mopped with an approved liquid bitumen material so as to provide a water-tight joint at the interface of the two mixes.

**Section 12.05 FINISHED SURFACE REQUIREMENTS**

For the purpose of testing the finished surface, the Contractor shall provide a 15 foot rolling straight edge (to include a recent certification of calibration) and standard template cut to the true cross section of the road. These shall be available at all times during construction so that the City may check the finished surface. The Contractor shall provide and designate an employee whose duty it is to use the straight edge and template in checking all rolled surface under the direction of the City. Vertical measurement from a string line between curbs, to determined crown, may be accepted as an alternate. The finished surface shall be such that it will not vary more than ¼ inch from the 15 foot rolling straight edge applied parallel to the centerline of the pavement and shall be of uniform texture and compaction. The lip of the asphalt shall be higher than the gutter by ¼ to ½ inch. The surface shall have no pulled, torn or loosened portions and shall be free from segregation, sand streaks, sand spots, or ripples. Irregularities of the surface, exceeding the above requirements, shall be corrected by the Contractor who has the option of selecting one of the following methods:

- A) Removing and Replacing - If correction is made by removing and replacing the pavement, the removal must be for the full depth of the course and extend at least 50 feet on either side of the defective area, for the full width of the paving lane.
- B) Overlaying - If correction is made by overlaying, the overlay shall cover the length of the defective area and taper uniformly to a feather edge thickness at a minimum distance of 50 feet on either side of the defective area. The overlay shall extend full width of the roadway. Care shall be taken to maintain the specified cross slope. The mix used for the overlay may be adjusted as necessary for this purpose by the City Engineer. Overlaying

shall not be permitted when the finished pavement surface is a friction course or abuts concrete curbs.

- C) Other Methods - For courses which will not be the final pavement surface, correction of minor straightedge deficiencies by methods other than specified above may be approved by the City Engineer.

The City Engineer or his Designee may require in-laid type pavement markings or alkyd thermoplastic pavement markings at the time of the final course application.

**Section 12.06 SUBMITTALS**

Prior to the start of the placing of the asphaltic concrete, the job mix formula prepared by a certified material testing laboratory shall be submitted to and be approved by the City Engineer or his Designee. All job mix design formulas shall be current within the last 12 months.

The following items may be required by the City Engineer or his Designee:

- A) Plant inspection and calibration check.
- B) Aggregate verification.
- C) Temperature control and verification.

## ARTICLE 13

### PORTLAND CEMENT CONCRETE PAVEMENT

<b>Index</b>	<b>13.01</b>	<b><u><a href="#">GENERAL</a></u></b>
	<b>13.02</b>	<b><u><a href="#">SUBGRADE PREPARATION FOR RIGID PAVEMENT</a></u></b>
	<b>13.03</b>	<b><u><a href="#">MATERIALS, PROPORTIONING AND CONSTRUCTION FOR RIGID PAVEMENTS</a></u></b>
	<b>13.04</b>	<b><u><a href="#">EQUIPMENT</a></u></b>
	<b>13.05</b>	<b><u><a href="#">MIXING AND PLACING FOR RIGID PAVEMENT</a></u></b>
	<b>13.06</b>	<b><u><a href="#">FINISHING</a></u></b>
	<b>13.07</b>	<b><u><a href="#">CURING FOR RIGID PAVEMENTS</a></u></b>
	<b>13.08</b>	<b><u><a href="#">JOINTS IN RIGID PAVEMENTS</a></u></b>
	<b>13.09</b>	<b><u><a href="#">FINAL ACCEPTANCE FOR RIGID PAVEMENTS</a></u></b>

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<b>Section</b>	<b>13.01</b>	<b><u>GENERAL</u></b>
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Rigid pavement consists of constructing a specified Portland Cement Concrete Paving on a prepared subgrade. The utilities and other items in and beneath the street must be properly coordinated with the construction of rigid pavement to avoid all conflicts. The work to be done shall include the furnishing of all supervision, labor, materials, equipment and incidentals necessary for the proposed rigid pavement construction in accordance with the approved Drawings and specifications.

<b>Section</b>	<b>13.02</b>	<b><u>SUBGRADE PREPARATION FOR RIGID PAVEMENT</u></b>
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	13.02.01	<u>General</u>
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The bottom of the excavation for the pavement or top of the earth fill will be known as the pavement subgrade and shall conform to the lines, grade and cross sections shown on the plans.

Prior to placing the concrete, the subgrade shall be tested for conformity with the cross section shown on the plans. If necessary, material shall be removed or added as required to bring all portions of the subgrade to the correct elevation. Concrete shall not be placed on any portion of the subgrade which has not been tested for correct elevation. The subgrade shall be cleared of all debris, including tree roots, stumps, and loose material. If at any time trucks, construction equipment or slip forming machines cause rutting or displacement of the subgrade materials, the subgrade shall be reshaped and compacted. The subgrade shall be in a moist condition at the time the concrete is placed.

13.02.02      Subgrade Material

The top 6 inches shall be composed of well drained granular soils that are predominantly sandy, mixed with no more silt or clay than required to obtain a Florida bearing value of 50 plus or minus 5 and be compacted to a minimum density of 98% of maximum density in accordance with AASHTO T-180.

**Section      13.03            MATERIALS, PROPORTIONING AND CONSTRUCTION FOR RIGID PAVEMENTS**

The materials and proportioning shall be in accordance with ACI Standard 318, latest edition. All construction procedures shall be in accordance with FDOT Standard Specifications for Road and Bridge Construction, latest edition.

13.03.01      Strength Required

All concrete shall have a minimum compressive strength of 3,000 psi at 28 days. Conformance to strength requirements shall be determined by ACI Standard 318, latest edition.

13.03.02      Slump

The mixture shall contain no more water than is necessary to produce concrete which is workable and plastic. The minimum slump necessary to place the concrete satisfactorily shall be used. Slumps shall be maintained so as not to exceed 4½ inches for non-vibrated placement nor to exceed 5 inches for vibrated placement.

The design mix shall be submitted to the City Engineer and Construction Manager for approval prior to paving.

**Section      13.04            EQUIPMENT**

13.04.01      Forms

The pavement shall be placed to lines and grades established by the Engineer. The edges of pavement shall be vertical to the subgrade and forms shall be sufficient to support mechanical equipment.

13.04.02      Ready Mixed Plants

The plant shall be in accordance with the FDOT Standard Specifications for Road and Bridge Construction, latest edition. All plants must be DOT certified or approved by the City Engineer.

13.04.03 On-Site Central Mix Plants

The plant shall be in accordance with the FDOT Standard Specifications for Road and Bridge Construction, latest edition. The trucks used to transport the concrete shall be so constructed to prohibit segregation of the mix. All plant must be DOT certified or approved by the City Engineer.

13.04.04 Paver

All equipment used in the placement of concrete pavements shall conform to FDOT Standard Specifications for Road and Bridge Construction, latest edition.

**Section 13.05 MIXING AND PLACING FOR RIGID PAVEMENT**

13.05.01 General

Concrete pavement shall be constructed on the prepared subgrade in accordance with these Regulations and in conformity with the lines, grades, thickness, and typical cross sections shown on the construction plans. Concrete pavement shall meet the following Minimum thickness requirements.

<u>Type of Development</u>	<u>Roadway Classification</u>	<u>Minimum Concrete Thickness</u>
Residential	Marginal Access and Parking Areas	6"
	Local Street	8"
	Minor Collector Street	8"
	Major Collector Street	8"
Industrial and Commercial	Marginal Access and Parking Areas	6"
	Minor Street	8"
	Collector Street	8"

13.05.02 Transporting Concrete

Concrete may be transported any distance providing it is discharged on the grade with the slump within the required slump range and meets concrete time limit requirements. If additional water is required to maintain the specified slump of concrete transported in the truck mixers, it may be added with the permission of the City Engineer or his Designee. In this case, a minimum of 25 additional revolutions of the mixer drum at designed mixing speed shall be required before discharging of the concrete. All concrete deliveries shall be accompanied by a batch time stamped on the delivery ticket by means of a mechanical time clock. Batch time shall be an accurate time of concrete batch and delivery truck departure from the batch plant.

13.05.03 Concrete Time Limit

The length of time that the concrete can be held in the truck shall conform to the following:

- A) Air temperature 45°F to 80°F, 90 minutes.
- B) Air temperature over 80°F with a retarder added to the mix, 90 minutes maximum.
- C) Air temperature over 80°F without a retarder added to the mix, 60 minutes maximum.
- D) The maximum temperature of the concrete at the time of placing shall be 95°F.

13.05.04 Placing Concrete

The concrete shall be deposited on the grade in such a manner as to require as little rehandling as possible. It shall be deposited in successive batches in a continuous operation. The concrete shall be consolidated by suitable means so as to preclude the formation of voids or honeycomb pockets.

13.05.05 Placing in Cold Weather

Concrete shall only be placed when the temperature is at least 40°F and rising. Any concrete damaged by frost action shall be removed and replaced.

**Section 13.06 FINISHING**

13.06.01 General

The concrete shall be struck-off, consolidated, and finished with mechanical equipment in such a manner that after final finishing, it shall conform to the pavement cross section shown on the construction plans. Hand finishing shall be permitted in narrow widths, in areas of irregular dimensions, or in the event of breakdown of the mechanical equipment, only to finish the concrete already deposited on the grade.

13.06.02 Final Surface Finish

The final surface of the pavement shall have uniform, skid-resistant texture. The method of texturing shall be approved by the City Engineer or his Designee and may require change in the final finishing procedure as required to produce the desired final surface texture. A burlap drag or transverse broom finish is recommended for local and collector streets. Arterial and rural roads may require an overlapping stiff bristled broom or steel comb finish at the discretion of the City

Engineer or his Designee.

### 13.06.03 Pavement Exposed to Rain During Construction

The Contractor shall always have materials available to protect the surface of the plastic concrete against rain. Areas of the pavement surface that exhibit a smooth, sandy appearance after the rain ceases shall be textured before applying the membrane curing materials. Areas that have suffered surface erosion and have coarse aggregate exposed, and have not yet hardened, shall be reworked by hand methods or with the finishing machine when the form paving method is used. Fresh concrete containing the same materials and properties as the pavement concrete shall be added to maintain an adequate supply in front of the screeds or machine to assure replacement of the concrete eroded from the surface. The surface shall then be textured and cured as specified.

If pavement edges have been severely eroded and the concrete has not set, the edges shall be repaired by setting side forms and replacing eroded concrete. After the side forms are set, fresh concrete shall be placed and finished prior to texturing and curing. After the pavement has hardened, remedial work shall not be permitted until after the curing period has terminated.

## **Section 13.07 CURING FOR RIGID PAVEMENTS**

### 13.07.01 General

After finishing operations have been completed and immediately after the free water has left the surface, the surface of the slab and the sides of the slab, for slip formed pavement, shall be coated and sealed with a uniform layer of membrane curing compound. The curing compound shall be applied at the rate of not less than 1 gallon per 200 square feet of surface. When the forms are removed, curing compound shall be applied to the sides of the slab. Areas in which the curing membrane is damaged shall be re-sprayed with curing compound within a period of 3 days.

Curing compound may be omitted when, in conjunction with protection of pavement from inclement weather, a polyethylene film or other acceptable material is applied over the pavement and maintained intact for 3 days.

### 13.07.02 Cracks

Concrete rigid pavement shall not be accepted with excessive uncontrolled cracks. Shrinkage cracks must be avoided.

Uncontrolled cracks  $\frac{1}{8}$  inch or larger in width shall be repaired. One of the following repair methods shall be used:

- A) Remove and Replacement.

- B) Widen with power router and fill with an approved joint sealant.
- C) Epoxy grout injection.

The City Engineer or his Designee shall determine which cracks are to be repaired and the method to be used.

**Section 13.08            JOINTS IN RIGID PAVEMENTS**

13.08.01            General

Transverse and longitudinal joints shall be constructed to a maximum spacing of 15 feet. Transverse joints shall extend the entire width of the pavement and through the curbs.

Sawing of joints shall begin 4 to 6 hours after placing concrete or as soon as the concrete has hardened sufficiently to permit sawing without excessive raveling and before uncontrolled cracking occurs. If necessary, the sawing operations shall be carried on both day and night, regardless of weather conditions.

13.08.02            Construction Joints

Longitudinal joints may be construction joints at the discretion of the City Engineer or his Designee. Transverse construction joints shall be installed whenever the placing of concrete is suspended a sufficient length of time for the concrete to begin to harden.

13.08.03            Joint Sealing

Joints shall be sealed, if required, before the pavement is exposed to traffic, including construction traffic. Prior to sealing, all foreign material shall be removed from the joints and the joints shall be thoroughly dry.

**Section 13.09            FINAL ACCEPTANCE FOR RIGID PAVEMENTS**

13.09.01            General Acceptance for Rigid Pavements

Before the pavement shall be considered for acceptance, all items shall be complete in accordance with the construction plans and these Regulations. Equipment, surplus materials, and construction debris shall be removed from the project.

13.09.02            Opening to Traffic

The pavement shall be closed to traffic after the concrete is placed until it reaches a compressive strength of 3,000 psi under ordinary field conditions. This does not include the sawing and sealing equipment or other light miscellaneous equipment. New roadways shall be closed to public traffic until approved by the City Engineer

or his Designee.

13.09.03      Testing of Concrete

Concrete pavement shall have a 28 day compressive strength of 3,000 psi. Portland Cement Concrete control for slump testing, and concrete cylinder samples and testing is required and shall be in accordance with AASHTO and ASTM Specifications, latest editions. Test reports shall be submitted to the City Engineer or his Designee by the Engineer of Record for review of all non-public improvements. All tests on public improvements shall be conducted by a Geotechnical/Soils Engineer under contract to the City. Final acceptance shall be based on testing in accordance with other paving requirements. Failed tests or additional tests are at Contractor's expense.

## ARTICLE 14

### QUALITY CONTROL

<b>Index</b>	<b>14.01</b>	<b><u><a href="#">GENERAL</a></u></b>
	<b>14.02</b>	<b><u><a href="#">INSPECTIONS AND TESTS</a></u></b>

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<b>Section</b>	<b>14.01</b>	<b><u>GENERAL</u></b>
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Developments within the City of Oviedo which have improvements to be dedicated (property, utilities, and rights-of-way) or granted (easements) shall require quality control assurances. The cost for these assurances shall be 3.5% of the total construction cost of the dedicated and/or granted improvements. This is part of the requirements of a Right-of-Way Utilization Permit.

<b>Section</b>	<b>14.02</b>	<b><u>INSPECTIONS AND TESTS</u></b>
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Staged inspections during construction are required. It is the responsibility of the Owner/Developer, or his Contractor, to notify the City Engineer or his Designee to arrange for these inspections. All tests shall be the responsibility of the Owner/Developer unless otherwise stated in the following paragraph.

Tests which are required under this Manual shall be performed by a competent engineering testing laboratory. This laboratory shall have an Engineer registered in Florida as one of the responsible officials of the firm. All tests on facilities to be dedicated to the public shall be performed by a City contracted engineering firm. All such testing costs shall be paid for by the quality control fees. In accordance with City Policy, the Contractor shall reimburse the City for any extra cost incurred due to the retesting of failing portions of the project to be dedicated to the public. During construction and upon completion of the following construction stages, the builder shall notify the City that each stage is ready for inspection, and will await clearance by the City Engineer or his Designee before proceeding to the next stage:

- A) Work zone traffic control.
- B) Clearing and grubbing.
- C) Utility systems (sanitary sewer facilities only).
- D) Storm water facilities.
- E) Removal of unsuitable material.
- F) Stabilization of subgrade.

- G) Underdrains (mandatory unless otherwise directed by the City Engineer or Designee.
- H) Curb and gutter (including backfill behind curbing).
- I) Inlets, box culverts, and all other concrete structures when steel is in place prior to pouring.
- J) All underground utilities within right-of-way, including but not limited to water, wastewater, irrigation, electric, street lighting wiring and bases, cable television, telephones, gas, etc. shall be in place and an inspection approval on file with the Construction Manager prior to proceeding.
- K) Base course during construction or mixing.
- L) Traffic Signal Systems.
- M) Finishing base course prior to paving.
- N) Wearing surface during application.
- O) Sidewalks, driveway approach, dumpster pads, and other reinforced structures (prepour).
- P) Sodding and/or landscaping.
- Q) Cleanup and dressing of right-of-way limits.
- R) Pavement marking and traffic control signage.
- S) Street name signs.
- T) Final inspection.

The City requires a 24 hour notice of said scheduled inspections. The purpose of these inspections is to ensure compliance with the approved development plan and to advise the City whether or not the roads, traffic controls, storm drainage, utilities, and other required improvements being constructed appear to qualify for acceptance by the City. The City accepts no responsibility or liability for the work, or for any contractual conditions involving acceptance, payment, or guarantees between the Contractor and the Developer, by virtue of these stage inspections. The City assumes no responsibility or commitment guaranteeing acceptance of the work, or for subsequent failure, by virtue of these stage inspections. However, if any aspect of the work being performed does not comply with acceptable standards, corrections will be required by the City as a condition for City acceptance. All required improvements shall be installed and have the approval of

the City prior to acceptance by the City.

Inspection of Private Facilities

Inspections and verifications of private streets and drainage facilities in approved developments shall be conducted by the City.

## ARTICLE 15

### CULVERTS AND STORM SEWERS

Index	15.01	<a href="#">GENERAL</a>
	15.02	<a href="#">PIPE</a>
	15.03	<a href="#">LAYING PIPE</a>
	15.04	<a href="#">BACKFILLING</a>
	15.05	<a href="#">PIPE FOUNDATIONS</a>
	15.06	<a href="#">TESTS</a>

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Section	15.01	<u>GENERAL</u>
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The work in this ARTICLE shall consist of furnishing and installing culverts and storm sewers with appurtenances in conformance with the Specifications hereafter described and of the sizes and dimensions shown on the plans. Storm sewer pumping stations shall in general conform to the Specifications for sanitary sewer lift stations. Submerged pipe ends shall terminate with a City approved sluice type gate installation, such as the Gator SG-30 as manufactured by Gator Gates of Sanford, Florida.

Section	15.02	<u>PIPE</u>
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	15.02.01	<u>Concrete Pipe</u>
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Concrete pipe shall be of first quality, conforming to the most current ASTM Designation C-76. Pipe requirements shall be shown on the plans. Class III reinforced concrete pipe is the minimum acceptable. Lifting holes are prohibited.

The joints shall have a continuous O-ring rubber gasket, or approved equal, which fits snugly in the annular space between the beveled surfaces of the tongue and groove ends of the pipe to form a flexible watertight joint under all conditions of service. There shall be no exposed metal in the joint, except that allowed by ASTM and FDOT for “chairs”. Elliptical concrete pipe joints shall be wrapped with filter fabric. Filter fabric shall conform to ARTICLE 17 of this Manual. Filter material shall extend a minimum of 1 foot both sides of the joint and a 2 foot overlap on the top. All joints shall prevent soil from infiltration into the pipe.

	15.02.02	<u>Alternative Material Pipes</u>
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Alternative pipe material may be allowed upon the submittal by the Project Engineer and approval by the City Engineer

**Section 15.03 LAYING PIPE**

All pipe shall be carefully laid, true to the lines and grades as shown on the plans. For pipe laid with rubber gasket joints, any deviation from true alignment or grade, which would result in a displacement from the normal position of the gasket of as much as ¼ inch, or which would produce a gap exceeding ½ inch between sections of pipe for more than ⅓ of the circumference of the inside of the pipe, shall not be acceptable and where such occurs the pipe shall be relaid. Where minor imperfections in the manufacture of the pipe cause a gap greater than ½ inch between pipe sections, the joint will be acceptable provided the gap does not extend more than ⅓ the circumference of the inside of the pipe. No mortar, joint compound, or other filler which would tend to restrict the flexibility of the gasket joint shall be applied to the gap. All pipe shall be laid “in-the-dry” unless specifically authorized otherwise by the City Engineer.

**Section 15.04 BACKFILLING**

Backfilling shall progress as rapidly as the construction and testing of the work will permit. All backfill material shall be suitable and free of deleterious material. The initial backfill shall be carefully deposited on both sides of the pipe at the same time and uniformly compacted around the barrel of the pipe until enough has been placed to provide a cover of 1 foot above the crown of the pipe. In no case shall backfill material be placed in the trench in a manner that will cause shock to or unequal pressure on the pipe. The backfill shall be placed and compacted to a minimum density of 98% of the maximum density value as determined by AASHTO T-180. Under no conditions shall construction debris, concrete, etc., be included with the backfill. All backfill in existing pavement shall be nonshrinkable fill unless this requirement is waived by the City Engineer.

**Section 15.05 PIPE FOUNDATIONS**

Where the nature of the foundation materials is of poor supporting value, the foundation material shall be consolidated by mechanical methods, replaced with sand or other material by constructing supporting cradles, or as approved by the City Engineer or his Designee.

**Section 15.06 TESTS**

Compaction tests shall be required for the first lift around the pipe and one test each 1 foot lift above that to subgrade for each 200 linear feet of pipe as a minimum. The City Engineer or his Designee may determine that more or fewer tests are required to certify the installation depending on the field conditions.

A pipe material certification shall be required to be submitted to the City Engineer or his Designee.

The certification shall be signed and sealed by a registered Professional Engineer in

the State of Florida. The certification shall state that the pipe installed and materials supplied comply with all applicable specification contained herein.

## ARTICLE 16

### INLETS AND MANHOLES

<b>Index</b>	<b>16.01</b>	<b><u><a href="#">GENERAL</a></u></b>
	<b>16.02</b>	<b><u><a href="#">MATERIALS</a></u></b>
	<b>16.03</b>	<b><u><a href="#">FOUNDATIONS</a></u></b>
	<b>16.04</b>	<b><u><a href="#">FORMS</a></u></b>
	<b>16.05</b>	<b><u><a href="#">PLACING AND CURING CONCRETE</a></u></b>
	<b>16.06</b>	<b><u><a href="#">MASONRY CONSTRUCTION</a></u></b>
	<b>16.07</b>	<b><u><a href="#">PRECAST INLETS AND MANHOLES</a></u></b>
	<b>16.08</b>	<b><u><a href="#">PLACING PIPE</a></u></b>
	<b>16.09</b>	<b><u><a href="#">FLOW CHANNELS</a></u></b>
	<b>16.10</b>	<b><u><a href="#">INLET PLACEMENT</a></u></b>
	<b>16.11</b>	<b><u><a href="#">MANHOLE COVERS AND RINGS</a></u></b>
	<b>16.12</b>	<b><u><a href="#">DIAMETER</a></u></b>
	<b>16.13</b>	<b><u><a href="#">ACCESS</a></u></b>

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<b>Section</b>	<b>16.01</b>	<b><u>GENERAL</u></b>
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The work specified in this ARTICLE shall consist of constructing inlets and manholes. These structures shall be constructed of Portland cement concrete and reinforcing steel with the necessary metal frames and gratings. They shall be constructed in conformity with the detailed plans and in accordance with this Manual and FDOT Standard Specifications. Stormwater and sewer facilities shall be in accordance with this Manual.

<b>Section</b>	<b>16.02</b>	<b><u>MATERIALS</u></b>
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Concrete shall be Class I and have a minimum compressive strength of 4,000 psi at 28 days. The mortar for masonry shall be of Portland cement and sand mixed in the proportions of 1 part cement to 3 parts of sand. At the option of the Contractor, high early strength cement may be used. All items shall be wet cast. Dry casting or low slump concrete shall not be allowed. There shall be no penetrating lifting holes on any structures, and no holes will be allowed within 6 inches of any joint on structures. Brick manholes shall not be permitted.

<b>Section</b>	<b>16.03</b>	<b><u>FOUNDATIONS</u></b>
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Compaction shall be to a minimum density of 98% of the maximum density determined by AASHTO T-180 for 12 inches, then stabilize using a 9 inch layer of crushed rock.

**Section 16.04 FORMS**

Forms shall be built true to line and grade, braced in a substantial and unyielding manner and so designed and constructed that they may be removed without injury to the concrete.

**Section 16.05 PLACING AND CURING CONCRETE**

The concrete shall be placed in the forms to the depth shown on the plans and thoroughly tamped and spaded. After the concrete has hardened sufficiently, it shall be covered with suitable material and kept moist for a period of 3 days or longer, if necessary, and shall be protected in a satisfactory manner from the elements until thoroughly cured.

**Section 16.06 MASONRY CONSTRUCTION**

Masonry construction shall be limited to completion of doghouses around pipes, adjusting manhole covers, etc., or as approved by the City Engineer. It is the intent of this Manual that structures be constructed of precast concrete or cast in place concrete. All clay brick used shall be solid and conform to the current ASTM Designation C-55 Grade P-11.

**Section 16.07 PRECAST INLETS AND MANHOLES**

Precast manholes, inlets and junction boxes shall be in accordance with ASTM C-478. Top elevation adjustment of the manhole top shall be adjustable between 6 inches and 12 inches using precast concrete rings or cast in-place concrete, minimum compressive strength of 3,000 psi. No brick will be accepted for the main structure. Vertical walls of manhole entrances shall not exceed 19 inches in length including the ring and cover.

**Section 16.08 PLACING PIPE**

The inlet and outlet pipes shall be flush with the inside face of the wall. Mortar bonding shall be required between pipe and structure wall. Concrete to PVC adapters shall be required when PVC pipes are connected to concrete structures.

**Section 16.09 FLOW CHANNELS**

Flow channel to be precast in place or cast in-place concrete, minimum compressive strength of 3,000 psi. Fillers of any other material will not be accepted. A flow channel shall be formed in the invert of all inlets, manholes and junction boxes and shall extend to the spring line of the pipe. The flow channel through manholes shall be made to conform in shape and slope to the lower 0.8 diameter of the inlets and outlets. Flow direction changes in excess of 90° shall not be included in sewer alignments without special consideration. When directional changes exceeding 45° occur, an additional flow line elevation drop of 0.1 foot

across manholes shall be provided. Straight-through channels may be formed with pre-cut half pipes. Benching shall be provided with a minimum slope of 2 inches per foot.

In general, manhole drop connections are not allowed. The City may allow such connections on a case by case basis. These connections shall only be considered when other alternatives are not feasible. If allowed, an outside drop pipe shall be provided for a sewer entering a manhole where its invert elevation is 24 inches or more above the manhole 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.

**Section 16.10 INLET PLACEMENT**

Radial inlets are prohibited. All inlets must be placed on tangents.

**Section 16.11 MANHOLE COVERS AND RINGS**

Covers and rings for manholes shall conform to U.S. Foundry and Manufacturing Company of Miami, Florida Part Number USF 1260-AK Slab Type Ring and Cover Series, or USF 227-AS, depending upon specific application. The cover shall have the wording “STORM” or “SANITARY”, as applicable, cast into the face in 1½ to 2 inch letters raised flush with the top of the cover as specified in the Typical City Details attached as part of this Manual. The logo of the City of Oviedo may also be cast into the face of the cover equal to that specified in the Typical City Details attached as part of this Manual.

**Section 16.12 DIAMETER**

For pipe sizes 24 inches in diameter and smaller, the minimum inside diameter of manholes shall be 48 inches. For pipe sizes between 24 and 36 inches, the minimum inside diameter shall be 60 inches. For pipe sizes larger than 36 inches in diameter, a 72 inch inside diameter manhole shall be provided

**Section 16.13 ACCESS**

A 10 foot wide access road and minimum 20 foot easement shall be provided for all structures to be dedicated to the public which are located outside of City roadways. The top 8 inches of the access road shall be stabilized to FBV 50 , and compacted to a minimum density of 98% of the maximum density as determined by AASHTO T-180 for the top 8 inches.

## ARTICLE 17

### UNDERDRAINS

<b>Index</b>	<b>17.01</b>	<b><u>GENERAL</u></b>
	<b>17.02</b>	<b><u>MATERIALS</u></b>
	<b>17.03</b>	<b><u>EXCAVATION TRENCH</u></b>
	<b>17.04</b>	<b><u>PLACING THE FILTER FABRIC</u></b>
	<b>17.05</b>	<b><u>LAYING THE PIPE</u></b>
	<b>17.06</b>	<b><u>PLACING AND COMPACTING FILTER AGGREGATE</u></b>
	<b>17.07</b>	<b><u>BACKFILL ABOVE FILTER AGGREGATE</u></b>
	<b>17.08</b>	<b><u>CERTIFICATION</u></b>
	<b>17.09</b>	<b><u>ACCEPTANCE OF UNDERDRAINS</u></b>

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#### **Section 17.01 GENERAL**

The work specified in this ARTICLE consists of the construction of underdrains. Underdrain pipe shall have a minimum diameter of 8 inches, unless otherwise approved by the City Engineer. Underdrains shall be required in all cases unless explicitly deleted by the City Engineer.

#### **Section 17.02 MATERIALS**

The materials used shall conform to the following requirements.

##### **17.02.01 Filter Fabric**

Filter fabrics for use in underdrains shall conform to the following properties, minimum (use Mirafy 140 or approved equal):

<u>Fabric</u>	<u>Test Method</u>	<u>Unit</u>	<u>Typical Value</u>
Grab Tensile Strength	ASTM D-1682	lb	120
Grab Tensile Elongation	ASTM D-1682	%	55
Trapezoidal Tear Strength	ASTM D-1117	lb	50
Mullen Burst Strength	ASTM D-3786	psi	210
Puncture Strength	ASTM D-3787	lb	70
Water Flow Rate	CEMC-GET-2	gal/min/sf	285

##### **17.02.02 Pipe Wrap**

The filter fabric pipe wrap shall be an approved strong, tough, porous nylon, polyester, polypropylene or other approved fabric. It shall be secured to and completely cover the perforated plastic tubing pipe underdrain to prevent infiltration of trench backfill material. The filter envelope shall weigh a minimum

of 4 ounces per square yard and shall retain soil particles larger than 212 microns (No. 70 sieve) when tested in accordance with ASTM D-1682. The grab strength (wet) of the filter wrap shall not be less than 100 lbs and the grab elongation shall not be less than 60%. Storage and handling of filter envelope shall be in accordance with the manufacturer's recommendation. Torn or punctured filter wrap shall not be used.

17.02.03 Filter Aggregate (Fine Aggregate)

Sand used for backfilling trenches under, around and over underdrain pipe shall consist of hard, durable, clean quartz and shall be reasonably well graded, from coarse to fine. When tested by means of laboratory sieves, it shall meet the following requirements, in percent of total weight.

Total Retained on:

<u>Sieve</u>	<u>Percent</u>
No. 4	0 to 5
No. 8	0 to 15
No. 16	3 to 35
No. 30	30 to 75
No. 50	65 to 95
No. 80	93 to 100

17.02.04 Filter Aggregate (Other)

A) Stone

When stone is used for filter aggregate it shall be composed of clean, durable rock that is non-cementous when exposed to water for extended periods and shall be so certified by a Geotechnical/Soils Engineer. The gradations of stone filter aggregates shall be designed and certified by a Geotechnical/Soils Engineer and approved by the City Engineer. Washed limerock shall not be permitted.

B) Slag

Slag shall be clean, tough and durable. It may be either air-cooled blast-furnace slag or phosphate slag. It shall be reasonably uniform in density and quality, and the gradations of slag filter aggregates shall be designed and certified by a Geotechnical/Soils Engineer and approved by the City Engineer.

C) Expanded Shale

Expanded shale may be used, but only in the filter material grade that meets

the gradations specified above for sand.

17.02.05 Pipe

Corrugated Polyethylene Tubing shall be used as underdrain and shall conform to the requirements of AASHTO M-252, latest edition. Polyethylene Tubing shall be delivered in 20 foot lengths (minimum) and shall be fitted, prior to installation, with a filter fabric wrap. PVC Pipe shall satisfy ASTM D-3033 specifications; Aluminum pipe shall satisfy AASHTO M-196 specifications.

**Section 17.03 EXCAVATION TRENCH**

The trench shall be excavated carefully, to such depth as is required to permit the pipe to be laid to the grade desired and to the dimensions shown in the plans.

The underdrain trench shall be constructed in a dry condition. This shall be accomplished by the use of a well point system or other positive dewatering method.

**Section 17.04 PLACING THE FILTER FABRIC**

After the trench has been excavated, the filter fabric shall be rolled out over the trench and walked into the trench. Care shall be taken to prevent the excavated material from entering the trench after the fabric has been installed.

**Section 17.05 LAYING THE PIPE**

After the filter fabric has been placed in the trench, approximately 6 inches of filter aggregate shall be placed in the trench. The pipe shall be bedded firmly in the filter aggregate to the correct line and grade. The upper end of the run of pipe shall terminate at a drainage structure or underdrain cleanout to prevent any filter aggregate from entering the pipe.

All lateral connections to underdrains shall be made at approved drainage structures. Cleanouts and/or approved drainage structures shall be located along all underdrain systems. The maximum spacing of cleanouts or structures shall be 200 feet, or as directed by the City Engineer or his Designee.

**Section 17.06 PLACING AND COMPACTING FILTER AGGREGATE**

After the pipe has been laid to grade, the pipe shall be firmly held in place by mechanical means while the filter aggregate is placed to a maximum height of 5 inches plus 1 inch (compacted) above the top of the pipe. After the first lift is placed and compacted to the satisfaction of the City Engineer or his Designee the remainder of the filter aggregate shall be placed. The excavation of the trench, the placement of the filter fabric, the installation of the pipe and the placement and compaction of the first lift of filter aggregate shall be accomplished in a single

continuous operation. Special care shall be taken to avoid displacement or damage to the pipe or filter fabric.

**Section 17.07 BACKFILL ABOVE FILTER AGGREGATE**

After the filter aggregate has been placed 12 inches above the pipe the filter fabric shall be lapped the full width of the trench from both sides. The portion of the trench above the filter aggregate shall be filled with fine filter aggregate which shall be placed and tamped in layers not thicker than 12 inches to the existing grade.

**Section 17.08 CERTIFICATION**

The Contractor shall provide to the City Engineer or his Designee, prior to the final acceptance, a written statement from a Geotechnical/Soils Engineer that all materials installed and that the construction of the underdrain system complies with the approved design.

**Section 17.09 ACCEPTANCE OF UNDERDRAINS**

Prior to the acceptance for maintenance, the Owner/Developer shall correct any deficiencies. A mandrel shall be used to insure pipe geometry. Failure of the Contractor to perform the required inspection and repairs will result in the City Engineer or his Designee withholding final acceptance and/or Certificates of Occupancy.

## ARTICLE 18

### SIDEWALKS/BIKEPATHS, CONCRETE CURB, ETC.

<b>Index</b>	<b>18.01</b>	<b><u><a href="#">GENERAL</a></u></b>
	<b>18.02</b>	<b><u><a href="#">MATERIALS</a></u></b>
	<b>18.03</b>	<b><u><a href="#">FORMS</a></u></b>
	<b>18.04</b>	<b><u><a href="#">CONSTRUCTION METHODS</a></u></b>
	<b>18.05</b>	<b><u><a href="#">JOINTS</a></u></b>
	<b>18.06</b>	<b><u><a href="#">FINISHING</a></u></b>
	<b>18.07</b>	<b><u><a href="#">CURING</a></u></b>
	<b>18.08</b>	<b><u><a href="#">BACKFILLING AND COMPACTION</a></u></b>
	<b>18.09</b>	<b><u><a href="#">REQUIREMENTS FOR MACHINE-LAYING</a></u></b>
	<b>18.10</b>	<b><u><a href="#">HANDICAP RAMPS</a></u></b>

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<b>Section</b>	<b>18.01</b>	<b><u>GENERAL</u></b>
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The work specified in this ARTICLE consists of the construction of curb, curb and gutter, and sidewalks/bikepaths of Portland Cement Concrete. Such work shall be constructed in accordance with this Manual and in conformity with the lines, grades, dimensions, and notes shown on the Plans. Should the Contractor so elect, a curb machine can be used. All concrete shall be finished and supplied as recommended by the PCA and ARTICLE 13 of this Manual. Sidewalks/Bikepaths shall be located at least 2 feet away from walls and fences unless otherwise approved by the City Engineer. Sidewalks/Bikepaths

<b>Section</b>	<b>18.02</b>	<b><u>MATERIALS</u></b>
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Unless otherwise shown on the Plans, concrete shall be Class I, 3,000 psi.

<b>Section</b>	<b>18.03</b>	<b><u>FORMS</u></b>
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Forms for this work shall be made of either wood or metal. They shall be straight, free from warp or bends, and of sufficient strength when staked to resist the pressure of the concrete without springing.

Forms shall have a depth equal to the plan dimensions for the depth of the concrete being deposited against them.

<b>Section</b>	<b>18.04</b>	<b><u>CONSTRUCTION METHODS</u></b>
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Excavation shall be made to the required depth. Subgrade or base shall be compacted to a minimum density of 95% of the maximum density as determined by AASHTO T-180 for sidewalks/bikepaths and 98% of the maximum density as determined by AASHTO T-180 for curbs.

Sidewalk/Bikepath construction shall be similar to street construction. Concrete sidewalks/bikepaths shall be at least 4 inches thick, increasing to at least 6 inches thick at driveway entrances. Sidewalks/Bikepaths shall have a maximum longitudinal run of 12:1 and a minimum of ¼ inch, maximum of ½ inch per foot positive slope across the surface. There shall be a minimum of ½ inch and maximum of 1 inch per foot positive slope between the top of curb or edge of pavement and the sidewalk/bikepath, unless otherwise specifically approved by the City Engineer.

The concrete shall be placed in the forms to the depth specified and tamped and spaded until mortar entirely covers its surface. The top of the curb or gutter shall be floated smooth and the edges rounded to the radius shown on the plans.

**Section 18.05      JOINTS**

Where metal templates are used for joint construction, the curb, curb and gutter, etc., shall be constructed in uniform sections 10 feet in length, except where shorter sections are necessary for closures, but no section shall be less than 5 feet.

At the option of the Contractor, the sections may be formed by the use of dummy joints (either formed or sawed) or by the use of sheet metal templates. If sheet metal templates are used, they shall be of the dimensions and set to the lines shown on the plans. The templates shall be held firmly during the placing of the concrete and shall be left in place until the concrete has set sufficiently to hold its shape, but shall be removed while the forms are still in place. Contraction joints shall be spaced at 10 foot intervals for curb and 5 foot intervals for sidewalks/bikepaths. They shall be ¼ the depth of the concrete. Expansion joints, extending to the full depth of concrete, shall be placed in sidewalks/bikepaths at a maximum of 100 feet, at driveways, sidewalks/bikepaths intersections, all inlets, all radius points, all points where operations cease for any considerable time (such as the end of the day's run), etc. A ½ inch expansion joint shall be installed between all curbs and any abutting structures.

**Section 18.06      FINISHING**

**18.06.01      Surface Requirements**

The gutter or flow-line section or curb shall be tested with a 10 foot straight edge laid parallel to the centerline of the roadway while the concrete is still plastic. Irregularities in excess of ¼ inch for curb, curb and gutter, or sidewalks/bikepaths shall be immediately removed.

**18.06.02      Repair of Minor Defects**

The forms shall be removed within 24 hours after the concrete has been placed, and minor defects then filled with mortar composed of one part Portland cement

and two parts fine aggregate. Plastering shall not be permitted on the face of the curb or sidewalk/bikepath. Any rejected curb, curb and gutter, or sidewalk/bikepath shall be removed and replaced.

18.06.03 Final Finish

Sidewalk/bikepath surface, top of the curb, and the face from the top to 8 inches below shall be given a surface finish while the concrete is still green. In general, only a brush finish shall be required.

**Section 18.07 CURING**

All curbs and sidewalk/bikepath shall be covered with suitable material and kept moist for a period of 3 days or longer, if necessary, and shall be protected in a satisfactory manner from damage by the elements or other causes until acceptance of the work. If curing compound is used, moistening is not required.

**Section 18.08 BACKFILLING AND COMPACTION**

After the concrete has set sufficiently, but not later than 3 days after placing, the spaces in front and back of the curb shall be refilled to the required elevation with suitable material, which shall be placed and thoroughly compacted in layers not thicker than 6 inches.

Where bases are to be constructed adjacent to the curb, the concrete shall be properly backfilled and shall set for a period of not less than 3 days before any base material is placed against it.

**Section 18.09 REQUIREMENTS FOR MACHINE-LAYING**

As a specific requirement for machine-laid curb and gutter, contraction joints shall be sawed unless an alternate method of construction is approved in advance by the City Engineer. Joints on curbs shall be provided at intervals of 10 feet, except where shorter intervals are required for closure, but no joints shall be sawed or constructed at intervals of less than 5 feet. Sidewalks may also be machine laid.

**Section 18.10 HANDICAP RAMPS**

Ramps shall be required at all intersections and be in compliance with the most recent edition of the Florida Accessibility Code for Building Construction as prescribed by law and FDOT Standard Specifications. At each intersection there must be a sufficient number of handicap ramps to facilitate ingress and egress from both sides of the roadway. The slope of the ramp shall not exceed a ratio of 12 horizontal to 1 vertical.

## ARTICLE 19

### CHAIN LINK FENCE

<b>Index</b>	<b>19.01</b>	<b><u><a href="#">GENERAL</a></u></b>
	<b>19.02</b>	<b><u><a href="#">MATERIALS</a></u></b>
	<b>19.03</b>	<b><u><a href="#">INSTALLATION</a></u></b>
	<b>19.04</b>	<b><u><a href="#">ELECTRICAL GROUNDS</a></u></b>

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<b>Section</b>	<b>19.01</b>	<b><u>GENERAL</u></b>
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The work specified in this ARTICLE consists of furnishing and erecting chain link fence in accordance with this Manual, and Section 02444 of the Chain Link Manufacturers Institute's Specifications. The placement of any fence shall not interfere with the clear sight distance of intersections or driveways. Driveway gates shall be positioned to allow the length of one standard size vehicle behind the right-of-way line.

<b>Section</b>	<b>19.02</b>	<b><u>MATERIALS</u></b>
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	19.02.01	<u>General</u>
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The fabric, posts, fastenings, fittings and other accessories for chain link fence shall meet the requirements of AASHTO M-181 with the following changes:

- A) ANSI/ASTM A-123 - Zinc (Hot Galvanized) Coatings of Products  
Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars and Strips.
- B) ANSI/ASTM F-567 - Installation of Chain-Link Fence.
- C) ASTM A-120 - Black and Hot-dipped Zinc-coated (Galvanized) Welded and Seamless Steel Pipe, for Ordinary Uses.
- D) ASTM C-94 - Ready-mixed Concrete.
- E) ASTM A-120 - Schedule 40 steel or SS-40 pipe, standard weight, welded joints permitted. Size and weight as specified.
- F) FS RR-F-191 - Type I: Zinc-coated steel.  
Type IV(A): Extruded vinyl coated steel.  
Type IV(B): Fusion bonded vinyl coated steel.

19.02.02 Concrete Mix

Concrete shall meet ASTM C-94 and be of normal sulphate resisting Portland Cement, 3,000 psi minimum at 28 days with a 3 inch slump, and ½ inch sized aggregate.

19.02.03 Framing Materials

		<u>Type I Size/in</u>	<u>Round Wt/plf</u>
	<u>Framing Members</u>		
A)	End, Corner and Pull Posts		
	6 ft and less	2 <sup>3</sup> / <sub>8</sub>	3.65
	Over 6 ft to 12 ft	2 <sup>7</sup> / <sub>8</sub>	5.79
	Over 12 ft	4	9.11
B)	Line Posts (fabric height)		
	6 ft and less	2	2.72
	Over 6 ft	2 <sup>3</sup> / <sub>8</sub>	3.65
C)	Rails and Braces (fabric heights)		
	Horizontal brace at 6 ft	1 <sup>2</sup> / <sub>3</sub>	2.27
	Top Rail	1 <sup>2</sup> / <sub>3</sub>	2.27
	Center and Bottom Rail	1 <sup>2</sup> / <sub>3</sub>	2.27
D)	Gate Posts (width of leaf)		
	6 ft and less	2 <sup>7</sup> / <sub>8</sub>	5.79
	Over 6 ft to 13 ft	4	9.11
	Over 13 ft to 18 ft	6 <sup>5</sup> / <sub>8</sub>	18.97
	Over 18 ft	Design to be approved and certified	
E)	Gate Frame (size of leaf)		
	6 ft high OR 8 ft wide	1 <sup>2</sup> / <sub>3</sub>	2.27
	Over 6 ft high OR 8 ft wide	2	2.72
	Over 8 ft high OR 10 ft wide		
	Plus additional structural members	2	2.72

19.02.04 Chain Link Fabric (Fences and Gates)

PVC Coated Galvanized Steel shall be of steel wire, conforming to ASTM A-641, a tensile strength 75,000 psi, galvanized (0.30 oz/sf), and coated as follows:

- A) Coating type I extruded polyvinyl chloride.
- B) Coating type II FUSION BONDED PVC of 7 mils.

The standard material shall be Standard Industrial 2 inch mesh, 9 gauge, 0.148 inch diameter.

The color of fabric, gates, and posts shall be as approved by the City Engineer in either medium green, dark green, black, or brown, as applicable.

19.02.05      Manual Operating Gates

A)      Fabrication

Gate frames shall be assembled by welding connections. The same fabric as for the fence shall be used unless otherwise specified. Fabric shall be installed with stretcher bars, or tie wires at the top and bottom if stretcher bars are not used. Stretcher bars shall be attached to the gate frame not more than 14 inches off center. Hardware shall be attached with rivets or by other means which provide security against removal or breakage.

- 1)      For sections over 8 feet in height and 10 feet in width, horizontal and vertical members shall be provided to ensure proper gate operation and for attachment of fabric, hardware and accessories.
- 2)      Diagonal cross-bracing consisting of  $\frac{3}{8}$  inch diameter adjustable truss rods on gates shall be used where four sided tension rods are not used. Frame rigidity shall be achieved without sag or twist.

B)      Gate hardware shall be galvanized per ASTM A-153.

- 1)      Hinges shall be pressed steel or malleable iron to suit gate size, of non lift off type, and offset to permit 180° gate opening. One pair of hinges per leaf, up to 12 feet in height, shall be provided.
- 2)      Latches shall be the forked type to permit operation from either side of gate. A padlock eye shall be provided as an integral part of the latch.
- 3)      The keeper for the gates, which automatically engages the gate leaf and holds it in the open position until manually released, shall be provided.
- 4)      For double gates, a drop rod to hold the inactive leaf shall be provided. A pipe to engage the center drop rod shall be provided in the pavement. Locking devices and padlock eyes shall be provided as an integral part of the latch thereby requiring one padlock for locking both gate leaves.

19.02.06      Power Actuated Sliding Gates

The manufacturer's standard heavy-duty inverted channel track, ball bearing trollies, hanger, sheaves, overhead framing, supports, guides, stays, bracing and accessories shall be provided when power actuated gates are used.

19.02.07      Gate Operator

The gate operator shall be a Stanley Model ASJH, 120 volt, 60 Hz, drive motor or approved equal. The Owner/Developer shall be responsible for providing a unit with a drive motor that will provide for long term operation of the gate weight.

19.02.08      Controls

- A)      The control station shall consist of a three-position push button station (open close stop), which is capable of being connected to a time delay device. The location shall be as approved by the City. The Owner/Developer shall provide a suitable conduit for power and control wiring.
- B)      The Owner/Developer shall provide 1 digital keyless entry station (Stanley Part No. 320-0720 or approved equal).
- C)      Emergency vehicle access shall be provided by two methods. The first is the acceptance of a 7 digit code, specified by the City of Oviedo Fire Rescue Department, at the entry control station. The second is the use of a keyless entry device on a frequency and code combination as specified by the City of Oviedo Fire Rescue Department. The Owner/Developer shall provide the City of Oviedo Fire Rescue Department with 2 remote entry devices.

19.02.09      Accessories

- A)      All items shall be galvanized to comply with ASTM A-153 (except tie wires and barbed wire) plus finished to match framing.
- B)      Tension and tie wire
  - 1)      Tension wire shall be 7 gauge galvanized wire.
  - 2)      Fabric to line posts, rails and braces shall be 9 gauge minimum.
  - 3)      Fabric to tension wire shall use 11 gauge hog rings.
- C)      Post tops shall be pressed steel, or malleable iron, designed as a drive fit, weather tight closure cap on tubular posts. Where top rails are used, tops shall permit passage of the top rail.
- D)      Stretcher bars shall be one piece lengths to full height of the fabric with a minimum cross section of  $\frac{3}{16}$  inch x  $\frac{3}{4}$  inch or equivalent fiberglass rod. Stretcher bars shall be provided for each gate, end, corner and pull post. Stretcher bar bands and clips shall be heavy pressed steel or malleable iron.

At square posts, special design clips shall be provided.

- E) Barbed wire supporting arms shall be pressed steel, complete with provision for anchoring to end, corner, and pull posts and for attaching three rows of barbed wire to each arm.
  - 1) Single outward projecting and vertical arms on gates shall be integral with the post top weather cap.
  - 2) Intermediate arms shall make provision for the passage of the top rail. Arms shall be capable of withstanding, without failure, 250 pound downward pull at the outer most end of the arm.
- F) Galvanized barbed wire shall be ASTM A-121 double strand 12-½ gage wire with 14 gage 4 point, galvanized, class 3 barbs.

**Section 19.03                    INSTALLATION**

- A) Framework, fabric, accessories and gates shall be installed in accordance with ANSI/ASTM F-567.
- B) Fence shall be of the height and length indicated on the approved plans.
- C) Line posts intervals shall not exceed 10 feet.
- D) Terminal gate and posts shall be set plumb, in concrete footings with the top of the footing 2 inches below the finished grade. Slope top of concrete for water runoff. Excavate depth as required by ANSI/ASTM F-567.
- E) Top rail shall pass through line post tops and be spliced with 7 inch long rail sleeves.
- F) Each gate and corner post shall be braced back to the adjacent line post with horizontal center brace rails and diagonal truss rods. Brace rails shall be installed one bay from end and gate posts.
- G) Center and bottom brace rails shall be installed on corner and gate leaves.
- H) Fabric shall be stretched between terminal posts or at intervals of 100 feet maximum, whichever is less.
- I) The bottom of the fabric shall be positioned 2 inches above the finished grade.
- J) The fabric shall be fastened to the top rail, line posts, braces, and bottom tension wire with wire ties at a maximum of 15 inches on centers.

- K) The fabric shall be attached to the end, corner, and gate posts with tension bars and bar clips.
- L) The bottom tension wire shall be stretched taut between terminal posts.
- M) Barbed wire support arms shall be sloped. The barbed wire shall be attached under tension and secure.
- N) Gates with fabric and barbed wire overhang shall match fence. Three hinges per leaf, latch, catches, drop bolt foot bolts and sockets, torsion spring retainer, and locking clamp shall be installed.
- O) Concrete center drop shall be installed to the depth of the foundation. Drop rod retainers shall be placed at the center of double gate openings.

**Section 19.04 ELECTRICAL GROUNDS**

Wherever a power line passes over the fence, a ground shall be installed directly below the point of crossing. The ground rod shall consist of an aluminum or galvanized rod, with connection of similar metal if required, or of other appropriate material, 8 feet in length and at least 5/8 inch in diameter. The rod shall be driven vertically until the top of the rod is approximately 6 inches below the ground surface. A No. 6 conductor shall be used to connect the rod and all fence elements. The conductor shall be connected to each fence element and the ground rod by means of electrical-type clamps which will prevent corrosion.

**ARTICLE 20**

**GRASSING AND MULCHING**

**Index**      **20.01** [GENERAL](#)  
                 **20.02** [MATERIALS](#)  
                 **20.03** [CONSTRUCTION METHODS](#)  
                 **20.04** [SODDING](#)  
                 **20.05** [CLEAN-UP](#)

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**Section**      **20.01**              **GENERAL**

The work specified in this ARTICLE shall consist of all grassing efforts on road shoulders, ditches, embankments, and other areas left barren by construction in order to establish a dense stand of grass.

**Section**      **20.02**              **MATERIALS**

The grass seed shall be common Bermuda and Bahia, as a minimum. In addition, brown top millet will be included during summer months and annual rye in the winter months. The mulch shall consist of thoroughly shredded straw or hay. All seed shall meet the requirements of the State Department of Agriculture. The chemical composition of the fertilizer shall be 8-8-8 or other chemical composition specified in the plans.

**Section**      **20.03**              **CONSTRUCTION METHODS**

Construction methods shall be in accordance with FDOT Standard Specifications.

Seed shall be applied at not less than the following rate:

Bermuda	30 lb per acre
Bahia (Argentina)	120 lb per acre
Annual Rye	20 lb per acre (October - March)
Brown-Top Millet	20 lb per acre (April - September)

Fertilizer shall be applied at the rate of 1,000 lb per acre.

**Section**      **20.04**              **SODDING**

Sodding shall be in accordance with FDOT Standard Specifications. Sod destroyed or damaged by construction shall be replaced with the same existing type of grass in place prior to construction. All disturbed areas in the public right-of-way shall be sodded.

**Section 20.05 CLEAN-UP**

After each day's work, all materials shall be removed from all sidewalks and roadways used by the general public.

## ARTICLE 21

### PAVEMENT MARKINGS

<b>Index</b>	<b>21.01</b>	<b><u><a href="#">GENERAL</a></u></b>
	<b>21.02</b>	<b><u><a href="#">MATERIALS</a></u></b>
	<b>21.03</b>	<b><u><a href="#">INSTALLATION</a></u></b>

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<b>Section</b>	<b>21.01</b>	<b><u>GENERAL</u></b>
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The work specified in this ARTICLE shall consist of the design and installation of pavement markings as shown on the plans in accordance with this Manual and Seminole County Standards. Temporary markings shall be used as required by the City. The City Engineer has approval jurisdiction over ARTICLE 21 and any requests for modifications from these Standards.

<b>Section</b>	<b>21.02</b>	<b><u>MATERIALS</u></b>
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All paint and Thermoplastic Compounds used for pavement markings (only alkyd materials shall be used), reflective pavement markers, and glass spheres shall conform FDOT Standard Specifications.

<b>Section</b>	<b>21.03</b>	<b><u>INSTALLATION</u></b>
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All surfaces shall be cleaned prior to the start of installation.

21.03.01	<b><u>Painted Markings</u></b>
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Painted traffic markings shall be installed in accordance with FDOT Standard Specifications and the MUTCD. Paint may be used only on private development improvements or as temporary markings.

21.03.02	<b><u>Thermoplastic Traffic Markings</u></b>
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Thermoplastic traffic markings shall be installed in accordance with FDOT Standard Specifications and the MUTCD. Pre-formed plastic markings may be substituted as permitted by the City Engineer. Alkyd materials may be applied immediately after final compaction of asphaltic concrete.

21.03.03	<b><u>Reflective Pavement Markers</u></b>
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All reflective pavements markers shall be installed in accordance with FDOT Standard Specifications. Blue pavement reflectors shall be installed in the street, in front of fire hydrants, slightly offset from the centerline of the road in the closest lane to the hydrant.

21.03.04      Striping Design

- A) Temporary tape to be installed prior to darkness on the day of existing markings removal. No conflicting markings permitted.
- B) No markings are to be installed prior to layout approval.
- C) All markings are to be thermoplastic with raised pavement markers where applicable.
- D) Centerline and edgeline to extend 15 feet beyond transition point downstream and 15 feet prior to transition point upstream.
- E) Hash marks spacing to be 30 feet from center to center.
- F) Gore bullnose to have 25 foot minimum radius.
- G) Arrow spacing to conform with FDOT Standard Specifications.
- H) The City Engineer must approve all striping plans.
- I) During auxiliary lane construction and installation of markings the work zone shall be signed in accordance with the MUTCD.
- J) Two-way blue reflective markers shall be supplied and installed by the Developer, in front of hydrants, slightly offset from the centerline of the road in the closest lane to the hydrant. Further specifications can be obtained through the City of Oviedo Fire Rescue Department.
- K) When a lane closure is permitted on a road classification of collector or above, the hours of operation shall be limited to 9:00 AM to 4:00 PM.

## ARTICLE 22

### MEDIANS

Index	22.01	<a href="#"><u>MEDIAN SEPARATION REQUIREMENTS</u></a>
	22.02	<a href="#"><u>MINIMUM WIDTHS</u></a>
	22.03	<a href="#"><u>OPENINGS</u></a>
	22.04	<a href="#"><u>SPECIAL CONSIDERATIONS</u></a>

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<b>Section</b>	<b>22.01</b>	<b><u>MEDIAN SEPARATION REQUIREMENTS</u></b>
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At a minimum, median separations shall be required on all divided streets with four or more travel lanes. Median separations may be required in other areas when deemed appropriate. The City Engineer has approval jurisdiction over ARTICLE 22 and any request for modifications from these Standards.

<b>Section</b>	<b>22.02</b>	<b><u>MINIMUM WIDTHS</u></b>
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- A) The minimum width of a median containing a left turn lane shall be 16 feet when curbed. If the median is a bi-directional turn lane, the minimum width shall be 12 feet.
- B) The minimum width of a median intended to shadow a crossing or left turning vehicle (from side street or driveway) shall be 22 feet when curbed.

<b>Section</b>	<b>22.03</b>	<b><u>OPENINGS</u></b>
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- A) Median openings on all streets shall be spaced at 660 foot intervals or per the Standards of the LDC.
- B) Correct signal spacing and dedicated public streets are given priority consideration for median opening approvals.
- C) All median designs and provisions shall be consistent with Standards provided by the Manual of Uniform Minimum Standards for Design, Construction and Maintenance for Streets and Highways (FDOT).
- D) All median openings and taper shall include a 12 foot wide left turn storage lane and taper. The minimum lengths for the storage lanes and tapers are included in ARTICLE 23 of this Manual.
- E) The preferred end treatment for median opening is the bullet-nose design rather than the circular design.
- F) The width of median openings shall be a minimum of 40 feet. The design

shall be based upon the required turning radii and lane alignment of the intersection.

- G) No median opening shall be allowed where the median is intended to shadow a crossing or left turning vehicle (from side street or driveway), and is of insufficient width to do so.

**Section 22.04 SPECIAL CONSIDERATIONS**

The minimum spacing requirements of this ARTICLE may be modified upon approval by City Council given the particular conditions of the proposed development, if the minimums cannot be met, and if such reduction will not compromise operational and safety standards of the adjacent roadway.

## ARTICLE 23

### TURN LANES AND TAPERS

<b>Index</b>	<b>23.01</b>	<b><u><a href="#">GENERAL</a></u></b>
	<b>23.02</b>	<b><u><a href="#">DEDICATION OF ADDITIONAL RIGHT-OF-WAY</a></u></b>
	<b>23.03</b>	<b><u><a href="#">RIGHT TURN DECELERATION AND STORAGE LANES</a></u></b>
	<b>23.04</b>	<b><u><a href="#">ACCELERATION LANES AND TAPERS</a></u></b>
	<b>23.05</b>	<b><u><a href="#">LEFT TURN DECELERATION AND STORAGE LANES</a></u></b>
	<b>23.06</b>	<b><u><a href="#">ALTERNATE STORAGE LENGTHS FOR LEFT TURN LANES</a></u></b>
	<b>23.07</b>	<b><u><a href="#">BYPASS LANES</a></u></b>
	<b>23.08</b>	<b><u><a href="#">EXCEPTIONS</a></u></b>
	<b>23.09</b>	<b><u><a href="#">REVERSE CURVES</a></u></b>

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<b>Section</b>	<b>23.01</b>	<b><u>GENERAL</u></b>
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Turn lanes and tapers shall be designed in accordance with this Manual and the Manual of Uniform Minimum Standards for Design, Construction and Maintenance for Streets and Highways (FDOT). Turn lanes and tapers shall be used to reduce conflict between the traffic on driveways or intersecting streets and the traffic on the through street. This conflict reduction is achieved by providing turning vehicles with a refuge area where acceleration, deceleration, storage, and turning maneuvers may be accomplished. The City Engineer has approval jurisdiction over ARTICLE 23 and any request for modifications from these Standards. Turn lanes and tapers are required for the following conditions:

- A) The design speed of the accessed street is 35 MPH or greater.
- B) The parcel of property accessing the street is projected to generate 500 or more vehicle trips per day, or 50 or more vehicle trips in any hour.
- C) The parcel of property accessing the street is residential and has 50 or more dwelling units.
- D) The parcel of property accessing the street is a development that characteristically experiences peaks in its trip generation pattern, i.e., schools, subdivisions, restaurants, public assembly places.
- E) At any development as a Traffic Impact Analysis by a registered professional may warrant.
- F) At any parcel of property where a use changes to one that meets one of the above conditions.
- G) The main street has an average daily traffic count of 500 or more vehicles

per day or 50 or more vehicles in any hour.

- H) At any location, where grades or other unusual conditions indicate turn lanes to be desirable, as determined by the City. Turn lanes may be required on local streets at intersections for safety or capacity reasons.
- I) The street is classified as a thoroughfare.

**Section 23.02 DEDICATION OF ADDITIONAL RIGHT-OF-WAY**

On any arterial or collector street within a minimum of 150 feet (or as required) of its intersection with another arterial or collector, or at any other location where provisions of this Section require additional right-of-way, the right-of-way shall be increased by at least 10 feet, or as required, to permit proper design of auxiliary lanes and tapers. This additional right-of-way shall be dedicated or conveyed as a public right-of-way. Twenty-five foot corner triangle shall be provided as a minimum at street intersections. A larger triangle may be required at the discretion of the City Engineer.

**Section 23.03 RIGHT TURN DECELERATION AND STORAGE LANES**

The desirable requirements for lengths of tapers and storage for right turn lanes are based on the speed limit of the road and are as follows:

<u>Posted Speed of Roadway</u>	<u>Length of Taper</u>	<u>Length of Storage</u>	
		<u>Stop Condition</u>	<u>Free Right</u>
30 MPH	150'	50'	50'
35 MPH	170'	105'	80'
40 MPH	190'	135'	110'
45 MPH	210'	165'	140'
50 MPH	230'	195'	170'
55 MPH	250'	210'	200'

**Section 23.04 ACCELERATION LANES AND TAPERS**

The desirable requirements for lengths of acceleration lane and tapers are based on the speed limit of the road and are as follows:

<u>Speed Limit</u>	<u>Acceleration Lane</u>	<u>Taper Length</u>
45 MPH	300'	210'
50 MPH	470'	230'
55 MPH	660'	250'

**Section 23.05 LEFT TURN DECELERATION AND STORAGE LANES**

<u>Posted Speed of Roadway</u>	<u>Length of Taper</u>	<u>Length of Storage</u>
30 MPH	150'	100'
35 MPH	170'	105'
40 MPH	190'	135'
45 MPH	210'	165'
50 MPH	230'	195'
55 MPH	250'	210'

**Section 23.06 ALTERNATE STORAGE LENGTHS FOR LEFT TURN LANES**

Storage lengths for left turn lanes may be calculated in lieu of using the above tables (final approval by the City Engineer or his Designee) by one the of following methods:

- A) At un-signalized intersections, the storage length, exclusive of taper, may be based on the number of turning vehicles which are likely to arrive in an average 2 minute period within the peak hour, i.e.,  $SL$  (storage length in feet) =  $2 \times 25$  ft (average vehicle length)  $\times$  (number of left turning vehicles in peak hour/60).
- B) At signalized intersections, the storage length may be based on the signal cycle length, the signal phasing arrangement, and the rate of arrivals and departures of left turning vehicles that would store per cycle to allow for occasional surges.

**Section 23.07 BYPASS LANES**

A bypass lane shall be provided for left turns when a median or adequate pavement width does not exist. The taper shall be based on the formula: turn lane = speed  $\times$  width of lateral movement. Road sections disturbed by bypass and turn lanes shall be completely overlaid with a minimum of 1 inch of asphaltic concrete.

**Section 23.08 EXCEPTIONS**

Turn lane provisions (left and right) may be imposed unless roadway cross section, right-of-way width, or deficient frontage prohibit compliance and no other access location can be provided for the site. The lanes shall be installed by the Owner/Developer, in the future, when the right-of-way becomes available.

**Section 23.09 REVERSE CURVES**

Reverse curves shall not be used in place of straight tapers on curb and gutter sections.

## ARTICLE 24

### DRIVEWAYS

<b>Index</b>	<b>24.01</b>	<b><u><a href="#">GENERAL</a></u></b>
	<b>24.02</b>	<b><u><a href="#">REQUIRED SUBMITTALS</a></u></b>
	<b>24.03</b>	<b><u><a href="#">DESIGN CONSIDERATIONS</a></u></b>
	<b>24.04</b>	<b><u><a href="#">DESIGN SPECIFICATIONS</a></u></b>
	<b>24.05</b>	<b><u><a href="#">HANDICAP RAMPS</a></u></b>
	<b>24.06</b>	<b><u><a href="#">EXISTING DRIVEWAYS AND ACCESS POINTS</a></u></b>

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<b>Section</b>	<b>24.01</b>	<b><u>GENERAL</u></b>
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All curb cuts and driveways constructed, altered, or removed within the limits of the City of Oviedo shall be constructed, altered, or removed as provided for in this ARTICLE and the LDC. No person shall make any curb cut for a driveway, walkway or any other purpose within the street right-of-way or connect to an existing curb cut or driveway without first obtaining a Right-of-Way Utilization Permit from the City Public Works Department. Additional permits may be required from the County or FDOT for rights-of-way under their jurisdiction. The City Engineer has approval jurisdiction over the design, location and operational portion of this ARTICLE and any requests for modifications from these Standards. The City Engineer has approval jurisdiction over the construction permits, materials and methods portions of this ARTICLE and any requests for modifications from these Standards.

<b>Section</b>	<b>24.02</b>	<b><u>REQUIRED SUBMITTALS</u></b>
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Information required on plans submitted shall include:

- A) A complete plot plan showing all proposed and/or existing buildings and parking layouts and shall include a north arrow, date, and dimensions.
- B) Existing and proposed driveway locations and widths on the site and within 150 feet of the site on both sides of the street and in both directions.
- C) Distances to the nearest public intersection and to the nearest median cut in both directions, if applicable.
- D) Street pavement types and widths, laneage layout and widths, curb types, and right-of-way widths.
- E) Proposed and/or existing off-street loading and unloading facilities, interior parking arrangements and interior traffic circulating arrangements. (Non-residential requirement only.)

- F) Retaining walls, drainage, utility poles, trees, fences, and other physical features which affect the driveway location and sight distance.

**Section 24.03            DESIGN CONSIDERATIONS**

- A) The choice of the proper location of driveways must involve consideration of the amount of the conflict which can be expected to occur both within the parking area and on the abutting streets. One primary concept which shall be followed is to reduce the number of driveways to a practical minimum and to promote consolidated driveway usage wherever possible, thus providing fewer locations where conflicts may occur.
- B) The area to which the driveway provides access shall be of sufficient size and design to allow all necessary functions for loading, unloading, parking, circulation, and standing to be carried out on private property completely off the street right-of-way.
  - 1) Parking areas shall be so designed and marked as to provide for orderly and safe movement and storage of vehicles and pedestrians.
  - 2) No design shall be permitted which requires any vehicle to back out onto public right-of-way, i.e., a public street, parkway, or sidewalk, except for single family residences.
  - 3) Facilities with drive-in windows must be so designed that waiting vehicles do not extend into the street or right-of-way. A by-pass lane shall be required for all such facilities.

**Section 24.04            DESIGN SPECIFICATIONS**

24.04.01            Location

- A) Single family residential driveways shall not be permitted in the radius return of an intersection.
- B) No single family residential driveway, other than duplex or zero lot line, or temporary commercial driveway shall be permitted with its center nearer than 40 feet to the center of the next nearest driveways, except upon special approval of the City Engineer.
- C) No centerline of a residential driveway, other than duplex or zero lot line, driveway shall be closer to the adjacent property than ½ of the driveway width plus 6 feet.
- D) The centerline of all other types of driveways shall be no closer to the adjoining property than ½ the width of the driveway plus the return radius

dimension and 3 feet.

- E) No driveway shall be permitted which includes any facility such as traffic signal standards, trees, utility poles, site sign, catch basins, fire hydrants, or any other similar type structure, unless such facility is relocated at the property Owner's/Developer's expense. All setbacks shall meet the FDOT requirements for fixed object hazards.
- F) No curb cut shall be made within 3 feet of a drainage inlet or property line.
- G) Joint-use driveways shall be used when deemed necessary. The above criteria shall be complied with unless otherwise approved by the City Engineer.

24.04.02 Width

- A) The minimum width of single family residential driveways shall be 10 feet and the maximum width shall be 18 feet, with 3 foot flares on either side. For driveways longer than 100 feet, the width may be increased at the discretion of the City of Oviedo Fire Rescue Department.
- B) The minimum and maximum widths of commercial driveways, as based upon 12 foot travel lanes for two-way and emergency vehicles for one-way, shall be as specified below:

	<u>Minimum</u>	<u>Maximum</u>
One-Way	20	20*
Two-Way	24	36*

\*or as required for multi-lane driveways

- C) Non-residential driveways exceeding the maximum width shall only be considered when usage of 40 foot radius cannot be accommodated.
- D) All driveway widths shall be measured at the throat.
- E) For all residential driveways, the width of the curb opening shall not exceed the width of the driveway by more than 3 feet on each side.

24.04.03 Angle

- A) All driveways shall be constructed as nearly to a right angle (90°) to the street or roadway as possible.
- B) This requirement may be waived for one-way driveways, provided that the angle chosen represents improved ingress or egress compared to a right angle driveway and does not adversely affect the driver's sight distance.

24.05.04      Radii

- A)      On commercial and multi-family residential driveways, a proper radius which will accommodate the minimum turning radii and off-track of the design vehicle according to AASHTO Standards shall be provided. Normally, the design vehicle will be fire and emergency apparatus requiring a minimum radius of 40 feet based on a 24 foot wide two lane driveway. Consideration may be given to the street speed limit and width of driveway opening.
- B)      Tractor trailer combination shall be the design vehicle, when warranted, with a 55 foot radius as a minimum on all non-single family residential driveways.
- C)      A radius of less than 40 feet may be approved upon the applicant's demonstration to the City Engineer that the smaller radius is more appropriate for the particular parcel of property being served and that the traffic flow on the street being accessed is not impaired. The minimum radii for internal circulation shall be 20 feet. Three foot flares may be utilized on commercial projects where inadequate distance between the property and the road edge prohibits the use of radii, and shall be used on all non-single family residential driveways.
- D)      Contraction joints shall be tied at the radii to prevent uneven settlement.

24.04.05      Grade

- A)      All driveways shall cross the sidewalk/bikepath area at the sidewalk/bikepath grade as approved by the City Engineer. See the Typical City Details attached as part of this Manual.
- B)      In cases where property slopes down from the street, the driveway shall be constructed in such a manner as to raise the driveway to a height equal to the top of the curb at the right-of-way line or at a more appropriate point, as determined by the City Engineer, before the down slope or up slope of the driveway begins. See the Typical City Details attached as part of this Manual.
- C)      The driveway shall be designed so that approach, ramp and departure angles do not exceed the maximum as determined by the appropriate design vehicle.

Single Family Residential Driveway - Design Vehicle - Passenger Car

<u>Angle Type</u>		<u>Maximum Angle</u>
Approach Angle	(A)	16.4°
Ramp Angle	(B)	11.0°
Departure Angle	(C)	10.9°

All Other Driveways - Design Vehicle - Emergency Fire Apparatus

<u>Angle Type</u>		<u>Maximum Angle</u>
Approach Angle	(A)	14.14°
Ramp Angle	(B)	7.26°
Departure Angle	(C)	8.53°

- D) All curb cuts shall consist of a 6 inch raised or flush header curb for non-concrete approaches from the point of curvature to the point of tangency on each side of the driveway, except in locations where the accessed road is constructed with an existing swale, then a flush concrete header curb shall be provided.

24.04.05 Construction Specifications

- A) All driveways shall be constructed in conformance to the plans and specifications approved by the City Engineer.
- B) Concrete for the construction of the driveway approaches (the portion of the driveway in the right-of-way) shall be at least 3,000 psi concrete and at least 6 inches in thickness, with a break and exposed joint at the property line.
- C) Concrete for the construction of curbs shall be at least 3,000 psi concrete.
- D) Subgrade of driveways, driveway approaches, and curbs shall be compacted to a minimum density of 98% of the maximum density as determined by AASHTO T-180.

**Section 24.05 HANDICAP RAMPS**

Handicap ramps shall be constructed for all sidewalks/bikepaths at their intersection with a driveway. All handicap ramps shall be constructed in accordance with ARTICLE 18 of this Manual.

**Section 24.06 EXISTING DRIVEWAYS AND ACCESS POINTS**

- A) Existing driveways shall not be relocated, altered, or reconstructed without a permit approving the relocation, alteration, or reconstruction, and such driveway shall be subject to the provisions of this Section.

- B) When the use of any driveway is discontinued, the Owner/Developer(s) of the abutting property shall, at the Owners'/Developers' own expenses, remove the driveway and replace all curbs, gutters, sidewalks/bikepaths, swales, and grass areas.
- C) When the use, building size or ownership of any property with a driveway(s) is changed, the Owner/Developer(s) of the subject property shall reconstruct the driveway in conformance with City Standards.
- D) If an existing driveway becomes a hazard to the driving or pedestrian public using the public facilities within the public right-of-way, the City Engineer may require reconstruction, relocation, or removal of said driveway. Proper notice shall be made to the property Owner as required by law.

**ARTICLE 25**

**WASTEWATER FACILITIES DESIGN**

<b>Index</b>	<b>25.01</b>	<b><u><a href="#">GENERAL</a></u></b>
	<b>25.02</b>	<b><u><a href="#">DESIGN STANDARDS</a></u></b>
	<b>25.03</b>	<b><u><a href="#">MANHOLES</a></u></b>
	<b>25.04</b>	<b><u><a href="#">SERVICE CONNECTIONS</a></u></b>
	<b>25.05</b>	<b><u><a href="#">LINE LOCATIONS</a></u></b>
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<b>Section</b>	<b>25.01</b>	<b><u>GENERAL</u></b>
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The following design criteria shall pertain to the general requirements of all sanitary manholes, gravity sanitary sewers, lift stations, force mains, and sanitary manholes. Additionally, the Water Pollution Control Federation (WPCF), Manual of Practice No. 9, entitled “Design and Construction of Sanitary and Storm Sewers”, latest edition, may generally be used as a design guide, if not in conflict with State, local, or other regulatory agency requirements or with any material presented herein.

25.01.01	<u>Type of Sewers</u>
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The City will approve Plans for new sewer systems and extensions only when designed as separate systems in which precipitation, runoff and groundwater are excluded.

25.01.02	<u>Design Period</u>
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Sewer systems shall be designed for the estimated ultimate tributary population, as delineated in the approved City of Oviedo Wastewater Master Plan, latest edition, except in considering parts of the systems that can be readily increased in capacity.

25.01.03	<u>Location</u>
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Gravity sewers shall be located in dedicated rights-of-way or utility easements. Whenever possible, sewers shall be located under pavement in dedicated rights-of-way. All sewers located outside of dedicated rights-of-way shall require a minimum 20 foot easement. 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 so dictate. 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.

25.01.04      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.

**Section      25.02              DESIGN STANDARDS**

Sanitary sewer force mains and gravity design shall specifically be in accordance with ARTICLE 26 and ARTICLE 27 of this Manual.

25.02.01      Average Daily Flow (ADF)

The average daily flow is the standard base reference in the design of all wastewater systems. It represents the annual average daily flow of wastewater generation. All service area generators such as domestic, commercial, institutional, and industrial shall be included in the determination of the total average daily flow. Both the per capita unit flows and fixture unit methods shall be used by the designer in determining the ultimate project flow in accordance with those rates currently in effect and available at the City of Oviedo.

25.02.02      Peak Flow

The peak flow is used in the design of all wastewater systems. It is the product of a peaking factor and the average daily flow. The peaking factor is a ratio of the average daily flow and the peak discharge, occurring during the maximum daily flow of the year. The selection of the peaking factor is based upon the following table for flows (ADF) up to 3.0 MGD. Peaking factors for flows with larger average daily flows will be evaluated by the Engineer on an individual basis.

<u>Flow Range</u> (MGD-ADF)	<u>Peaking Factors</u> (PF)
0.000-0.100	4.0
0.101-0.300	3.5
0.301-0.900	3.0
0.901-3.000	2.5

**Section      25.03              MANHOLES**

25.03.01      General

Manholes shall be in accordance with ARTICLE 16 and the Typical City Details attached as part of this Manual and FDOT Standard Specifications. Manholes

shall be precast concrete with integral slab and lower ring, or be poured in place concrete slab with precast ring wall, or be of all fiberglass construction meeting ASTM D-3753-81 standards.

#### 25.03.02      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. When Private sewer systems must be separated from the City sewer system, a manhole shall be located at the right-of-way line.

#### 25.03.03      Manhole Base

Bottom slabs for fiberglass and poured in place manholes shall be a minimum of 8 inches thick and reinforced with No. 4 @ 9 inches on centers. Precast manholes shall be in accordance with FDOT Standard Specifications. All bases shall have proper lifting hooks in the bottom slabs (minimum of 3). There shall be no penetrating lifting holes on any structures, and no holes shall be allowed within 6 inches of any joint on structures.

#### 25.03.04      Frames and Covers

Covers and rings for sanitary manholes shall conform to U.S. Foundry and Manufacturing Company of Miami, Florida Part Number USF 227-AS. The cover shall have the wording "SANITARY" cast into the face as specified in the Typical City Details attached as part of this Manual.

All manhole rings and covers shall be made watertight by means of dovetail grooves and gaskets in the cover. Bolt down and/or gasketed covers shall be provided where manholes are located in areas subject to ponding or flooding. Frames and covers shall be set to conform to the finished grades. All frames shall be set securely in a cement mortar bed and fillet. All covers shall be made flush with existing permanent surfaces except outside the limits of the traveled ways where they shall be set approximately 0.2 foot above the existing ground unless otherwise noted.

#### 25.03.05      Top Elevation

Precast manhole tops shall be adjustable between 6 and 12 inches by means of solid clay bricks laid in mortar. Vertical walls of manhole entrances shall not exceed 18 inches in length, including the ring and cover.

#### 25.03.06      Coating

All concrete sanitary manholes shall be lined, at a minimum, with coal tar epoxy, but upon the City Engineer's or his Designee's direction a fiberglass liner or AGRU Sure Grip<sup>®</sup> liner shall be installed. This work shall be accomplished prior

to TV inspection.

25.03.07      Joint Sealer

A pre-formed plastic joint sealer such as “Ram-Nek” as manufactured by the K. T. Snyder Co., Inc., or approved equal shall be required. All exterior joints shall be sealed with Portland type II cement after the setting of the “Ram-Nek” and placement of each manhole section to form a water-tight joint.

25.03.08      Connections to Manholes

Connections shall be as specified in the Typical City Details attached as part of this Manual. Connections shall be made with a Kor-N-Seal/**A-Lock** type or equal wall penetration boot. Space between boot and pipe OD shall be filled with appropriately sized cavity O-ring. Clay pipe shall have a short nipple (18 inch or 24 inch) between the manhole fitting and the first full length of pipe. All openings for pipes into existing structures shall be made by cutting with a power driven circular coring machine.

25.03.09      Non-Shrink Mortar

All holes in manholes and wet wells shall be thoroughly plugged with Embeco No. 167 Mortar, or an approved equal non-shrinking mortar, applied and cured in strict conformance with the manufacturer's recommendations. The mortar shall be finished smooth and flush with the adjoining interior and exterior manhole and wet well wall surfaces. When mortar is set coat with Koppers 300 M coal tar epoxy 16 dry mils.

25.03.10      Stubs and Stoppers

Pipe stoppers shall be installed in all manhole stubs. When connecting to an existing stub and prior to removing the existing stopper, brick the inside opening to prevent any flow until the new system has been tested and cleaned. The brick shall not be removed until the final inspection.

25.03.11      Bulkheading Stub Channels

The downstream end of all outlets in the manholes of sub-out-channels not in use shall be bulkheaded to prevent the creation of a septic condition resulting from ponding of sewage or debris up the used channel.

**Section**      **25.04**              **SERVICE CONNECTIONS**

25.04.01      General

Service connection, connecting the gravity sewer to the house or establishment being served, shall be through a lateral and miscellaneous appurtenances, all as

specified in the Typical City Details attached as part of this Manual.

25.04.02      Size and Length

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

25.04.03      Slope

Service laterals shall have a minimum slope of 1%.

25.04.04      Connection

In general, service laterals shall not be allowed to discharge into sanitary manholes, except at terminal manholes. A case by case exception to this requirement may be allowed if the lateral discharges at the same elevation as the manhole invert.

**Section      25.05              LINE LOCATIONS**

- A)      Mains shall be installed in the center of paved right-of-way on new construction.
  
- B)      Where sewers are to be installed in existing paved areas, mains may be installed in unpaved portions of right-of-way. All utility lines to be dedicated to the public, located outside of dedicated rights-of-way, shall require a minimum 20 foot easement. If a utility line to be dedicated to the public 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.
  
- C)      Mains shall not cross under curbs or sidewalks/bikepaths unless approved by the City Public Works Department prior to construction.
  
- D)      Mains shall not be allowed in side or back lot easements unless approved by the City Public Works Department prior to construction.
  
- E)      Mains shall not be installed beneath canals, retention areas, or swales without prior approval of the City Public Works Department. Any lines in these areas must be installed within a pipe casing that extends the full length of the body being crossed.

**Section      25.06              GREASE TRAPS**

25.06.01      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.

25.06.02      Fast Food Restaurants

Single grease trap capacity shall be sized at the rate of 10 gallons per seat. If 2 grease traps are used in series, total capacity of the grease traps shall be based on 5 gallons per seat.

25.06.03      General Restaurants

Single grease trap capacity shall be sized at the rate of 20 gallons per seat. If 2 grease traps are used in series, total capacity of the grease traps shall be based on 10 gallons per seat

25.06.04      24 Hour Restaurants

Single grease trap capacity shall be sized at the rate of 30 gallons per seat. If 2 grease traps are used in series, total capacity of the grease traps shall be based on 15 gallons per seat.

25.06.05      Convention Center/Manufacturing Cafeterias

Single grease trap capacity shall be sized at the rate of 3 gallons per meal. If 2 grease traps are used in series, total capacity of the grease traps shall be based on 1.5 gallons per meal.

25.06.06      Miscellaneous Food Preparation/Service Establishments

Developer's Engineer shall consult with the City Public Works Department before finalizing the design.

## ARTICLE 26

### GRAVITY SANITARY SEWERS

Index	26.01	<a href="#"><u>GENERAL</u></a>
	26.02	<a href="#"><u>DESIGN CRITERIA</u></a>
	26.03	<a href="#"><u>MATERIALS</u></a>
	26.04	<a href="#"><u>INSTALLATION</u></a>
	26.05	<a href="#"><u>CONNECTIONS</u></a>
	26.06	<a href="#"><u>TESTING</u></a>
	26.07	<a href="#"><u>TESTING PRIOR TO RESURFACING</u></a>
	26.08	<a href="#"><u>FINAL INSPECTION</u></a>
	26.09	<a href="#"><u>GREASE INTERCEPTORS</u></a>
	26.10	<a href="#"><u>IDENTIFICATION</u></a>

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#### Section 26.01 GENERAL

This ARTICLE shall govern the design and construction of gravity sewer mains, service laterals, manholes, stoppers, and other appurtenances.

Pipe used in gravity sewer construction shall be polyvinyl chloride (PVC) or ductile iron pipe (DIP). Concrete pipe use may be allowed if prior approval is obtained from the City. Where reference is made to an ASTM, ANSI 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. At the Contractor's expense, all materials found to be defective or damaged in handling or storage shall be replaced. 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.

#### Section 26.02 DESIGN CRITERIA

- A) Design Flow: Sewers of 15 inches in diameter and less shall be designed to flow  $\frac{1}{2}$  full at peak design flow. Sewers greater than 15 inches shall be designed to flow  $\frac{3}{4}$  full at peak design flow.
- B) Minimum diameter
  - 1) Main Sewer - 8 inches.
  - 2) Single lateral - 4 inches.
  - 3) Commercial user lateral - 6 inches.
  - 4) Multi Family user lateral - 6 inches.

- C) Velocity in pipes (at peak flow)
  - 1) Minimum - 2 feet per second.
  - 2) Maximum - 7 feet per second.

D) 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.

- E) Roughness Coefficient: For Manning's formula use an “n” value of 0.012 for PVC and 0.013 for other pipe materials.

F) Minimum Slope versus Pipe Diameter

Minimum Slope in Foot Per 100 Feet

<u>Sewer Size</u>	<u>PVC</u>	<u>Other Material</u>
8"	0.30	0.33
10"	0.21	0.25
12"	0.17	0.19
15"	0.12	0.15
18"	0.10	0.11
21"	0.08	0.09
24"	0.07	0.08
27"	0.06	0.07
30"	0.05	0.06
36"	0.04	0.04

Slopes slightly less than those required for the velocity of 2.0 feet per second may be permitted under special conditions, when pipe is flowing full, if detailed justifiable reasons are given. Such decreased slopes shall only be considered where the depth of flow will be 0.3 of the diameter or greater for design average flow. Whenever such decreased slopes are selected, the Developer's Engineer must furnish computations of the depths of flow in such pipes at minimum, average, and peak rates of flow.

Where design velocities greater than 15 feet per second are attained, due to topography or other reasons, special provisions shall be provided for sewer protection.

Sewers shall be laid with uniform slope between manholes.

G) Size and Alignments

Size conversion between manholes shall not be allowed. All sewers shall be laid with straight alignments between manholes.

H) Additional Requirements

Main drain and back wash systems for pools, 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:

- A) Total sewer extension length shall be limited to 50 feet.
- B) Sewer extension location at the initiating manhole shall be plugged to the satisfaction of the City.
- C) Such sewer extensions shall not be a part of the accepted sewer facilities. This shall be clearly delineated on the plans.
- D) All such sewer extensions shall be inspected and accepted as part of the future construction phase.

**Section 26.03 MATERIALS**

26.03.01 PVC Gravity Sewer Pipe

PVC Gravity Sewer Pipe (4 inch to 15 inch), ASTM D-3034, SDR 35. Uniform minimum “pipe stiffness” at 5% deflection shall be 46 psi. The joints shall be integral bell elastomeric gasket joints manufactured in accordance with ASTM D-3212 and ASTM F-477. Applicable UNI-Bell Plastic Pipe Association standard is UNI-B-4.

PVC Gravity Sewer Pipe (18 inch to 27 inch), ASTM F-679, SDR 35. Uniform minimum “pipe stiffness” at 5% deflection shall be 46 psi. The joints shall be integral bell elastomeric gasket joints manufactured in accordance with ASTM D-3212 and ASTM F-477. 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 13 feet.

26.03.02 DIP Gravity Sewer Pipe

Ductile iron pipe shall conform to ANSI/AWWA A-21.51/C-151, class thickness

designed per ANSI/AWWA A-21.50/C-150, with mechanical or push on joints. An interior protective lining of coal tar epoxy shall be provided with a minimum dry thickness of 30 mils or be Polylined<sup>®</sup> or equivalent. Ductile iron gravity sewers, where called for by the City, shall be wrapped with polyethylene film, AWWA C-105. (See approved Manufacturer's List attached as part of this Manual.) The minimum standard length of pipe shall be 18 feet.

#### 26.03.03 Reinforced Concrete Pipe

Reinforced concrete pipe shall conform to ASTM C-76, Classes III, IV or V. For pipes 30 inches or more in diameter, the length of the unit shall not be less than 8 feet. An interior protective lining of coal tar epoxy shall be provided with a minimum dry thickness of 30 mils. (See approved Manufacturer's List attached as part of this Manual.)

#### 26.03.04 Coatings and Linings (Iron Pipe)

All pipe and fittings shall have a protective interior lining heat bonded to pipe and fittings using 40 mil (maximum dry thickness) virgin polyethylene per ASTM D-1248 compounded with an inert filler with sufficient carbon black to resist ultraviolet rays during above ground storage. An approved equal to "Polybond" by American Cast Iron Pipe Company shall be allowed. Polyethylene Encasement, where required, shall be per ANSI A-21.5 (AWWA C-105). If polyethylene encasement is not required. The pipe exterior shall be bituminous coated. In cases where polyethylene lining is not available, the interior surface of the pipe shall be coated with a minimum of 16 mils (dry) of coal tar epoxy or Polylined<sup>®</sup> or equivalent

#### 26.03.05 Non-Shrink Mortar

All holes in manholes and wet wells shall be thoroughly plugged with Embeco No. 167 Mortar, or an approved equal non-shrinking mortar, applied and cured in strict conformance with the manufacturer's recommendations. The mortar shall be finished smooth and flush with the adjoining interior and exterior manhole and wet well wall surfaces. When mortar is set coat with Koppers 300 M coal tar epoxy 16 dry mils.

#### 26.03.06 Sanitary Manholes

Sanitary manholes shall be in accordance with ARTICLES 16 and 25 of this Manual.

### **Section 26.04 INSTALLATION**

#### 26.04.01 General

Trench excavating and backfill including sheeting and bracing, dewatering, bedding and foundation, and furnishing and disposal of materials shall be performed in such

a manner as to promote the safe and expedient execution of the work.

#### 26.04.02 Pipeline Trenching

- A) Excavation of trenches shall not advance more than 50 feet ahead of completed pipe installation, except as approved by the City Engineer or his Designee.
- B) Excavation in close proximity to existing utilities shall be performed in a manner to prevent damage. Representatives of utilities shall be contacted for assistance in locating buried lines.
- C) All excavations may be made by open cut **unless otherwise indicated in this Manual**. See the Typical City Details attached as part of this Manual.

#### 26.04.03 Sheeting, Shoring, and Bracing

Furnish, install, and maintain sheeting, bracing, and shoring support required to keep excavations within the easement or right-of-way, to support the sides of the excavation, and to prevent any movement which may damage adjacent pavements or structures, damage or delay the work, or endanger life and health. Voids outside the supports shall be immediately filled and compacted. Sheeting, bracing, and shoring to be used shall be designed by a Florida Registered Professional Engineer.

#### 26.04.04 Dewatering and Drainage

At all times during construction keep excavations free from standing water. Sumps, if required, shall be located outside of load bearing areas so the bearing surfaces will not be disturbed. Water pumped from the excavation shall be discharged to prevent re-entry into the soil strata being dewatered. Water containing silt in suspension shall not be pumped into sewer lines or adjacent streams. The method of disposing of water pumped from the excavation shall be approved by the City Engineer or his Designee prior to actual disposal.

#### 26.04.05 Stabilization

If portions of the bottom of trenches or excavations consists of material unstable to such a degree that, in the opinion of the City Engineer, it cannot adequately support the pipe or structure, the bottom shall be over-excavated and stabilized with  $\frac{3}{4}$  inch stone or smaller with a minimum of 6 inch base, approved coarse granular stabilization material. Depth of stabilization shall be as directed by the City Engineer or his Designee.

26.04.06      Bedding of Piping

A)      General

- 1)      Haunching is defined as the shaped and tamped granular material which extends from the pipe bedding to the spring line of the pipe. Cover is defined as the compacted material which protects and covers piping, and which extends from the top of haunching material to a point 1 foot above the top of the pipe. Backfill, as specified hereafter, is defined as the material extending above the top of pipe cover to topsoil, paving subgrade, or foundation level.
- 2)      All buried piping shall be continuously bedded and covered, except where concrete encasement, concrete cradles, or jack and bore are indicated.

B)      Pipe Bedding

Any part of the trench bottom that is excavated below the pipe grade shall be backfilled to grade with a minimum of 6 inches of granular material and compacted as required in Section 26.04.07. Bedding materials shall be limited to Class I or Class II materials.

C)      Pipe Cover

All cover materials shall be clean fill with no debris and carefully deposited to avoid damage to the pipe and shall be compacted as specified hereafter.

26.04.07      Trench Backfilling

Backfill shall be granular material or suitable previously excavated pipe trench material approved for use by the City Engineer. The granular backfill shall be carefully deposited in uniform lifts as specified below and each lift shall be wetted adequately as needed to obtain the required compaction density with vibratory compactors, as specified hereafter.

Unless otherwise indicated or approved by the City Engineer or his Designee, fills shall be placed in the loose lift thicknesses indicated hereafter and compact to a dry density, not less than the following percentage of maximum dry density, determined by the Modified Proctor Test, ASTM D-1557, unless otherwise noted.

	<u>Type of Fill</u>	<u>Usage</u>	<u>Thickness</u>	<u>%</u>
1)	Trenched Pipe Foundation, Bedding, and Haunching	Beneath piping	6"	98
2)	Trenched Pipe Cover	Over and/or around piping	6"	98
3)	Utilities Trench Backfill	"Influence area" beneath other piping or utility lines	8"	98
		"Influence area" beneath rigid paving and railroad tracks	6"	98
		"Influence area" beneath non-rigid paving	9"	98
		Adjacent to or under structures	9"	98
4)	Structural Fill	All locations under minor structures (manhole, etc.)	8"	98
5)	Granular Fill	Below concrete slab bedding, foundations, rigid paving, and excavated areas adjacent to structures	8"	98
6)	Structural Backfill	(See Trench Backfill)		
7)	General Site Grading	Fill in other locations not covered herein	12"	92
		Topsoil Placement	12"	92

"Influence area" shall be considered the area within lines sloped downward at 45° from the outer edges of paving, foundations, and utility lines.

#### 26.04.08 Pipe Laying and Jointing

Gravity sewers shall be laid in the dry to the elevations and slopes shown on the approved construction drawings. Laser equipment shall be used to provide line

and grade. Surveying equipment shall be used to set the laser. The laser equipment shall have a slope indicator to facilitate checking by both the pipe laying foreman and the City Engineer. Since most gravity sewers are laid with extremely flat slopes, zero tolerance for errors in line and grade will be allowed. Upon completion of the work, the lines shall be cleaned, with all debris removed at downstream manhole. Each section of pipe shall be TV inspected to indicate any pipe defects such as bellies or other deformities, and, if necessary, shall be taken up and relaid to provide the correct line and grade. Special attention shall be given to the requirement that the pipe be laid in a dry trench with properly compacted bedding and backfill. The pipe shall be laid with the spigot ends pointing in the direction of flow, starting at the lowest point. Joint contact surfaces shall be cleaned immediately prior to jointing. Lubricants, primers, or adhesives shall be used as recommended by the joint manufacturer. The minimum allowable cover for gravity sewers shall be 3 feet from the top of the pipe to the finished grade. However, should this depth not be feasible, where grade depressions along the alignment are unavoidable, ductile iron pipe shall be provided within the limits of the lesser cover. In no case shall the pipe cover be less than 18 inches, and any deviations from 3 feet of cover shall be approved by the City Engineer. Pipes shall be installed to the alignment and grade as shown on the approved plans.

#### 26.04.09      Branches

Wye branches are to be installed in conjunction with the laying of sewer pipe. Wyes to serve all existing and future dwelling units shall be installed. The longitudinal barrel of branch fittings shall conform to the line and grade, diameter, and quality of the sewer main. All service laterals shall be perpendicular to the longitudinal axis of the pipe.

#### 26.04.10      Laterals

Laterals shall be extended to and located between 3 and 4 feet below the right-of-way line's finished grade, with the cleanout between the sidewalk and curb line or if room permitting, they shall be placed between the sidewalk and property line. Laterals shall run in the most direct route and perpendicular to the sewer main at a minimum grade of 1% from the main to the right-of-way line. A wye branch fitting for each service line shall be provided. Double wyes are not acceptable. All laterals and service wyes at the last joint shall be plugged and securely sealed to withstand the internal pressure of leakage or air pressure testing. The plug shall be capable of removal without injury to the socket. A cross (+) shall be saw cut in the top of the curb directly over the lateral location. If curbing is not part of the work, a 4" x 4" x 3' wooden stake shall be painted green and installed at the end of the connection. Clean-out caps shall be brass and of the inverted hex-nut type. If required by the City Engineer or his Designee, the terminal ends of laterals shall be marked by electronic location devices that are compatible with City owned equipment. Cleanouts in driveways and other paved areas shall be cast in place rings with metal covers stamped with the word "Sewer".

#### 26.04.11 Protection of Water System Crossings

Where the horizontal separation between sanitary sewer and water mains is less than 10 feet, the sewer line can be laid closer to the water line, provided that the bottom of the water line is at least 18 inches above the top of the sewer line and in a separate trench or on an undisturbed earth shelf. Where the sewer line crosses below the water line with a vertical clearance of less than 18 inches, sewers shall be ductile iron pipe with mechanical joints or concrete encased for a minimum distance of 18 feet, centered at the point of crossing so that the joints will be equidistant and as far as possible from the water line. If required by the City Engineer, cathodic protection shall be provided.

#### 26.04.12 Downstream Protection

Dirt and debris collected in the pipe during construction shall not be flushed downstream. The open end of pipe shall be closed daily to prevent foreign matter from entering.

### **Section 26.05 CONNECTIONS**

#### 26.05.01 Transition Connections

Where pipes of alternate materials (VC to CI, etc.) are to be connected between manholes, suitable approved transition couplings shall be installed. Special designed units may be submitted for approval. Concrete collars are not acceptable.

#### 26.05.02 Connections to Existing Lines

A collar wye saddle for 4 inch and 6 inch diameter connections to existing sewer lines shall be used. The existing line shall be cut using a template to accomplish a true and clean opening for the saddle. Gasketed saddles with stainless steel straps shall be used, where available from the manufacturer. The sewer main shall be protected and cleaned of debris.

#### 26.05.03 Tall Riser Connections

Connections shall be provided, as specified in the Typical City Details attached as part of this Manual, where the depth of the sewer main invert exceeds 10 feet below the finished grade of the street, unless otherwise required by the City Engineer or his Designee. Lateral connections shall be made by individual single wyes. Double wyes for connection are not permitted. One tall riser connection may service no more than 2 connections, 1 to each side.

#### 26.05.04 Connections to Manholes

Connections shall be as specified in the Typical City Details attached as part of this Manual. Connections shall be made with a Kor-N-Seal/**A-Lock** type or equal wall

penetration boot. Space between boot and pipe OD shall be filled with appropriately sized cavity O-ring. Clay pipe shall have a short nipple (18 inch or 24 inch) between the manhole fitting and the first full length of pipe. All openings for pipes into existing structures shall be made by cutting with a power driven circular coring machine.

26.05.05      Connections to Wet Wells

One joint (18-20 feet) of ductile iron pipe shall extend outward from the structure. Perform connections as for manholes.

26.05.06      Conflicting Structures and Protection of Sanitary Sewer at Utility Crossing

Where it becomes necessary to extend sewers through structures, such as conflicting manholes, junction boxes, etc., the pipe shall be ductile iron within a casing pipe with no joints inside the conflicting structure. Where the vertical separation between sanitary sewer and storm sewer is less than 18 inches, the sanitary sewer shall be installed as polyethylene lined ductile iron pipe.

**Section      26.06      TESTING**

26.06.01      PVC Ring Deflection

Maximum diameter ring deflection shall not exceed 7% of the internal pipe diameter throughout the warranty period when tested by a mandrel. The mandrel shall be a GO-NO-GO type with an unequal number of runners, minimum of 9, and a maximum distance between the runners of 2 inches. A gaging ring certified for each size of pipe inside diameter and the mandrel size shall be as follows:

<u>Pipe Size</u>	<u>Mandrel Diameter</u>
8"	7.37
10"	9.22
12"	10.98
15"	13.43

Should the test fail, necessary repairs shall be accomplished by the Contractor and the test repeated until within the established limits. The Contractor shall furnish the necessary labor, water, and all other items necessary to conduct the required testing and perform the necessary system repairs required to comply with the specified test. On pipes determined to have excessive deflection, the length in question shall be relayed or rerounded.

26.06.02      Infiltration/Exfiltration

There shall be no detectable level of infiltration or exfiltration from the system at

the time of inspection. Any evidence of leakage must be corrected prior to acceptance by the City. This includes both line and manholes.

**Section 26.07 TESTING PRIOR TO RESURFACING**

All tests shall be completed and accepted by the City Engineer before any trench or pavement is asphalted. Lines shall be televised to determine if they were acceptably constructed. Lines to be dedicated to the City and private lines shall be televised by a reputable company experienced in sewer examination. The Contractor shall be present to note required corrections, if any, and schedule remedial action prior to acceptance by the City. In all cases, a stabilized driving surface shall be prepared to allow access to all manholes by TV inspection trucks. The cost of the TV inspections shall be borne by the Contractor installing the line.

**Section 26.08 FINAL INSPECTION**

After all manholes are raised to grade and paving operations completed, a final visual inspection shall be made by the City Engineer or his Designee. All manholes shall be examined for proper grade and water tightness. The Contractor shall assist the City Engineer or his Designee by providing all labor as required. The Contractor shall make note of any corrections required and shall perform all remedial actions prior to the acceptance by the City.

**Section 26.09 GREASE INTERCEPTORS**

- A) All grease interceptors shall be approved by the City Building Department in accordance with the Standard Plumbing Code.
- B) All grease interceptors shall be sized, as a minimum, in accordance with this Manual and the Florida Administrative Code.

**Section 26.10 IDENTIFICATION**

All pipe shall be buried with identification tape above the top of the pipe. The tape shall indicate the presence of gravity sanitary sewers plainly on the tape face. Indicator tape buried with PVC pipe shall be able to be detected by standard metal detection equipment, as manufactured by Terra Tape Detectable, or approved equal.

## ARTICLE 27

### SANITARY SEWER FORCE MAINS

<b>Index</b>	<b>27.01</b>	<b><u>GENERAL</u></b>
	<b>27.02</b>	<b><u>DESIGN CRITERIA</u></b>
	<b>27.03</b>	<b><u>MATERIALS</u></b>
	<b>27.04</b>	<b><u>VALVES</u></b>
	<b>27.05</b>	<b><u>INSTALLATION</u></b>
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<b>Section</b>	<b>27.01</b>	<b><u>GENERAL</u></b>
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This ARTICLE shall govern the design and construction of force mains including valves, fittings, and other appurtenances.

Pipe used in wastewater force main systems shall be either Polyvinyl Chloride (PVC), or Ductile Iron Pipe (DIP). Prestressed Concrete Cylinder Pipe (PCCP) may be allowed if prior approval is obtained from the City.

The Contractor shall be responsible for all materials furnished and storage of same until the date of substantial completion. At the Contractor's expense, all materials found to be defective or damaged in handling or storage shall be replaced. 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.

<b>Section</b>	<b>27.02</b>	<b><u>DESIGN CRITERIA</u></b>
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	27.02.01	<u>Design Period</u>
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Force main systems shall be designed for the estimated ultimate tributary population, as delineated in the approved City of Oviedo Wastewater Master Plan, latest edition, except in considering parts of the systems that can be readily increased in capacity.

	27.02.02	<u>Design Calculations</u>
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Owner's/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. The Design Flow shall be the Peak Flow Rate

### 27.02.03 Velocity and diameter

At design pumping rates, a cleansing velocity of at least 2 feet per second shall be maintained. Maximum velocity at design pumping rates shall not exceed 5 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.

### 27.02.04 Design Friction Losses

Friction losses through force mains shall be based on the Hazen-Williams formula. In the use of Hazen-Williams formula, the value for "C" shall be 100 for ductile iron pipe and 130 for PVC pipe. "C" values greater than 130 shall not be allowed. When initially installed, force mains may have a significantly higher "C" factor. The higher "C" factor shall be considered only in calculating maximum power requirements and duty cycle time of the motor.

### 27.02.05 Design Pressure and Restraint

The force main and fittings, including all restrained joint fittings and thrust blocking, shall be designed to withstand pump operating pressures and pressure surges, but not less than 100 psi. The required lengths of restrained joints shall be determined by the Engineer and shown in a tabular form as depicted on the "Restrained Pipe Table" in the Typical City Details attached as part of this Manual. Thrust blocks shall not be typical and shall only be used when the City Engineer deems it a hardship or good engineering standards deem it necessary because restraining assemblies are impractical or insufficient. If thrust blocks are used, the bearing area of thrust blocks shall be adequate to prevent any movement of the fitting. The sizes and dimensions of the thrust blocks shall be shown in a thrust block table.

### 27.02.06 Termination

Force mains shall not terminate directly into a gravity sewer line. Force mains shall enter the terminal facility, gravity sewer manhole, pumping station wet well or other, at a point equal to the operational water level of said receiving unit and not more than 1 foot above the flow line. The receiving manhole shall be either lined with an approved liner or be constructed of an approved material that prevents degradation due to the creation of gas in the structure. Should an elevation drop be required to obtain the outlet connection, the prior down-slope of the force main shall not exceed 45°. Adequate air venting shall be provided at the profile break-point.

### 27.02.07 Air Release and Vacuum Relief Valves

Where the force main profile is such that air pockets or entrapment could occur, resulting in flow blockage, provisions for air release shall be provided. Automatic

air release assemblies shall be installed, where venting is required, on all major force mains and at critical points on lesser mains. At profile break points on major force mains, such as tops of hills, etc., where free flow will occur during operation or after pumping stops, combined air release and vacuum valve assemblies shall be provided. Air and vacuum valves and/or air release valves shall be as capacity requires and, if in an open area, they shall be suitably housed in a properly vented, underground chamber (manhole). All such valves shall be clearly delineated on the force main profile in the detail sheets. The Owner's/Developer's Engineer shall submit calculations to the City justifying the valve sizing.

27.02.08      Aerial Crossings

A)      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.

B)      Expansion Protection

Expansion joints shall be provided between the aerial and buried sections of the pipe.

C)      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.

D)      Pipe Material And Joints

Flanged joints shall be used. Pipe and flange material shall be Polyline or epoxy lined ductile iron, minimum class 53. All above ground pipe shall be painted as specified in ARTICLE 27 of this Manual for above ground wastewater force mains. Use of epoxy coated steel pipe may be allowed on a case by case basis.

E)      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.

F)      Guards

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

G) Permits And Requirements Of Other Agencies

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

27.02.09 Underwater Crossings

A) Pipe Material And Cover

A minimum cover of 3 feet plus a 6 inch concrete slab shall be provided over the pipe. The pipe material shall meet appropriate AWWA Standards for use in submerged conditions.

B) Valves

Valves shall be provided 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.

C) Permits

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

27.02.10 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 27.03 MATERIALS**

27.03.01 PVC Pipe

All PVC pipe of nominal diameter 6 through 12 inches shall be manufactured in accordance with AWWA standard C-900. The PVC pipe shall have a minimum working pressure rating of 100 psi and shall have a dimension ratio (DR) of 25. Pipe shall be the same OD as ductile iron pipe. PVC pipe of 4 inch nominal diameter may be AWWA Standard C-900, DR 25 or PVC pipe with a Standard Dimension Ratio (SDR) of 21.

27.03.02      PVC Joints

PVC pipe shall have integral bell push on type joints conforming to ASTM D-3139.

27.03.03      Fittings for PVC Pipe

Fittings used with PVC pipe shall conform to Section 27.03.05.

27.03.04      Ductile Iron Pipe

All ductile iron pipe of nominal diameter 4 through 54 inches shall conform to ANSI/AWWA A-21.51/C-151. A minimum of Thickness Class 50 pipe or Pressure Class 350 pipe shall be supplied for all sizes of pipe unless a higher class pipe is specifically called out or required by the City.

27.03.05      Fittings

All fittings shall be mechanical joint ductile iron or gray iron conforming to ANSI/AWWA A-21.10/C-110, 250 psi minimum pressure rating, or ductile iron compact fittings 4 through 12 inches in accordance with ANSI/AWWA A-21.53/C-153.

27.03.06      Joints for DIP

Joints for ductile iron pipe and fittings shall be push-on or mechanical joints conforming to ANSI/AWWA A-21.11/C-111, unless otherwise specifically called out or required by the City. Where called for on the Drawings, restrained or flanged joints shall be provided. Flanged joints shall conform to ANSI Standard B-16.1-125 lb restrained joints shall conform to ARTICLE 5 of this Manual.

27.03.07      Coatings and Linings for DIP

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 A-21.51/C-151. 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 Manufacturer's List attached as part of this Manual.) Final field coat color shall be grey for raw wastewater and brown for treated wastewater.

All ductile iron pipe and fittings shall have interior protective lining of coal tar epoxy or polyethylene with a minimum dry thickness of 30 mils applied by the pipe

manufacturer. Polyethylene lining material shall comply with ASTM D-1248 and shall be fused to the interior of the pipe by heat forming a tightly bonded lining. (See approved Manufacturer's List attached as part of this Manual.)

27.03.08      Polyethylene Encasement

The pipe shall be polyethylene encased (8 mil) where shown in the Typical City Details or required by the City in accordance with ANSI/AWWA A-21.51/C-105.

**Section      27.04      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 1,000 feet. Additional valves shall be provided where force mains intersect to facilitate isolation of pipe segments.

27.04.01      Plug Valves

Plug valves shall have a semi-steel body, non-lubricated, eccentric type, 100% port opening with resilient faced plugs capable of drip-tight, bi-directional, shut-off at the full rated pressure. Exposed valves shall have flanged connections. Buried valves shall have mechanical joint connections. Gear actuators for valves 8 inches or larger shall be provided.

27.04.02      Check Valves

Check valves shall have an iron body, bronze-mounted, stainless steel hinge pin, outside spring operated, swing non-slam type, equipped with removable inspection covers. Units shall be rated for 150 psi minimum working pressure and permit full flow area equal to that of the connecting pipe.

27.04.03      Air Release Valves

Air release valves shall have a cast iron body, minimum 150 psi working pressure, equipped with a vacuum ball to prevent air return, a 2 inch inlet, and 1 inch blow off valve as manufactured by APCO 400/401, or an approved equal.

27.04.04      Tapping Sleeves and Valves

Tapping Sleeves shall be a joint type with flanged outlet per ANSI B-16.1, Class 125. Valves shall be gate valves specially designed for wet tapping and compatible with the connecting sleeve.

27.04.05      Valve Boxes

Valve boxes shall be adjustable, cast iron and suitably sized to the valve with a minimum diameter of 5 inches. The cover shall have the word "SEWER" legibly

cast into the face. Boxes shall be suitable for H-20 loading.

**Section 27.05 INSTALLATION**

27.05.01 General

Excavation and backfill including sheeting and bracing, dewatering, bedding and foundation, and furnishing and disposal of materials shall be as required in ARTICLE 26 of this Manual.

27.05.02 Pipe Laying

All pipe shall be laid “in-the-dry” along straight lines and grades between fittings, manholes, or other defined points, unless definite alignment deflections or grade changes are necessary. The standard minimum cover for sewage force main systems shall be 3 feet from the top of the pipe to finished grade. Where waterways, canals, ditches, or other cuts are crossed, a protective casing shall be bored and jacked beneath the waterway, where possible, and the pipe installed in the casing. Additionally, approved utility crossing signs shall be placed on the pipe alignment at each side of the canal, etc. All materials shall be maintained and all coatings shall be protected from damage and kept clean. The interior of the pipe shall be maintained clean and free of dirt and debris. When work is not in progress, plug all open ends. Underground piping shall not be driven to grade by striking it with an unyielding object. Bell holes in the bedding shall be provided to allow uniform load bearing along the pipe barrel.

27.05.03 Push-on Joints

The pipe bell and spigot shall be thoroughly cleaned immediately prior to inserting the gasket and jointing. The gasket shall be properly faced and positioned. Lubrication shall be in accordance with the manufacturer's recommendations. Pipe shall be protected against damage from jointing equipment by using timber headers, etc.

27.05.04 Mechanical Joints

The socket and plain end shall be wiped clean. The plain end, socket, and gasket shall be washed with a soap solution immediately prior to jointing. The joint shall be kept straight during assembly with the gasket pressed firm and even into the recess. Bolts shall be tightened such that the gland remains reasonably parallel to the flange by alternating from bolt to bolt in cycles. The required bolt size (pipes 4 inches to 24 inches in diameter) shall be  $\frac{3}{4}$  inches, torqued to 75-90 ft-lbs.

27.05.05 Flange Joints

Make all flanged joints tight, without applying undue strain upon the joint or other appurtenances. Joints shall be fitted such that contact surfaces bear uniformly on

the gasket with relatively uniform bolt stresses.

#### 27.05.06 Connections at Structures

Where pipes are to extend into or through structures, Link Seal-Type penetration seals shall be provided at the wall face. Openings in existing structures shall be made with a circular core boring machine.

#### 27.05.07 Pipe Cutting

Cutting of pipes for the insertion of valves, fittings, or closure pieces shall be done in a neat, workmanlike manner without damaging pipe coatings or linings. The pipe shall be cut with an abrasive pipe saw, rotary wheel cutter, guillotine pipe saw, or milling wheel saw. Cut ends and rough edges shall be ground smooth and, for push-on joint connections, the cut end shall be beveled. Where castings or linings have been damaged, apply two coats of Koppers 300M Bitumastic Coating.

#### 27.05.08 Pipe Restraint

All plugs, caps, tees, and bends, unless otherwise specified, shall be restrained by the use of Mega-Lugs, tie rods, retainer glands and/or restrained joints. Where concrete is to be placed around bolted joints, a sheet of 3 mil (minimum) polyethylene shall be placed between the fitting and the concrete. Tie rods, clamps, or other components of dissimilar metal shall be protected against corrosion by hand application of a bituminous coating. Backfilling over pipe restraints shall not proceed until inspected by the City Engineer or his Designee. Thrust blocks shall not be typical and shall only be used when the City Engineer deems it a hardship or good engineering standards deem it necessary because restraining assemblies are impractical or insufficient. If thrust blocks are used, the bearing area of thrust blocks shall be adequate to prevent any movement of the fitting. The sizes and dimensions of the thrust blocks shall be shown in a thrust block table.

#### 27.05.09 Polyethylene Encasement

Extra protection shall be provided for underground cast or ductile iron pipe and fittings within areas of severe corrosive conditions. This shall be accomplished by the installation of polyethylene encasement through the area of concern. The soil-test evaluation to determine the necessity for extra protection in suspect areas shall be as set forth in ANSI Standard A-21.5.

#### 27.05.10 Above Ground Pipe Support

Support exposed systems, as necessary, to hold the piping and appurtenances in a firm substantial manner to the required lines and grades with no undue piping stresses transmitted to the equipment. All above ground pipe ,outside of buildings, shall be supported by concrete supports.

#### 27.05.11 Connections

Tapping shall be by tapping sleeve and valve installed with a tapping device designed for the pipe material. Where the branch force main enters the receiving force main, a wye fitting shall be used for pipes where the receiving diameter is 4 times or less than the diameter of the branch main. Where the receiving main sectional area is more than 4 times that of the branch, the tee fitting connections shall be acceptable. Tapping saddles shall be recommended for receiving mains 24 inches and larger.

#### 27.05.12 Valve Installation

Valves shall be installed on all subsidiary force mains at the point of connection to the major main, in order to isolate said pipeline for maintenance. Where force mains are to be extended, valves shall be placed at the future connection points so as to preclude line shut-down at the time of extension. All valves shall be opened wide and then tightly closed. Nuts and bolts shall be inspected for tightness. Special care shall be taken to prevent joint materials, stones, and other substances from becoming lodged in the valve seat. Any valve that does not operate correctly shall be replaced.

Unless otherwise noted, set valve stems vertically above the center-line of the pipe. Where extension stems are required within valve boxes, insert stems shall be provided.

#### 27.05.13 Valve Boxes

All valve boxes shall be centered over the operating nut of underground valves to permit a valve wrench to be easily fitted to the nut. Top of boxes shall be set to final grade. The valve box shall not transmit surface loads directly to either the pipe or valve. Excessive care shall be used to prevent earth and other materials from entering the boxes. Any valve box that becomes out of alignment or is not to grade shall be dug out and adjusted. A concrete collar shall be provided as specified in the Typical City Details attached as part of this Manual.

#### 27.05.14 Air and Vacuum Valves

Where the force main profile is such that air pockets or entrapment could occur, resulting in flow blockage, provisions for air release shall be provided. Automatic air release assemblies shall be installed, where venting is required, on all major force mains and at critical points on lesser mains. At profile break points on major force mains, such as tops of hills, etc., where free flow will occur during operation or after pumping stops, combined air release and vacuum valve assemblies shall be provided. Air and vacuum valves and/or air release valves shall be as capacity requires and, if in an open area, they shall be suitably housed in a properly vented, underground chamber (manhole).

27.05.15      Terminal Discharge

Force mains shall not terminate directly into a gravity sewer line. Force mains shall enter the terminal facility, gravity sewer manhole, pumping station wet well or other, at a point equal to the operational water level of said receiving unit and not more than 1 foot above the flow line. The receiving manhole shall be either lined with an approved liner or be constructed of an approved material that prevents degradation due to the creation of gas in the structure. Should an elevation drop be required to obtain the outlet connection, the prior down-slope of the force main shall not exceed 45°. Adequate air venting shall be provided at the profile break-point.

**Section      27.06              IDENTIFICATION**

In order to preclude possible domestic water tapping, all installed underground sanitary sewer force mains shall be marked with a continuous stripe painted within the top 90° of the pipe. Said stripe shall be a minimum 2 inches in width and shall be green in color. Backfill shall not be placed for 30 minutes following paint application. In addition, all pipe shall be buried with identification tape above the top of the pipe, see the Typical City Details attached as part of this Manual. The tape shall indicate the presence of a sanitary force main plainly on the tape face. Indicator tape buried with PVC pipe shall be able to be detected by standard metal detection equipment.

**Section      27.07              HYDROSTATIC TESTING**

This test shall be performed by the Contractor, with the Contractor's labor and equipment, in the presence of the City Engineer or his Designee. No testing shall proceed until all restraining devices are installed or thrust blocks have cured. Clean and flush all piping thoroughly prior to testing. The amount of water to be used shall be twice the volume of the pipe being tested and the velocity of flow shall be a minimum of 3 fps. During filling of water, all air shall be carefully permitted to escape through release cocks installed as required.

The hydrostatic test shall be performed at 100 psi for a period of 2 hours per AWWA C-600. The maximum allowable leakage shall not exceed that determined by the following formula:

$$L = \frac{(N)(D)(P)^5}{3700} = \text{Allowable leakage in gals per 2 hr}$$

$$L = 0.00270 ND; \text{ for 100 psi test for 2 hours}$$

N =      Number of joints in the section tested

D =      Nominal pipe diameter in inches

P = Average test pressure maintained during the leakage test in psig  
(gauge)

During the 2 hour period of the test, the Contractor shall maintain a continuous pressure of 100 psi by means of a pump taking supply from a container suitable for the measurement of water loss. Should the test fail, the leak shall be located and repaired and the test performed again until it meets the above specified limits.

## ARTICLE 28

### SANITARY SEWER PUMP STATION

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<b>Section</b>	<b>28.01</b>	<b><u>GENERAL</u></b>
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This ARTICLE shall govern the design and construction of a wet pit sewage pumping station to include the wet well, influent piping (one length), effluent piping (to the wye), valves, valve boxes and covers, pumps and motors, hatches, control panel, flow meter, telemetry system, electrical service and wiring, and testing for a complete installation ready to operate. Design and layout of the system must approved by the City Engineer or his Designee prior to construction. The system shall be designed and sized for peak flow.

<b>Section</b>	<b>28.02</b>	<b><u>SITE</u></b>
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Pump station sites shall be sized as delineated in the Typical City Details attached as part of this Manual. Owner/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 in the Typical City Details attached as part of this Manual. In general, the site for the paved access road shall also be dedicated to

the City by warranty deed or plat. Exceptions to this requirement may be allowed by the City Engineer or his Designee on a case by case basis in the form of an ingress/egress easement for the access road. 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.

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

**Section 28.03 BUOYANCY**

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

**Section 28.04 EXCAVATION AND BACKFILL**

Excavation and backfill (including sheeting and bracing), dewatering, bedding and foundation, and furnishing and disposal of materials shall be as required in ARTICLE 26.

**Section 28.05 GRADING**

The site shall be graded away from the cover slab at a 1 inch per foot drop.

**Section 28.06 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 wooded planks, strongly built and securely bolted thereto. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.

**Section 28.07 WET WELLS**

Wet wells shall be to the same requirements as sanitary sewer manholes with the following additional requirements:

- A) The base shall be monolithic with lower ring.
- B) The base slab and top slab shall be constructed to the dimensions specified in the Typical City Details attached as part of this Manual. The wall

thickness and inside diameter of the wet well shall be constant over its full depth. Generally, the minimum acceptable inside diameter for a wet well shall be 6 feet, however sufficient space for installed equipment, required suction pipe submergence and spacing shall be provided. A minimum of 24 inches between shut off and lead pump start levels shall be provided. Low water level shall provide adequate submergence to prevent pump inlet from vortexing, air binding, or other operational problems.

- C) A minimum 5 foot depth from the lowest invert shall be provided.
- D) The maximum high water level shall be less than the low pipe influent invert, with the high water alarm no higher than the mid-depth point of said pipe.
- E) Brick construction shall not be acceptable.
- F) Wet well shall be free from all detectable leaks. Any leaks detected shall be corrected prior to acceptance by the City.

**Section 28.08 PIPE, VALVES AND FITTINGS**

All exposed pipe shall have flanged joints. All buried pipes shall have restrained joints. All exposed piping shall be coated with a minimum of 16 mils of Koppers 300M.

**Section 28.09 PUMPS**

28.09.01 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 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 specified in the Typical City Details attached as part of this Manual.

Pumps shall be submersible and of a dual rail system - dual rail pumps with dual rails. Pump station shall be capable of pumping the peak design flow with any one pumping unit out of service. Pumps shall be capable of meeting all system hydraulic conditions without motors overloading. In addition, a minimum 5 HP motor shall be required. Head-capacity (performance) curves shall verify that pumps are operating at peak efficiency for application. The system head-capacity analysis shall provide the following and be subject to review by the City Engineer or his Designee:

- A) System operation under peak flow conditions, with one pump or multiple parallel pumping, as designed. If the receiving force main system is

interconnected to additional pumping stations, hydraulic design conditions shall also include said pumping systems operating at rated capacity.

- B) Pumping capability with one pump running, all units operating in parallel and other combinations, if applicable.

All parts 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 316 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.

Two pumps shall be required for all stations discharging 2,000 gallons per minute or less. Additional pumps shall be required as necessary for larger flows. A minimum 5 minutes between successive starts of pumps. Pumps shall alternate operation automatically. Wherever possible, pumps shall be preceded by a flanged coupling adapter and followed by an expansion joint. The pumps shall be capable of handling raw unscreened domestic wastewater and minimum 3 inch diameter solid spheres. Pump operation shall be controlled automatically by means of a SCADA Control System with a float back-up system. Pumps shall be mounted in the wet well as specified in the Typical City Details attached as part of this Manual. (See approved Manufacturer's List attached as part of this Manual.)

Pumping stations shall have a maximum of 20 brake horsepower motors unless overhead crane system is installed. All stations with 20 brake horsepower or larger motors shall be 480 volt. Stations larger than 40 combined brake horsepower shall be conceptually approved by the Public Works Department prior to design. Pump motors shall be 3 phased power supply.

#### 28.09.02 Installation

Equipment shall be installed in accordance with approved shop drawings and manufacturer's instructions to operate as intended by the manufacturer. Shop drawings shall be sent to the Public Works Department for review prior to installation of equipment. Upper guide rail holders shall be located exactly as required.

- A) 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 2 permanently lubricated bearings. The upper bearing shall be a single row ball bearing. The lower bearing shall be a 2 row angular contact ball bearing, if required, to minimize vibration and provide maximum bearing life.

B) Impeller

The impeller shall be constructed of gray cast iron, ASTM A-48, class 30. All external bolts and nuts shall be of Type 304 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 provided on the pump impeller shall be required. A two part system is acceptable.

C) 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 replaceable. Conventional double mechanical seals with a single spring between the rotating faces, requiring constant differential pressure to effect sealing and subject to openings and penetration by pumping forces shall not be considered equal to tandem seal specified and required.

D) 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 2 Type 316 seamless tubular stainless steel guides per pump, 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

shall 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 minimum ¼ inch 316 stainless steel cable, air craft rating, to remove the pumps from the wet well. The cable shall be of sufficient size to accommodate removal of the pump without breaking.

28.09.03      Pump Warranty

The pump manufacturer shall warrant the units being supplied to the City against defects in workmanship and material for a period of 5 years or 10,000 hours.

**Section      28.10            MOTORS**

28.10.01      General Requirements

All motors shall be built in accordance with latest NEMA, IEEE, ANSI and AFBMA Standards and be UL listed 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°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, and 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 below 20 horsepower shall be rated 240/480 volt, 3 phase. Motors 20 horsepower and greater shall be 480 volt, 3 phase.

28.10.02      Heat Sensors

Each motor shall incorporate a minimum of 1 ambient temperature compensated overheat sensing device. This protective device shall be wired into the pump controls in such a way that if excessive temperature is detected the pump will shut down. This device shall be self-resetting.

28.10.03      Cables

Cables shall be designed specifically for submersible pump applications and shall be properly sealed. The cable entry junction chamber and motor shall be separated by

a stator lead sealing gland or terminal board, which shall isolate the motor interior from foreign material gaining access through the pump top. Sealing systems utilizing epoxy potting compounds may be used. All cables shall be continuous without splices from the motor to the control panel, unless otherwise approved by the City.

The junction chamber, containing the terminal board, shall be perfectly leak proof.

**Section 28.11 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.

**Section 28.12 TELEMETRY SYSTEMS**

Telemetry systems shall be provided on all public stations. The system shall be a radio unit installed with the SCADA RTU which is 100% compatible to the system in use by City.

**Section 28.13 ELECTRICAL POWER AND CONTROL SYSTEM**

**28.13.01 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 2 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.

Lightning arrester, surge suppressor, pump disagree sensors, emergency disconnect switch, telemetry system, flow meter and totalizer, emergency generator plug, red alarm light, and convenience outlet shall be provided as specified in the Typical City Details attached as part of this Manual.

#### 28.13.02 Control Panel

A pump station control panel shall be provided for each wastewater pump station. (See approved Manufacturer's List attached as part of this Manual.) The control panel shall be factory assembled and tested prior to installation at the pump station. Contractor shall provide for coordination between pump manufacturer and panel manufacturer to assure that the control panel as a whole, as well as the individual components, comprise a system which is intimately compatible with the pumps. The following equipment shall be included in the panel: Main breakers (2), pump circuit breakers (2), 20 amp panel circuit breaker, mercury vapor stat switches (2), starters (2), alternator, elapsed time meter for each pump, run lights (2), HOA switches (2), pump disagree timer, phase voltage monitor relay, and SCADA RTU with a radio telemetry unit. All switches, main circuit wiring, breakers and other devices shall be clearly and neatly labeled inside the control panel. See the Typical City Details attached as part of this Manual. A single line wiring diagram shall be included within the panel with a copy provided for the City's records.

#### 28.13.03 Pump Alternator

An 8 pin plug-in solid state alternator (see approved Manufacturer's List attached as part of this Manual) shall be provided to change the pump starting sequence on each pumping cycle. A 3 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.

#### 28.13.04 Motor Starter and Selector Switches

The panel shall contain 2 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 Manufacturer's List attached as part of this Manual.) 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" 3 position switch to control the operation mode of each pump motor starter.

#### 28.13.05 Motor Circuit Protectors

Each pump motor shall be protected by a 3 pole motor circuit protector. (See approved Manufacturer's List attached as part of this Manual.) 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 current, causing the Motor Circuit Protector 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 push-to-trip 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.

#### 28.13.06 Power Supply and Main Disconnect

Power supply to the control panel shall be either 240 volt, 3 phase, 4 wire or 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. In all 240 volt systems, disconnects shall be installed between the meter and the panel and on all 480 volt systems disconnect shall be installed ahead of the meter. LED power available indicators shall be supplied on all legs.

#### 28.13.07 Circuit Breakers

##### A) General

The control-panel shall include main circuit breakers and generator breaker with mechanical interlock, a circuit breaker and magnetic starter for each pump motor, and 20 amp, 120 volt circuit breakers as required.

##### B) 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 Manufacturer's List attached as part of this Manual.)

##### C) Circuit Breakers

All circuit breakers shall be heavy duty molded case breakers. The handle on the circuit breakers shall be operational through the inner door. (See approved Manufacturer's List attached as part of this Manual.)

##### D) Padlock Attachment

A Square D HPAFK (or approved equal) handler padlock attachment shall be installed on all motor circuit breakers.

#### 28.13.08 Emergency Power Receptacle

This item shall only be required on stations that do not have a permanent standby generator system. The panel shall have an external mounted generator receptacle of the required size. (See approved Manufacturer's List attached as part of this Manual.)

#### 28.13.09 Wiring

All power wires shall be THW or THWN 75°C insulated stranded copper conductors, and shall be appropriately 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.). Colors shall be red for 24 volt, white for neutral, black for 120 volts.

#### 28.13.10 Terminal Points

Terminal points of all terminal 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.

#### 28.13.11 Engraved Nameplates

All circuit breakers, control switches, indicator pilot lights, and other control devices shall be identified with permanently affixed legend plates and lamicoid-type engraved nameplates where applicable.

#### 28.13.12 Surge Protector

A surge protector shall be included and wired to protect motors and control equipment from lightning induced line surges. All surge protectors shall be UL approved and installed per respective power company requirements and manufacturers' specifications, surge protectors shall be attached to the main disconnects.

#### 28.13.13 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.

#### 28.13.14 Convenience Receptacle

On the face of the inner door unit, there shall be installed a 20 amp, 120 volt,

duplex convenience receptacle. It shall be provided with it's own single pole, 20 amp circuit breaker for protection. Ground fault interrupt type shall be required.

#### 28.13.15      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. An additional 10 space terminal strip shall be installed in the cabinet for future use, in addition to the required number of terminals for alarms or signals as specified in the Typical City Details attached as part of this Manual.

#### 28.13.16      Control Power Transformers

There shall be a control power transformer with a minimum size of 500 volt (AC) to provide 120 volt (AC) power for: coils for starters, 20 amp 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 volt (AC). This shall be provided by a 24 volt (AC) control power transformer properly sized with a fused secondary.

#### 28.13.17      Control Relay

The level control relays shall operate from 24 volt (AC). They shall be enclosed, plug-in 8 pin type with octal-style screw terminal sockets.

#### 28.13.18      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.

#### 28.13.19      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.

#### 28.13.20      Battery Backup

A 12 volt (DC) battery shall be supplied on all lift stations to insure operation of the SCADA system in the case of a power outage. Refer to the Typical City

Details attached as part of this Manual.

#### 28.13.21 Operation

The control panel shall respond to a pressure transducer coupled with SCADA control system as well as redundant liquid level float switches to automatically start and stop pumps as well as sound an alarm upon high or low wet well levels.

The control panel shall operate 2 electrical 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 shall automatically start to handle this increased flow. 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 timing 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.

Normal operations shall be governed by the pressure transducer coupled with the SCADA control system. Upon abnormal wet well levels all pump control operations shall automatically revert to the redundant float type liquid level control system. These control components shall be 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. Alternate methods of liquid level measurement in the wet well may be considered on a case by case basis.

#### 28.13.22 Housing

The duplex pump panel shall be housed in a NEMA 3R, Type 304, 14 Gauge stainless steel enclosure. 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. The outer door shall include a 3-point latch and stainless steel door handle as manufactured by Hoffman or approved equal.

There shall be, permanently affixed to the interior side of the exterior enclosure door, both a nameplate and a 10 inch x 12 inch 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 amperes at the operating point and at

least 2 other points on the pump curve.

The control panel enclosure shall be Underwriters Laboratories (UL) 50 type 4X Listed.

28.13.23      Testing and Warranty

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. The control panel manufacturer shall maintain a service organization in State of Florida that is available for service. The manufacturer shall furnish a 5 year warranty against defects in materials and workmanship covering parts and labor on all items supplied under this Section.

**Section      28.14              LIGHTS AND ALARMS**

28.14.01      Indicator Lights

Heavy duty, oil tight, indicator lights as specified in the Typical City Details attached as part of this Manual shall be installed on the face of the inner door unit.

28.14.02      High Level Alarm

Two mercury float ball switches shall be provided as high and low level backup alarm switches to the telemetry system and to the red alarm signal light. A vapor proof red light and horn shall be mounted on top of the control panel enclosure for high level alarm. Also, there shall be an alarm silence push button on the inner door and a silence relay which will silence the horn and automatically reset when these signals are restored to normal. The push button shall be heavy duty oil tight. The red globe shall be the screw-on type.

**Section      28.15              FLOW MONITORING SYSTEM**

28.15.01      General

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.

All meters shall be set to maintain a full pipe or fluid volume. Meters shall be designed to record or indicate peak pumping station capacity. Totalizer shall indicate flow in gpm and totalize in gallons.

## 28.15.02 Magnetic Flowmeter/Transmitters

The magnetic flowmeter shall be Rosemont Model 8712 indicator and 8705 flow tube or an approved equal. It 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 volt (AC)  $\pm 10\%$ , 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 flow meters 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  $1\frac{1}{2}$  times the meter diameter. Meters shall have polyurethane liners with stainless steel electrodes.

The electronics portion of the magnetic flowmeter shall include both a magnet driver to power the magnet coils and a signal converter. The remote signal converter and remote indicating totalizers shall be integrally mounted with the pump station control panel. Provide NEMA 3R enclosure to house signal converter/totalizer. Signal converter shielded cable shall be supplied by meter manufacturer. The converter shall include a separate customer connection section to isolate the electronics compartment and protect the electronics from the environment. A separate terminal strip for power connection shall be supplied. 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.

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 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.

Meter shall be installed in accordance with the installation instructions provided by the manufacturer and in accordance with the approved construction drawing. Meter shall be suitable for outdoors installation and shall be furnished complete with grounding rings at both ends of the mag tube and installation hardware, including studs, nuts, gaskets, and flange adapter hardware. 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. For large installations, meter shall be installed within the pumping station structure where possible. For smaller, submersible pump installations, the meter shall be enclosed within a protected drained pit with by-pass valves and piping. Meter pit shall be drained to wet well directly or shall have a sump pump installed to perform this function. Flexible rubber coupling shall be installed immediately upstream of the flow meter to facilitate its removal.

Meters shall not be less than 4 inches and shall be the same size as the force main. For all meters, the minimum straight run upstream is 5 times the pipe diameter. Transition pieces shall be installed in strict accordance with the flow meter manufacturer's recommendation to ensure accuracy of flow measurement.

There is a basic requirement that the meter be installed at a lower level than the remainder of the main line piping to ensure it is kept constantly wet. This must be accomplished without sacrificing the straight run requirement for both the influent and effluent piping. This shall be accomplished by the use of 45° bends upstream and downstream of the flow meter branch piping. Under no circumstances shall these 45° bends be installed in such a way as to sacrifice the required straight run upstream and downstream of the flow meter.

Conduit supplied by the Contractor shall be run from magnetic flow meter to pump station control panel. No AC voltage shall be installed inside flowmeter pit. Provide ¾ inch PVC conduit from control panel to pump disagree switches in valve vault. Provide ¾ inch PVC conduit from signal converter/totalizer to flow meter in meter vault. Provide separate feeder conduits from control panel to individual pumps in wet well. Provide a minimum clearance of 4'-0" in front of all electrical equipment to meet NEC requirements as adopted by the State of Florida and City of Oviedo. Bypass piping shall be provided as part of the flow meter installation to allow removal of the meter for cleaning, overhaul, or replacement. Bypass piping around the meter shall be provided for all stations with flow meters to facilitate meter maintenance.

#### 28.15.03 Electronic Chart Recorder

The electronic chart recorder shall be of the microprocessor, individually programmable type. The instrument shall contain a 100 mm circular chart, a minimum of a 40 character digital display, and shall also have up to 4 inputs capability. The electronic recording receiver shall be housed in a NEMA 4X case

suitable for panel mounting. The recorder shall be provided with an adjustable chart rotation of 1 to 4,096 hours per rotation.

28.15.04      Warranty and Service

A)      Warranty

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

B)      Service

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

**Section      28.16              ELECTRICAL GROUNDING SYSTEM**

28.16.01      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:

- A)      Wet well cover.
- B)      Valve vault cover.
- C)      Control panels.
- D)      Generator.
- E)      Utility company transformer.
- F)      Main disconnect switch.
- G)      Fence.

28.16.02      Material and Installation

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

**Section 28.17            STANDBY POWER GENERATOR SYSTEM**

28.17.01            General

A standby power generator system shall be installed at pump stations as required by this Manual for electrical power during the loss of normal power. Standby power generators shall be provided at all stations having the following characteristics:

- A)     30 or greater total combined brake horsepower.
- B)     Peak design capacity of 1,000 gpm or more.
- C)     Arterial stations receiving flow from at least one other service area.
- D)     Service area includes critical users as determined on a case by case review.

Generators shall be complete with all controls, automatic switchgear and shall produce 240 volts (AC), or 480 volts (AC), 3 phase, 4 wire power. Generator and controls shall be installed in an approved enclosure.

28.17.02            Generator Set 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, 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.

28.17.03            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 1 year from the date of equipment start-up.

#### 28.17.04 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, in the presence of the City's representative, shall be conducted at the site after installation has been completed. 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 8 hours, carrying normal lift station loads. The Contractor shall refill the main fuel tank at the completion of the tests.

#### 28.17.05 Ratings

The rating of the generator shall be as specified in the Typical City Details attached as part of this Manual. 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.

#### 28.17.06 Engine

The engine shall be water cooled, four stroke cycle, compression ignition diesel, LP or natural gas. 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, where applicable. 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  $\pm 0.25\%$  under steady state conditions. The engine shall start and assume its rated load within 10 seconds, including transfer time.

#### 28.17.07 Generator

The generator shall be a 3 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  $\pm 2\%$  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  $\pm 5\%$ .

#### 28.17.08 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:

##### A) 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.

##### B) Metering Equipment

Metering equipment shall include 3½ inch meters (dial or digital type frequency meter, 2% 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.

##### C) 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.

##### D) Function Switch

A four position function switch marked “Auto”, “Manual”, “Off/Reset”, and “Stop” shall be provided.

#### 28.17.09 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.

#### 28.17.10 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 replacement if found to be defective.

#### 28.17.11 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.

#### 28.17.12 Utility Connections

All connections to the generator set shall be flexible.

#### 28.17.13 Cooling System

The generator set shall be equipped with an engine mounted radiator sized to maintain safe operation at 110°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.

#### 28.17.14 Fuel System

An above ground, vaulted, main fuel oil storage tank with float switch, and fuel level indication, LP or natural gas tank shall be furnished and 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.

Above ground vaulted fuel oil tanks shall be equipped with an overflow containment system supplied by the tank manufacturer.

Fuel oil piping, including mounting of any required fuel tanks, shall be furnished and installed by the Contractor and shall have double wall containment for all

pipng.

#### 28.17.15 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. The exhaust system shall not exceed residential noise limit requirements.

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.

#### 28.17.16 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 2 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.

#### 28.17.17 Automatic Transfer Switch

The automatic transfer switch shall be part of the control panel. The transfer switch shall be provided with the following features:

- A) Complete protection, close differential voltage sensing relays monitoring all 3 phases (pick-up set for 95% of nominal voltage, drop-out set for 85% nominal voltage).

- B) Voltage sensing relay on emergency source (pick-up set for 95% of nominal frequency).
- C) Time delay on engine starting--adjustable from 1 second to 300 seconds (factory set at 3 seconds).
- D) Time delay normal to emergency transfer--adjustable from 0 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.
- E) 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.
- F) 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.

28.17.18      Warranty

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

**Section      28.18              FENCING**

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. 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 as specified in ARTICLE 19 and the Typical City Details attached as part of this Manual.

Chain link fence shall be 6 feet high, in accordance with of this Manual. One 12 foot double swing drive gate (two 6 foot leaves),hinged to swing through 180° from open to close to open, with center drop rod assembly latch (no post) and gate hold backs for both leaves shall be installed, complete with latches, locking device, stops keeper, hinges, fabric and braces. Gate shall open outward from station. 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.

All posts shall be set 3 feet deep in concrete footings, 12 inches in diameter for line posts, gate and corner posts. After the post has been set, aligned and plumbed, the hole shall be filled with 3,000 psi 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.

**Section 28.19 TOOLS AND SPARE PARTS**

One 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 only need to furnish an impeller wear ring. 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 28.20 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 metered, reduced pressure type backflow preventer

**Section 28.21 INSPECTION AND TESTING**

A factory representative knowledgeable in pump operation and maintenance shall inspect and supervise a test run at the pumping station in the presence of the City Engineer or his Designee. The City shall be provided 24 hour notice before this inspection is to commence. A minimum of 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 this 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 this Manual have been met by the equipment as installed, and shall include, but not be limited to, the following tests:

- A) That all units have been properly installed.
- B) That the units operate without overheating or overloading any parts and without objectionable vibration.
- C) That there are no mechanical defects in any of the parts.
- D) That the pumps can deliver the specified pressure and quantity.
- E) That the pumps are capable of pumping the specified material.

- F) That the pump controls perform satisfactorily.

**Section 28.22 LIFT STATION FEES**

Where a lift station is being dedicated for City ownership and maintenance, the following must be provided to the City:

- A) The most recent approved rate per ordinance or resolution for emergency generator funds to provide backup power during emergencies.
- B) In lieu of installation of the Radio Telemetry and SCADA control system the City may accept payment for the SCADA and Telemetry system. The amount of payment shall be for the actual cost of the equipment and installation at the time of the lift station installation.

**Section 28.23 REQUIRED SUBMITTALS**

Submittals shall be provided to the City, for any lift stations to be taken over by the City, in triplicate and include the following:

- A) As-Built Drawings providing a detail showing fencing, gates, all important details of construction, dimensions, anchor bolt locations, and the flow meter and valve pit relative to the lift station, including but not limited to all elevations, such as inverts, floor elevations and finished grades, etc. All the above improvements shall be included inside the fenced-in area. The approach road and driveway shall also be shown. The Drawing shall be fully dimensioned.
- B) Descriptive literature, bulletins, and/or catalogs of the equipment.
- C) 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 8½" by 11" 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.
- D) Complete layouts, wiring diagrams, telemetry 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.
- E) A drawing showing the layout of the pump control panel shall be furnished.

The layout shall indicate all devices mounted on the door and the panel shall be completely identified.

- F) The weight of each pump.
- G) Complete motor data shall be submitted including:
  - 1) Nameplate identification.
  - 2) No-load current.
  - 3) Full load current.
  - 4) Full load efficiency.
  - 5) Locked rotor current.
  - 6) High potential test data.
  - 7) Bearing Inspection report.

## ARTICLE 29

### WATER MAINS

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	29.01.01	<u>Type of Water Mains</u>
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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.

	29.01.02	<u>Design Period</u>
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Water mains shall be designed for the estimated ultimate tributary population, as delineated in the approved City of Oviedo 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.

	29.01.03	<u>Location</u>
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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 20 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. 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.

**Section 29.02 DESIGN BASIS**

29.02.01 Average Daily Flow and Peak Flow

Average daily water flow shall be calculated by referencing the Equivalent Residential Unit (ERU) flow rates as outlined below. Peak flow, at a minimum, shall be the average daily flow times a peaking factor of 4. The average daily flow for domestic use shall be calculated at the minimum rate of 100 gallons per day per capita, with 3.5 persons per single family residence, and 2.5 persons per multi-family or mobile home dwelling unit. Maximum hour demand to be used for design shall be 1.0 gallons per minute (gpm) per single family residence and 0.7 gpm per dwelling unit for each multi-family or mobile home unit. Flow demands for commercial, industrial or other special developments shall be established from the estimates provided in current City Ordinance. At the discretion of the City Engineer, existing records of like facilities or estimated projections, using the best available data, may be considered.

29.02.02 Fire Flow Requirements

Fire flow requirements shall be determined in accordance with applicable City Codes. As a minimum, the requirements outlined in the ISO. "Guide to Determining Needed Fire Flow", latest edition, shall be met. In no case shall needed fire flow be less than 750 gpm. Maximum daily flow with fire flow shall not exceed 10 fps. Maximum daily flow, at a minimum, shall be the average daily flow times a factor of 2.

29.02.03 Design Calculations

Owner's/Developer's Engineer shall submit signed, sealed and dated design calculations with the Plans for all water distribution projects. Calculations shall show that the water mains will have sufficient hydraulic capacity to transport:

- A) Peak hourly flows.
- B) A combination of maximum daily flows and fire flows.

All calculations shall meet the requirements of Section 29.03.01. Head losses through meters and backflow devices shall also be included in calculations. The Owner's/Developer's Engineer, at the request of the City, shall perform a nodal analysis of the proposed project along with its effects upon the City's entire system. The City's nodal model shall be obtained and used for this purpose. The

Owner/Developer may request the City to develop the project's nodal model, with input from the Owner's/Developer's Engineer, but this will be performed at the availability of City Staff and at a rate to cover City's cost.

**Section 29.03            DETAILS OF DESIGN AND CONSTRUCTION**

29.03.01            Pressure

All water mains shall be designed in accordance with Section 29.02.03 above. The system shall be designed to maintain a minimum pressure of 20 psi at all points in the distribution system under all conditions of flow. Higher pressures may be required at commercial, industrial and high density residential areas. The normal working pressure in the distribution system should be approximately 55 psi, but in no case less than 35 psi on the downstream side of a meter. For pressures greater than 90 psi special provisions may be required. Design Friction Losses for water mains shall be determined using the Hazen-Williams friction coefficient of C=100. Peak hourly flow shall not exceed 5 fps. Maximum daily flow with fire flow shall not exceed 10 fps.

29.03.02            Diameter

Only 4", 6", 8", 10", 12", 16", 20", 24", 30", 36", 42", 48" and 54" diameter water mains shall be permitted. Four inch water mains shall be permitted only in cul-de-sac areas with a maximum length of 500 feet of pipe. In cul-de-sac areas only, 4 inch looped connections are required to prevent dead ends. As a minimum, 6 inch looped systems shall be required in low density residential projects. Where looping of mains is not practical, minimum 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 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 29.03.01. New water mains installed along the following roadways shall be a minimum of 10 inches, or 8 inches when looped to the opposite side of the road: SR 434, CR 419, CR 426, Mitchell Hammock Rd., Lockwood Rd., Chapman Rd., Florida Avenue, South Division St. and DeLeon St.

29.03.03            Dead Ends

In order to provide increased reliability of service and reduce head loss, dead ends shall be minimized by making appropriate tie-ins wherever practical, as determined by the City. System looping is required wherever possible to increase overall capacity and service. Where dead-end mains occur, they shall be provided with a fire hydrant or with an approved flushing hydrant or blow-off for flushing purposes. Flushing devices shall be sized to provide flows which will give a velocity of at least 2.5 feet per second in the water main being flushed. No flushing device shall be directly connected to any sewer.

29.03.04      Valves

Valves shall be provided for all branch connections, loop ends, fire hydrant stubs, or other locations as required to provide an operable, easily maintained, and repaired water distribution system. Valves are to be placed so that the maximum allowable length of water main required to be shutdown for repair work shall be 500 feet in commercial, industrial or multi-family residential areas, or 800 feet in other areas.

29.03.05      Air Relief Valves

At high points in water mains where air can accumulate, provisions shall be made to remove the air by means of hydrants or automatic air relief valves. Automatic air relief valves shall not be used in situations where flooding of the manhole or chamber may occur. Refer to the Typical City Details attached as part of this Manual.

29.03.06      Fire Hydrants

Fire Hydrants shall be considered and designed in accordance with this ARTICLE.

29.03.07      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.

29.03.08      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 this Manual or AWWA C-651.

**Section      29.04      WATER METERING**

29.04.01      General

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

29.04.02      Single Family, Duplex, and Multi-Family Subdivisions

Each unit shall be individually metered. However, a variance may be requested for multi-family subdivisions. Single and Double services shall be installed at property lines as specified in the Typical City Details attached as part of this Manual.

29.04.03      Commercial, Industrial, and Institutional Projects

In general, each building shall be individually metered. Meter(s) shall be located in the public rights-of-way at the property line.

29.04.04      Shopping Centers

Each unit shall be individually metered. The meters shall be located either in the right-of-way or within a Utility Easement. The meters shall be located within an unpaved area to facilitate removal, repair and/or replacement without damage to paved surfaces.

29.04.05      Meter Installation

All meter boxes shall be installed by the Contractor at finished grade and level. All meters 2 inches and smaller will be installed by the City after payment of applicable fees and charges. All meters 2 inches in size and smaller shall be installed underground in an approved meter box. Meters larger than 2 inches shall be installed above ground. In general, meters larger than 2 inches shall be located in a meter easement located adjacent to the public right-of-way.

29.04.06      Meter Sizing

Size of all meters shall be determined by the Owner's/Developer's Engineer and approved by the City Utilities Division. The Owner's/Developer's Engineer shall provide sufficient information on estimated peak flows and low flows so that meter size can be evaluated. The Owner's/Developer's Engineer shall include head-losses through metering device when designing the water system.

**Section      29.05      WATER SERVICES AND CONNECTIONS**

Water services and connections shall conform to the applicable provisions of this Manual and the Typical City Details attached as part of this Manual. Only 1", 2", 3", 4", 6", 8" and 12" services shall be permitted. Where water services greater than 12 inches are required dual services shall be provided. New services and connections to the water system, either new or existing, shall be made by the Contractor.

Water service piping and connection shall be installed as specified in the Typical City Details attached as part of this Manual. The location of all service lines shall be as specified in the Typical City Details attached as part of this Manual and shall be either single or dual 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 method approved by the City.

**Section 29.06 SERVICE PIPE, STOPS, FITTINGS, AND SERVICE SADDLES**

29.06.01 Service Pipe

All service lines shall be 1 inch or 2 inch polyethylene tubing conforming to specifications in AWWA C-800 and AWWA C-901.

29.06.02 Stops

Corporation stops shall be 1 inch or 2 inch brass, equipped with connections compatible with the polyethylene tubing and threaded in accordance with specifications in AWWA C-800 and AWWA C-901. Curb stops shall be sized to match the meter size and conform to the specifications in AWWA C-800 and AWWA C-901.

29.06.03 Fittings

Fittings shall be brass, cast and machined in accordance with specifications in AWWA C-800 and AWWA C-901, with compatible polyethylene tubing connections.

29.06.04 Service Saddles

A service saddle may be used for all service line taps. Service saddles shall be double strap, anchored by a minimum 4 bolt pattern on a ductile iron saddle body. The City may require a stainless steel strap and fusion epoxy or nylon coated ductile iron body with stainless steel hardware in areas designated as corrosive.

**Section 29.07 WATER MAIN MATERIALS**

29.07.01 General

These Specifications cover the pipe, fittings, and accessory items used for water distribution systems.

Pipe used in water distribution systems shall be ductile iron pipe (DIP).

The Contractor shall be responsible for all materials furnished and storage of same, until the date of substantial completion. The Contractor shall replace, at the Contractor's 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.

#### 29.07.02 Ductile Iron Pipe

All ductile iron pipe of nominal diameter 4 through 54 inches shall conform to ANSI/AWWA A-21.51/C-151. A minimum of Pressure Class 350 pipe shall be supplied for all sizes of pipe unless specifically called out in the detail sheets, or required by the City.

#### 29.07.03 Fittings

Any fittings required shall be mechanical joint ductile iron or gray iron conforming to ANSI/AWWA A-21.10/C-110, 250 psi minimum pressure rating, or ductile iron compact fittings 4 through 12 inches in accordance with ANSI/AWWA A-21.53/C-153.

#### 29.07.04 Joints

Joints for ductile iron pipe and fitting joints shall be push-on or mechanical joints conforming to ANSI/AWWA A-21.11/C-111. Where called for in the plans, restrained or flanged joints shall be provided. Flanged joints shall conform to ANSI Standard B-16.1-125 lb. Restrained joints shall conform to ARTICLE 5 of this Manual.

#### 29.07.05 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 A-21.51/C-151. 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 manufacturer's recommendations. (See approved Manufacturer's List attached as part of this Manual.) Final field coat shall be dark blue for raw water and blue for finished water.

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 A-21.4/C-104.

#### 29.07.06 Polyethylene Encasement

The pipe shall be polyethylene encased (8 mil) where shown on the detail sheets or required by the City in accordance with ANSI/AWWA A-21.51/C-105.

#### 29.07.07 Resilient Seat Gate Valves

All gate valves 12 inches and smaller shall be resilient seat gate valves. Such valves shall be resilient seated, manufactured to meet or exceed the requirements of AWWA C-509, latest revision, and in accordance with the following Specifications. Valves shall have an unobstructed waterway equal to or greater than the full nominal diameter of the valve. (See approved Manufacturer's List attached as part of this Manual.)

The valve body, bonnet, and bonnet cover shall be cast iron ASTM A-126, Class B. All ferrous surface inside and outside shall have a fusion-bonded epoxy coating. A 2 inch wrench nut shall be provided for operating the valve. All valves are to be tested in strict accordance with AWWA C-509. The valve shall be operated opening counterclockwise.

The valves shall be non-rising stem with the stem made of cast, forged, or rolled bronze as specified in AWWA C-509. Two stem seals shall be provided and shall be of the O-ring type. The stem nut must be independent of the gate.

The resilient sealing mechanism shall provide zero leakage at the water working pressure when installed with the line flow in either direction.

#### 29.07.08 Butterfly Valves

All shut-off valves 16 inches and larger shall be Butterfly valves. Butterfly valves and operators shall conform to the AWWA Standard Specifications for Rubber Seated Butterfly Valves, Designation C-504, except as hereinafter specified. Valves, except as specified hereinafter, shall be Class 150A or B. (See approved Manufacturer's List attached as part of this Manual.)

The valve body shall be constructed of close grain cast iron per ASTM A-126, Class B or equivalent material. All retaining segments and adjusting devices shall be of corrosion resistant material. Valve seats shall be a natural rubber or synthetic rubber compound. Valve seats 30 inches and larger shall be field adjustable and replaceable without dismounting operator disc or shaft and without removing the valve from the line. All retaining segments and adjusting devices shall be of corrosion resistant material. Valves 24 inches and smaller shall have bonded or mechanically restrained seats as outlined in AWWA C-504.

The face-to-face dimensions of valves shall be in accordance with above mentioned AWWA Specification for short-body valve.

The valve shaft shall be turned, ground, and polished, constructed of 18-8 stainless steel and designed for both torsional and shearing stresses when the valve is operated under its greatest dynamic or seating torque. Shaft shall be of either a one piece unit extending full size through the valve disc and valve bearing or it may be of a stub shaft design.

#### 29.07.09 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 directed by the City. The barrel shall be 2 piece, sliding type, having 5¼ 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. 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 4 foot depth below finished grade.

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.

29.07.10      Air Release Valves

The air release valves for use in water mains shall be installed as specified in the Typical City Details attached as part of this Manual. The valves shall have a cast iron body, cover and baffle, stainless steel float, bronze water diffuser Buna-N or Viton seat and stainless steel trim. Valves shall be provided with a vacuum check to prevent air from reentering the line. The fittings shall be threaded.

**Section      29.08              WATER MAIN INSTALLATION**

29.08.01      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 C-600 and C-603, unless otherwise stated in these Specifications.

29.08.02      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 relaid. At times when pipe laying is not in progress, the open ends of the pipe shall be closed

by a water-tight plug or by other means approved by the City to ensure absolute cleanliness inside the pipe.

**Section 29.09 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. Valves shall be installed in a vertical position and be provided with a standard valve box so arranged that no shock will be transmitted to the valve. The box shall be vertically centered over the operating nut, and the cast iron box cover shall be set flush with the road bed or finished surface. After installation, all valves shall be subjected to the field test for piping as outlined in these Specifications. Should any defects in materials or workmanship appear during these tests, the Contractor shall correct such defects to the satisfaction of the City.

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. All buried bolts and nuts shall be heavily coated with 2 coats of bituminous paint.

**Section 29.10 SEPARATION OF WATER MAINS AND SEWERS**

**29.10.01 General**

No water pipe shall pass through or come in contact with any part of a sewer manhole.

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

Water mains that are laid in the vicinity of pipe lines designated to carry raw wastewater or reclaimed water (wastewater effluent) shall meet the horizontal and vertical separations specified below.

**29.10.02 Horizontal Separation**

Under 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. The distance shall be measured from inside edge of pipe to inside edge of pipe.

Under unusual conditions, when local conditions prevent a horizontal separation of 10 feet, a water main may be laid closer to a pipe carrying raw wastewater provided that the bottom of the water main is at least 18 inches above the top of the sewer pipe and the water main is laid in a separate trench or on an undisturbed earth shelf.

29.10.03      Vertical Separation

Under normal conditions, water mains shall be laid to provide a separation of at least 18 inches between the bottom of the water main and the top of the sewer. Under unusual conditions, when construction conditions prevent a vertical separation of 18 inches, sewers shall be ductile iron pipe with mechanical joints or concrete encased for a minimum distance of 18 feet, centered at the point of crossing so that the joints will be equidistant and as far as possible from the water main.

29.10.04      Crossing of Water Mains and Sewers

Water mains shall be above the sewer whenever they cross. A vertical separation shall be maintained as described above. Adequate structural support for both the water main and sewers shall be provided to prevent excessive deflection of joints and settling.

**Section      29.11      TRENCH PREPARATION AND PIPE BEDDING**

29.11.01      Trench Preparation and Pipe Bedding

Applicable provisions of ARTICLE 4 of this Manual shall apply. Also refer to the Typical City Details attached as part of this Manual.

29.11.02      Pipe Preparation, Handling and Laying

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 job site. Care shall be taken to not drop or dump pipe into trenches under any circumstances.

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. If the pipe laying crew cannot put the pipe

into the trench and in place without getting earth into the pipe, the City may require that snugly-fitted, tightly-woven canvas bags be placed over each end before lowering the pipe. The bags shall be left in place until the connection is to be made to the adjacent pipe. During laying operations, Contractor shall keep debris, tools, clothing, or other materials out of the pipe.

All ductile iron pipe shall be installed in accordance with AWWA C-600 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, and no substitutes shall be permitted under any circumstances.

The pipe shall be polyethylene encased (8 mil) where shown on the detail sheets in accordance with ANSI/AWWA A-21.51/C-105.

#### 29.11.03 Trench Dewatering and Drainage Control

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.

#### 29.11.04 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 1,000 foot intervals. The minimum pipe depth shall be 3 feet below the finished grade surface or 3 feet below the elevation of the edge of pavement of the road surface, whichever is greater.

#### 29.11.05 Laying of Pipes on Curves

Long radius curves, either horizontal or vertical, may be laid with standard pipe by deflections at the joints. Maximum deflections at pipe joints and laying radius for the various pipe lengths shall be as recommended by the pipe manufacturer.

#### 29.11.06 Pipe Restraining and Thrust Block

Requirements specified in ARTICLE 5 of this Manual shall apply.

#### 29.11.07 Bedding and Backfill for Pipes

Requirements specified in ARTICLE 4 of this Manual shall apply.

**Section 29.12 HYDROSTATIC TESTS**

29.12.01 General

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 shall not be permitted under any circumstance. Tests shall not be made on sections exceeding 2,000 feet. 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 informational purposes only. The hydrostatic tests for acceptance shall only be conducted after the trenches have been completely backfilled and compacted as specified. Where any section of pipe is provided with concrete thrust blocking, pressure test shall not be made until at least 5 days have elapsed after the thrust blocking is installed. If high-early cement is used for the concrete thrust blocking, the time may be reduced to 24 hours if the City concurs that the concrete has cured and reached adequate strength.

29.12.02 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.

29.12.03 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 hydrants 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 C-600, where applicable, shall apply.

29.12.04 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 C-600 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.

**Section 29.13 DISINFECTION OF WATER MAINS**

29.13.01 General

Before being placed in service, all new water mains shall be chlorinated in accordance with the Specifications below and the procedures outlined in AWWA C-651 "Standard Procedure for Disinfecting Water Mains".

29.13.02 Flushing

Sections of pipe to be disinfected shall first be flushed 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.

29.13.03 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 not less than 50 mg/l and that a chlorine residual of not less than 25 mg/l remains

in the water after standing 24 hours in the pipe.

29.13.04      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.

29.13.05      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 shall 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.

29.13.06      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.

29.13.07      Operation of City Valves

Valves shall be manipulated by the City personnel so that the strong chlorine solution in the line being treated shall not flow back into the line supplying the water.

29.13.08      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/l.

29.13.09      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.

After flushing, water samples collected on 2 successive days from the treated piping system, as directed by the FDEP permit, shall show acceptable bacteriological results. All bacteriological testing shall be performed by the Contractor. All such bacteriological analysis must be performed by a laboratory

certified by the State of Florida.

Proper chain of custody procedures must be followed and samples shall only be collected by certified laboratory personnel in the presence of City personnel.

Copies of testing results and all related correspondence with the FDEP shall be submitted to the City.

#### 29.13.10 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.

### **Section 29.14 FIRE HYDRANTS**

#### 29.14.01 Material

Fire hydrants shall have a minimum 5¼ inch valve opening and shall comply with AWWA Standard C-502 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 3½ foot depth of bury. It shall be provided with two 2½ inch hose nozzles and one 4½ inch pumper nozzle, all having National Standard hose threads. Nozzles shall have caps attached by chains. Operating nuts shall be AWWA Standard (pentagonal, measuring 1½ inch point to flat). Fire hydrants shall be equipped with O-Ring packing. (See approved Manufacturer's List attached as part of this Manual.)

#### 29.14.02 Painting

All iron parts of the hydrant, both inside and outside, shall be painted in accordance with AWWA C-502. All inside surfaces and outside surfaces below the ground line shall be coated with asphalt varnish. They shall be covered with 2 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 1 coat of paint of a durable composition, and 1 additional coat of silver aluminum paint.

#### 29.14.03 Construction Details

Hydrants shall be plumb and shall be set so that the lowest hose connection is, at least, 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, moving, and reconnecting of existing hydrants shall be handled in a manner similar to a new installation. Hydrant shall be constructed as

specified in the Typical City Details attached as part of this Manual. Fire hydrants shall be required to have Mega-Lugs used for restraint.

29.14.04      Location and Spacing

Fire hydrants shall be as specified in the Typical City Details attached as part of this Manual. The Fire Chief or his Designee shall review the actual placement locations and final field locations of all hydrants. Hydrants shall be located no less than 5 and no more than 10 feet from the edge of pavement of the adjacent roadway and no less than 5 feet away from any physical feature which may obstruct access or view of any hydrant unless otherwise approved by the City. Hydrants shall not be placed on private distribution systems unless specifically approved in writing by the City of Oviedo Fire Rescue Department. Hydrants shall be within right-of-way or an easement.

Hydrants shall be spaced and installed according to the following schedule in all buildings falling under the LDC regulations, unless specifically permitted by City Council to do otherwise

- A)    Single-Family Residential non-sprinklered:
  - 1)     800 feet between hydrants.
  - 2)     No building further than 400 feet from a hydrant.
- B)    Single-Family Residential sprinklered:
  - 1)     1,200 feet between hydrants.
  - 2)     No building further than 500 feet from a hydrant.
- C)    All other non-sprinklered:
  - 1)     500 feet between hydrants.
  - 2)     No building further than 250 feet from a hydrant.
- D)    All other sprinklered:
  - 1)     500 feet between hydrants.
  - 2)     No building further than 400 feet from a fire hydrant.

## ARTICLE 30

### RECLAIMED WATER SYSTEM

Index	30.01	<a href="#">GENERAL</a>
	30.02	<a href="#">MATERIALS</a>
	30.03	<a href="#">METALLIC LINED WARNING TAPES</a>
	30.04	<a href="#">SEPARATION</a>
	30.05	<a href="#">SET BACK REQUIREMENTS</a>
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#### Section 30.01 GENERAL

This ARTICLE covers the general design and installation Standards for reclaimed water.

#### Section 30.02 MATERIALS

##### 30.02.01 Pipe

PVC pipe, 4 inches minimum, shall be required in the construction of the reclaimed water system and of C-200 (SDR-21) at a minimum. The PVC pipe shall be color coded by purple pigmentation, imparting no qualities to the pipe other than color, in accordance AWWA C-900 - C-901, class 150 DR18 ASTM D-1784, D-2241, NSF approved. Installation shall be performed in accordance with applicable provisions of AWWA M23.

Ductile iron pipe shall be Class 150 minimum. Installation shall be performed in accordance with applicable provisions of AWWA standards.

##### 30.02.02 Fittings

All fittings shall be ductile iron, cement mortar lined, mechanical joint fittings, conforming to with ANSI/AWWA C-153/A-21.53.

##### 30.02.03 Valves

Valves 3 inches and larger shall be resilient seated gate valves conforming to AWWA C-509-87, iron body, non-ring stem, with O-ring seals.

##### 30.02.04 Valve Boxes

Valve boxes shall be adjustable, three piece, cast iron, minimum inside diameter of 5¼ inches, with **square** cast covers cast with the inscription “RECLAIM”.

30.02.05      Services

Standard AWWA C-901-88 PE 3406 (purple) polyethylene tubing, 200 psi rating, shall be used on all reclaimed water services up to 2 inches in diameter. Single and double service residential service lines shall be 1 inch diameter. Double service lines shall use 1" x 1" x 1" wye branch (Ford No. Y44-264) or equivalent.

One inch to 2 inch service line valves, installed on the main, shall be corporation stops with pack joint couplings (Mueller H-15008 or equivalent). Curb stops, 85-5-5-5 bronze, ASTM B-62, with O-ring body seal, low friction thrust washer, O-ring port seal, locking ring type (Mueller type H-14258 or equivalent), shall be required for 1 inch service lines.

Service tapping saddles for 1 inch through 2 inch taps shall be Ford style (F202 double strap or style FC101) or equivalent.

**Section      30.03              METALLIC LINED WARNING TAPES**

Pipe line identification locator tape is to be installed on reuse water mains, and placed not more than 1 foot above the center of the pipe. Locator tape shall be inert polyethylene tape with metallic core, 6 inches wide, with black printing on red field stating "CAUTION - RECLAIMED WATER LINE", continuously in letters a minimum of 1 inch.

**Section      30.04              SEPARATION**

A maximum separation of reclaimed water mains and potable water mains shall be maintained. A minimum horizontal separation of 5 feet (center to center) or 3 feet (inside edge of pipe to inside edge of pipe) shall be maintained. Where reclaimed water mains and potable water mains cross with less than 18 inches vertical clearance, the reclaimed water main shall be 20 feet of ductile iron pipe centered on the point the of crossing.

**Section      30.05              SET BACK REQUIREMENTS**

A minimum set back distance of 75 feet shall be maintained between reclaimed transmission facilities/transmission mains and any public or private potable water supply well. This set back distance requirement does not apply to closed loop heating or air condition return wells.

A minimum set back distance of 75 feet shall be maintained between public access reuse wetted areas and any public or potable water supply well.

**Section      30.06              ADDITIONAL REQUIREMENTS**

All reclaimed water hose bits, hand-operated connections and outlets shall be contained in under ground vaults or shall be appropriately tagged or labeled and

color coded to warn public and employees that the water is not intended for drinking. Vaults for reclaimed water hose and outlets shall be locked or require a special tool to operate the hose bib or outlets.

## **ARTICLE 31**

### **CROSS CONNECTION CONTROL**

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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. All backflow prevention devices shall comply with the City of Oviedo's Manual of Cross Connection Control and the Foundation for Cross Connection Control and Hydraulic Research, University of Southern California (FCCCHR).

## ARTICLE 32

### STORMWATER MANAGEMENT

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Section	32.01	<b><u>DESIGN STANDARDS</u></b>
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To comply with the foregoing performance Standards, the proposed stormwater management system shall conform to the following design Standards:

- A) Side slopes and bottoms of all retention areas shall have grass or other landscape material cover. The maximum side slopes of retention areas are given within this ARTICLE. Landscaping of maintenance berms is prohibited unless approved by City Engineer.
- B) Spillways or other entrance channels to retention areas shall be designed to prevent the flushing of these retention areas by heavy rains.
- C) Dry retention areas shall be designed and function such that all retained water is removed after 3 days (72 hours). If this is not accomplished by percolation and/or evaporation, the retention area must be improved to meet this requirement.
- D) The proposed stormwater management system shall be designed to accommodate the stormwater that originates within the development and stormwater that flows onto or across the development from adjacent lands.
- E) The proposed stormwater management system shall be designed to function properly for a minimum 20 year life.
- F) The design and construction of the stormwater management system shall be certified as meeting the requirements of this ARTICLE by a Professional Engineer registered in the State of Florida.
- G) No surface water may be channeled or directed into a sanitary sewer.
- H) Dredging, clearing of vegetation, deepening, widening, straightening, stabilizing or otherwise altering natural surface waters shall be minimized.
- I) Natural surface water shall not be used as sediment traps during or after development.

- J) For aesthetic reasons and to increase shoreline habitat, the shorelines of detention and retention areas shall be sinuous rather than straight.
- K) Water reuse and conservation shall, to the maximum extent practicable, be achieved by incorporating the stormwater management system into irrigation systems serving the development. (If Water Management District allows.)
- L) Vegetated buffers of sufficient width to prevent erosion shall be retained or created along the shores, banks or edges of all natural or man-made surface waters.
- M) Littoral zones for wet detention ponds shall meet the Saint Johns River Water Management District requirements.
- N) In phased developments the stormwater management system for each integrated stage of completion shall be capable of functioning independently as required by this ARTICLE.
- O) All detention and retention basins shall be adequately accessible for maintenance from streets or public rights-of-way.
- P) Inlets shall be spaced in such a manner as to accept 100% of the design runoff. The maximum allowable gutter run shall be 600 feet. The actual required spacing shall depend on the characteristics of each particular site. Manholes, in accordance with ARTICLE 16, shall be required at the end of each line, and at all changes in grade, size and alignment.
- Q) Specifications shall include a section outlining the proposed method of controlling soil erosion during construction.
- R) All drainage plans shall be subject to approval by the City Engineer or his Designee. Plan submission shall include clear engineering calculations showing the method of design, including soil information as required by the City Engineer, and existing, as well as proposed, topography.
- S) The required amount of treatment volume for each development shall be based on Saint Johns River Water Management District regulations.
- T) Discharge from new development shall remain the same as pre-developed flow patterns.
- U) The City Engineer, at his discretion, may implore additional requirements when project discharges into areas currently under drainage distress.
- V) All exfiltration systems are not acceptable unless approved by City

Engineer.

**Section 32.02      DESIGN STORM (minimum)**

- |    |   |                         |  |
|----|---|-------------------------|--|
| A) | Retention/Detention basins with positive outfall flows (to Atlantic Ocean)                                    | 25 year, 24 hour (8.5") | Attenuate peak to pre-developed rate                               |
| B) | Retention/Detention basins without positive outfall (to Atlantic Ocean) during 100 year, 24 hour design storm | 25 year, 4 day (11.4")  | Retain increased volume, attenuate peak flow to pre-developed rate |
| C) | Collection and conveyance systems (residential streets)   | 10 year, 1 hour         |  |
| D) | Collection and conveyance systems (collection and arterial roads)   | 25 year, 1 hour         |  |
| E) | Canals  | 25 year, 24 hour        |  |
| F) | Bridges   | 100 year, 24 hour       |  |

**Section 32.03      DRAINAGE AREA GEOMETRY**

- |    |                   |   |
|----|-------------------|---|
| A) | Open Ponds        | Maximum side: 4:1 Dry<br>6:1 Wet<br><br>To a depth of 3': 3:1 maximum |
| B) | Fenced Ponds      | Not allowed   |
| C) | Maintenance Berms | Minimum width: 10'  |
| D) | Easement Widths   | Minimum width: 20'  |

All pond and swale side slopes shall be sodded, and bottoms shall be seeded and mulched, except areas designed and approved as littoral zones. Shorelines shall be sinuous rather than straight, so that the length of the shoreline is maximized for growth of littoral vegetation and pollution attenuation.

**Section 32.04 MATERIAL AND DESIGN SPECIFICATIONS**

- A) Conveyance Pipe
  - 1) Minimum diameter for conveyance pipe shall be 15 inches.
  - 2) Conveyance pipe shall be of reinforced concrete or Perma-loc type pipe (or its approved equal), unless otherwise approved by City Engineer or his Designee.
  - 3) Minimum slope shall be that which produces a minimum flow of 2 ft/sec at low flow.
  - 4) Maximum run between structures or terminating ends shall be 500 feet.
- B) Underdrain Pipe
  - 1) Minimum diameter for underdrain pipe shall be 8 inches.
  - 2) Material
    - a) Polyethylene tubing, satisfying AASHTO M-252 (ADS with drain guard or approved equal.
    - b) PVC, satisfying ASTM D-3033.
    - c) Aluminum, satisfying AASHTO M-196.
  - 3) Filter aggregate: FDOT 902-4.
  - 4) Filter fabric: Mirafy 140 or approved equal.
- C) Design pipe velocity shall normally be less than 10 fps.
- D) Maximum hydraulic grade line shall be 1 foot below finished edge of pavement elevation for 10 year storm, 5 feet below finished edge of pavement elevation for 25 year storm in sump locations.
- E) See ARTICLE 16 of this Manual for Inlet and Structure Specifications.
- F) Fencing of stormwater management areas shall not be allowed.

## ARTICLE 33

### RIGHT-OF-WAY UTILIZATION

<b>Index</b>	<b>33.01</b>	<b><u><a href="#">GENERAL</a></u></b>
	<b>33.02</b>	<b><u><a href="#">DEFINITIONS</a></u></b>
	<b>33.03</b>	<b><u><a href="#">EXCLUSIONS</a></u></b>
	<b>33.04</b>	<b><u><a href="#">GENERAL REGULATIONS</a></u></b>
	<b>33.05</b>	<b><u><a href="#">RESTORATION AND MAINTENANCE</a></u></b>
	<b>33.06</b>	<b><u><a href="#">UTILITY ACCOMMODATION</a></u></b>
	<b>33.07</b>	<b><u><a href="#">INSPECTION</a></u></b>
	<b>33.08</b>	<b><u><a href="#">OPERATIONAL SAFETY</a></u></b>
	<b>33.09</b>	<b><u><a href="#">EXISTING USES</a></u></b>

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<b>Section</b>	<b>33.01</b>	<b><u>GENERAL</u></b>
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The purpose of this ARTICLE, in the interest of public health, safety and welfare of the citizens and inhabitants of the City of Oviedo, Florida, is to control, by the issuance of Right-of-Way Utilization Permits, the utilization of the public rights-of-way and public easements lying within the City of Oviedo. It is the intent of this ARTICLE to promote good engineering practices which will assure the maximum utilization of the public rights-of-way and public easements by all the citizens, with the lowest life cycle cost to all due safety, operation and maintenance. Right-of-way Utilization Permits shall be obtained as prescribed in the LDC. All activities within the jurisdiction of this Manual shall be reported to all Utilities in the area at least 72 hours prior to commencement. Permits from other entities may be required in addition to the City permit.

<b>Section</b>	<b>33.02</b>	<b><u>DEFINITIONS</u></b>
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The term “right-of-way” and the term “easement” as used in this ARTICLE, unless otherwise designated, shall be deemed public rights-of-way and public easements.

<b>Section</b>	<b>33.03</b>	<b><u>EXCLUSIONS</u></b>
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All construction and maintenance performed within the public rights-of-way and public easements lying within the City of Oviedo, Florida, unless specifically exempt, are within the purview of this ARTICLE, regardless of size or extent. Exclusion from any part in this ARTICLE does not provide exclusion (applicability of) of any other provisions.

<b>Section</b>	<b>33.04</b>	<b><u>GENERAL REGULATIONS</u></b>
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Pre-application meetings are recommended and pre-Construction conferences are mandatory between the Owner/Developer, his Engineer, all utilities, and the City

Staff when City facilities or improvements to be dedicated to the City are involved.

In all cases, full consideration shall be given to sound engineering principles and economic factors. Final determination of the types of facilities permitted shall be based on a cost/benefit analysis of the feasible alternatives. Consideration shall be given to aesthetics by all right-of-way users avoiding unnecessary appurtenances.

All construction and maintenance shall be performed with proper shoring, barricades, and maintenance of traffic signage in accordance with the MUTCD, the regulations of the Florida Industrial Safety Board, and the FDOT Safety Manual. All street closures will be restricted to the limits of rights-of-way with necessary traffic control devices and markings. A Right-of-Way Utilization Permit shall be required.

Shoring shall be required where necessary to protect existing pavement, and must be properly protected and removed.

All side drains, side ditches and storm sewers shall be referenced as to grade and location prior to construction.

Where direct burial is not required, only single-pole support systems shall be permitted within the rights-of-way. Any exception must be amply justified and approved by the City Engineer. Where it is necessary to place aerial crossings which will interfere with traffic, careful planning of work with regard to the safety of vehicular traffic is mandatory. No temporary supports shall be allowed closer than the minimum clearance unless where incorporated with suitable barrier systems. Such temporary construction shall be completed in the minimum time possible as approved in the Permit.

Where feasible, all longitudinal underground facilities shall be placed outside of the pavement of main-traveled lanes. Where encasement is used, the encasement pipe shall have strength equal to or exceeding the carrier pipe. Encasement shall be in accordance with ARTICLE 5 of this Manual. PVC pipe used in roadway crossings for use as non-pressure conduit intended for direct burial, or concrete encasement, unless otherwise specified, shall have a minimum pipe stiffness of 120 psi at a deflection of 0.2 inch, when tested in accordance with ASTM D-2412. Casing shall normally be required for paved roadway crossings of underground utilities where the carrier is of insufficient strength due to composition or depth of cover in accordance with this Manual.

All gas piping to be maintained by public and private utilities must comply with the Federal Standards as listed in the Florida Public Service Commission Rule 25-12.05, as amended by Order No. 5221 issued by the Commission on September 17, 1971, with any subsequent modifications thereto.

All jack and bore crossings shall be a continuous operation at each location at the proper location and depth. Any deviation from the above will be sufficient

grounds for work stoppage, plugging the line with concrete, and replacing the line at the proper location. All operations shall be in accordance with ARTICLE 5 of this Manual.

Open cutting of existing roadway pavement shall generally not be allowed, but may be considered under one or more of the following conditions upon the City Engineer's approval:

- A) Subsurface obstructions.
- B) Limited space for jacking pits.
- C) Condition of roadway surface, including imminent resurfacing and rebuilding.
- D) Where facility design prohibits.
- E) Extreme economic hardship.

In any analysis of a request for open cutting, primary consideration shall be given to the safety and convenience of the public. Permitted open cuts shall be in accordance with the Typical City Details attached as part of this Manual. The City Engineer will consider use of other methods where conditions warrant.

Where an open cut is considered, a smooth all-weather surface must be provided prior to traffic being placed on cut area. Temporary patches shall be topped with asphaltic material and maintained so as to provide a smooth, all-weather surface at all times. Permanent replacements of the temporary patch shall be made within 5 days. Proper repairs of open cuts shall be in accordance with this Manual.

The City shall establish control of access based upon location, geometric design, and traffic operations controls (in accordance with this Manual), all of which shall encourage safe and efficient operations, as well as provide suitable and sufficient access.

Any construction and maintenance performed within the rights-of-way and public easements of the City that encroach or affect in any way a primary drainage canal, lake, drain well, and/or drainage easement or right-of-way under the jurisdiction of Seminole County shall also obtain a Right-of-Way Utilization Permit from the County complying with the existing ordinances of Seminole County, Florida and its Right-of-Way Utilization Regulations.

**Section 33.05                    RESTORATION AND MAINTENANCE**

All public rights-of-way and public easements shall be restored to their original condition or better, in keeping with this Manual, and in a manner satisfactory to the City Engineer.

All excavated material in excess of the quantity required for backfill, and unusable material shall be disposed of at the Permittee's expense, and not placed within the limits of the public right-of-way or easement unless so directed by the City Engineer or his Designee.

At such locations where City signs and reflectors will interfere with proposed construction, the Permittee or his Consultant shall notify the City 48 hours in advance of starting work. All signs and reflectors will be removed or relocated only by City forces. Any signs or reflectors damaged, destroyed, removed, or relocated shall be replaced at the expense of the Permittee. No private signs of any type shall be permitted within the right-of-way.

Sodding operations are to begin as soon as fine grading and weather conditions permit, as directed by the City. Any private yards or part of the right-of-way in front of private property that has a grass mat shall be resodded with like sod.

All debris shall be removed by the Permittee at the Permittee's expense. Dust control shall be mandatory.

All vegetation shall be provided the maximum protection as required by the LDC. The indiscriminate cutting of trees or disfiguring of any feature of scenic value, including methods such as herbiciding, shall not be permitted. Trees and/or shrubs destroyed during construction are subject to replacement at the Permittee's expense as directed by the City. The necessary trimming or cutting of trees by utility companies, in the interest of public safety or continuity of utility service, shall not be considered indiscriminate where such utilities cannot bypass the obstruction without violating the clear roadside policy. This shall not be construed to mean that existing pole lines must be relocated to comply with the above. City tree removal permits shall be obtained from the City Planning Department.

All landscaping within public rights-of-way and public easements shall comply with the following provisions:

- A) The City Engineer or his Designee may request line of sight calculations and details to determine the permissibility of various landscaping and signage in areas of ingress and egress per the requirements of this Manual.
- B) In order for the City to allow the non-City installation of right-of-way or easement landscaping, a statement in writing as to who will be responsible for the maintenance of the project including watering, fertilizing, pruning, etc., shall be required. This statement shall come from the adjacent property Owner/Developer, the appropriate homeowners association, or civic organization.
- C) The Permittee shall not hold the City responsible for any damage to the plants during subsequent right-of-way construction.

- D) Landscaping within State and County rights-of-way within the limits of the City of Oviedo shall comply with Seminole County or FDOT highway beautification and planting regulations and the City of Oviedo requirements.
- E) Plants between 2 and 7 feet above the ground, in a median island within 100 feet of a crossover nose, shall provide a clear drivers sight distance. Conditions may require the above 100 foot length to be extended for safety considerations.
- F) A 4 foot mowing strip shall be maintained between the plants and the curb or sidewalks/bikepaths. If plants are desired in this mowing strip they shall be kept under 24 inches.
- G) No rock boulders, utility facilities, stationary signs, or above ground monuments shall be allowed in the medians.
- H) Persons and equipment maintaining the project are to carry out their work in such a manner as not to obstruct vision or traffic flow.
- I) Plantings shall be maintained at all times to prevent being a hazard in the safe operation of a vehicle, which includes the sight distance of drivers.
- J) Trees planted within the right-of-way on high speed (50 MPH and above) and high volume roadways shall be 30 feet from the edge of the pavement or at the right-of-way line. Each location will be reviewed for any special requirements by the City.
- K) Sprinkler heads and irrigation systems installed adjacent to public roadways and sidewalks shall be designed to insure public safety and shall not spray water over or on the roadway or sidewalk area. They shall not be operated during high pedestrian or vehicular travel times. On non-curbed streets, the sprinkler head shall be located adjacent to the right-of-way line or on private property to prevent damage from any vehicles, parked or otherwise.

**Section 33.06            UTILITY ACCOMMODATION**

33.06.01            General

The placement of utilities within the public rights-of-way and public easements shall be placed in accordance with all applicable Codes, and current industry standards. All accommodations within the FDOT maintained right-of-way shall be in accordance with FDOT’s Utility Accommodation Guide. All accommodations within the Seminole County maintained roadways shall be in accordance with Seminole County regulations. All other installations within the City maintained roadways shall be in accordance with this Manual.

As far as mechanically possible, the accommodations shall be followed for public right-of-way and public easement utilization within the City with the exception above.

All utilities are to be installed in accordance with the latest editions of the Federal Standards, as listed in the Florida Public Service Commission Rule 25.12.05, as amended by Order No. 5221 issued by the Commission on September 17, 1971, with any subsequent modifications thereto, the National Electrical Safety Code, FDOT's Safety Manual, MUTCD, LDC, this Manual, and any City Codes and Ordinances.

The criteria identified in this ARTICLE shall not be applied to a minor segment of an existing utility installation in such a manner as to result in misalignment of the installation or adjustment of the entire installation.

### 33.06.02 Light and Utility Poles

Light and utility poles shall be at least 18 feet from edge of pavement or at right-of-way line. Poles are permitted to within 12 feet from edge of pavement, provided a frangible base is used or if poles are placed behind a barrier. A minimum distance of 6 feet shall be required from the edge of pavement on deceleration and acceleration lanes. Where design permits, 14 foot clearance shall be used. In curb and gutter sections, poles shall be at the right-of-way line with 4 foot minimum from face of non-mountable curb to front of pole. Edge of pavement does not include shoulder pavement. Median locations shall not be used or approved.

In exposed areas, fragile or breakaway poles and light standards shall be considered to the extent practical. Where location is not exposed, consideration can be given to other type standards. Where feasible and practical, luminaries shall be attached to existing utility poles which meet offset criteria. For the purpose of this ARTICLE, frangible base poles will be accepted as bases in accordance with the FDOT Index Number 9623 (including later revisions), approved slip-type bases, or aluminum poles with an 8 inch outside diameter and 0.188 inch wall thickness, mounted on cast aluminum flange base, alloy 356-T6 and 356-F.

Projects where the 4 foot minimum offset would place the utility or other obstruction in substantial conflict with the sidewalk/bikepath or an unreasonable conflict with requirements of the National Electrical Safety Code would be created (in the case of power poles), and other alternatives are deemed impractical, the minimum may be reduced to 2½ feet from back of curb. Each case where this deviation is proposed must be supported on an individual basis and approved by the City Engineer or his Designee.

### 33.06.03 Mailboxes and Newspaper Boxes

Non-single family mailboxes, newspaper boxes, etc. shall be placed on private

property or at the right-of-way line where possible. Poles may be located up to 6½ feet from right-of-way line, provided that they are at least 18 feet from edge of pavement. In curb and gutter sections, poles shall be at the right-of-way line with 4 foot minimum from face of non-mountable curb to front of pole. Edge of pavement does not include shoulder pavement. Poles shall not be permitted in medians, except for temporary construction purposes where incorporated within a suitable barrier system. Privately owned boxes, etc. are placed at the Owner's expense and liability, and when in City right-of-way shall be removed/relocated if directed to do so by the City Engineer; a permit is required.

Single family mailboxes shall be constructed and/or installed in a manner that does not endanger the public. U.S. Postal regulations shall be considered.

Projects where the 4 foot minimum offset would place the utility or other obstruction in substantial conflict with the sidewalk/bikepath and other alternatives are deemed impractical, the minimum may be reduced to 2½ feet from back of curb. Each case where this deviation is proposed must be supported on an individual basis and approved by the City Engineer or his Designee.

#### 33.06.04 Other Structures

Devices such as signal-strain poles, above ground enclosures, and other items whose construction and size would cause extensive damage to a vehicle if struck are to be located according to the standards for utility poles.

#### 33.06.05 Underground Installations

Underground utility installations shall have a minimum vertical clearance 36 inches below top of roadway pavement or top of ground, including ditch grades.

#### 33.06.06 Aerial Crossings

Aerial crossings shall be in accordance with the National Electrical Safety Code, and a minimum of 18 feet over roadways and driveways. Crossing shall not interfere with existing or planned signal installation.

The roadside clearances for above ground utility facilities shall be consistent with those clearances applicable to other obstacles on the type of highway involved, reflecting good engineering and economic considerations.

#### 33.06.07 Excavation

Where possible, excavation shall not be allowed within 4 feet of the edge of pavement. This shall necessitate that the utility be placed a sufficient distance from the pavement. Where this requirement imposes a hardship on the utility due to a narrow distance between the back of curb and the right-of-way or edge of sidewalk/bikepath, the utility may place their facilities within 2 feet of the back of

the curb, but only upon approval from the City Engineer or his Designee.

**Section 33.07            INSPECTION**

The City Engineer or his Designee shall inspect work within the scope of this Manual to ensure that the rights-of-way are established and/or restored properly. Upon project completion, a final inspection shall be required. The City's representatives, together with the representatives of other interested agencies, shall perform the final inspection. Provide 48 hour prior request, excluding weekends and holidays, for final inspection.

The job shall be inspected against the provisions of the approved plans and the City Engineer shall not recommend acceptance until all such provisions are met, and any required tests are performed and accepted.

The Contractor shall have all materials within the scope of this Manual and the right-of-way regulations inspected before being laid, concealed or covered.

The Contractor shall inform the City Engineer or his Designee at the time backfill or any other process which should be monitored is occurring, and provide any requested reports. The laying and simultaneous covering of power cables, telephone cables, television cables, and gas mains is allowed outside the pavement.

**Section 33.08            OPERATIONAL SAFETY**

The City Engineer shall disapprove any curb cut, median opening, or access which will constitute a public hazard or create excessive conflicts in traffic or pedestrian flow, or adversely impact the public safety.

The City Engineer or his Designee shall authorize a "stop work" order upon any Permittee who is committing or creating unsafe acts which may create a public hazard, or who is not complying with the provisions of the permit and this ARTICLE. The order shall remain in effect until such time as these matters are corrected.

The City Engineer or his Designee shall not be held responsible for any damages as a result of the above actions taken under this ARTICLE.

**Section 33.09            EXISTING USES**

Any Owner/Developer of property on which there is a roadway access point lawfully in existence, but which is determined by the City to present a hazard to the public safety and welfare due to the location of curb cuts, median openings, or other matters regulated within this Manual, and which does not comply with this Manual and/or the LDC shall be required to reconstruct or alter such hazardous situation at the time of any modifications/permits (use-changes , remodeling, reconstruction, enlargement, alterations, paving).

Any curb cut made after the date of this publication, which fails to provide for smooth flow of traffic on and/or off the right-of-way and traveled way, shall be closed by the City until repaired. The City Engineer or his Designee shall make such closure upon notification to the property Owner/Developer. The closure shall be maintained until the condition has been corrected to the satisfaction of the City Engineer.

## ARTICLE 34

### SITE PREPARATION, SURFACE REMOVAL AND RESTORATION

<b>Index</b>	<b>34.01</b>	<b><u><a href="#">GENERAL DEVELOPMENT STANDARDS</a></u></b>
	<b>34.02</b>	<b><u><a href="#">CLEARING AND GRUBBING</a></u></b>
	<b>34.03</b>	<b><u><a href="#">EROSION CONTROL</a></u></b>
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	<b>34.07</b>	<b><u><a href="#">FINISHED FLOOR ELEVATIONS</a></u></b>

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	34.01.1	<u>General</u>
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All land proposed for development within the City of Oviedo shall be suitable for the use proposed, shall be adequately served by public facilities and services, and shall conform to adopted goals, objectives, and policies of the City Council. All proposed development shall also be consistent with the adopted Comprehensive Plan for the City.

	34.01.2	<u>Environmental Considerations</u>
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Development shall make advantageous use of natural topography and preserve mature trees wherever possible. Special development stipulations may be placed on areas with low and very low potential soils, areas within the 100 year flood plain, wetlands, and other unique environments. Because most environmental problems are site specific, conditions and proposals will be evaluated with permit reviews.

<b>Section</b>	<b>34.02</b>	<b><u>CLEARING AND GRUBBING</u></b>
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Clearing and grubbing of property shall conform to ARTICLE 6 of this Manual.

<b>Section</b>	<b>34.03</b>	<b><u>EROSION CONTROL</u></b>
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All commercial and residential Developers and Builders shall follow erosion control methods as described in Section 3.09 of this Manual.

<b>Section</b>	<b>34.04</b>	<b><u>DUST CONTROL</u></b>
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Contractor shall control dust resulting from clearing and grubbing operations to prevent nuisance to adjacent property Owners and the general public.

**Section 34.05 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, affording sufficient room for proper efficiency and construction. All applicable City regulations shall be followed under the guides of this Manual and FDOT Standards. Where sidewalks, driveways, pavements and curb and gutter are encountered, caution 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.

**Section 34.06 RESTORATION**

Restoration of all surfaces including road subbase, soil cement, limerock base, asphaltic concrete surface, portland cement concrete pavement, driveways, sidewalks and concrete curbs shall be in strict accordance with this Manual. All grassing, sodding and mulching shall be done as specified in ARTICLE 20 of this Manual. In addition, Contractor shall restore all storm drains, culverts, inlets and storm manholes to equal or better condition in accordance with this Manual.

**Section 34.07 FINISHED FLOOR ELEVATIONS**

Lots and building sites shall be graded to permit construction utilizing a first floor elevation based on the following:

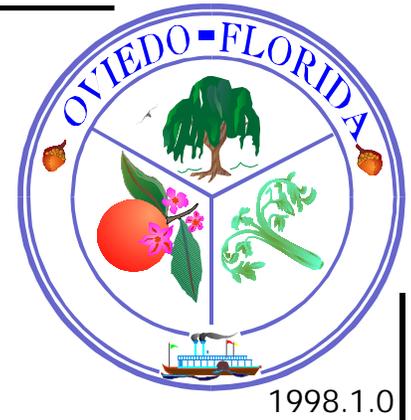
- A) At least 1 foot above the 100 year flood prone elevation.
- B) If a lot or site is reasonably level, or slopes toward a street, the minimum finished floor elevation shall not be less than 18 inches above the average crown of that portion of the adjacent street, or right-of-way upon which the structure fronts. This applies to grading classified as Type A or B.
- C) If a lot or site slopes away from a street or road with continuous slope to the rear, the finished floor elevation of any structure shall be at least 1 foot above the finished elevations at the side lot lines nearest the front corners of the dwelling. This requirement applies to grading classified as Type C.
- D) It is the intent of the City that lots and building sites provide the necessary finished floor elevation without excessive filling of land. Specific grading plans with proposed finished floor elevations and grading shall be submitted for review and approval of the Public Works Department. When a subdivision lot grading plan has been prepared and approved, specified finished floor elevations and grading types shall be observed. Finished floor elevation shall not deviate below that specified in the grading plan, but may be increased up to 6 inches above that specified without approval. Justification shall be provided for raising finished floor elevation more than 6 inches above that specified. An approved plan that specifies individual

elevations shall supersede the requirements of (B) and (C) above and this paragraph.

- E) Swales shall be constructed to carry runoff along side lot lines without allowing unintended runoff to adjacent lots. Grading shall minimize the impact of runoff onto other lots when intended by Type B and C grading. Use of stem wall construction, retaining walls or other techniques shall be considered to improve drainage and aesthetics. Areas adjacent to structures or paved surfaces shall be graded to drain away from structures and pavement. Ponding shall be prevented.
  
- F) All slopes of 4:1 or greater shall be sodded. Sodded slopes shall not exceed 4:1 without approval. Where lots adjoin ponds, natural, conservation, or common areas, the lot line elevation specified on the subdivision plans (or natural elevation) shall be maintained and the lot graded at a slope not to exceed 4:1.

# Engineering Standards Manual

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# **ENGINEERING STANDARDS MANUAL**

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## **MISSION**

This Engineering Standards Manual is a firm technical guideline for engineering materials' design, construction, and layout for all improvements that shall be dedicated, owned, and/or maintained by the City of Oviedo.

## **INTRODUCTION**

The provisions of this Manual are established in order to effectively carry out the purposes of the **Land Development Code of the City of Oviedo**, in the interests of public health, safety, and welfare of the citizens and inhabitants of Oviedo, Florida.

Should there be any discrepancy or conflict between the Engineering Standards Manual and any applicable City Codes, such as the Land Development Code, the most stringent and restrictive specification, condition and/or directive shall apply. If any item is not specifically addressed in this Manual, good engineering standards shall be practiced and is subject to the City Engineer's approval.

## **DISCLAIMER**

The City of Oviedo, in the form of this Manual, its attachments and documents referenced here in, is attempting to provide the best available information in an electronic format. It is the responsibility of the recipient to ensure that this information is the most recent, up to date, and in its entirety, as was originally provided by the City. This information is provided as is, without warranty or guarantee of any kind. The entire risk, as to quality, performance, and accuracy, are with the recipient. In no event, is the City of Oviedo or its Staff liable for any direct, indirect, incidental, special, consequential, punitive or other damages whatsoever (including loss of profit, loss of information, interruptions, or other pecuniary losses) arising from the use of or inability to use this data.

**[I HAVE READ AND UNDERSTOOD THE ABOVE.  
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## Approved Manufacturer's List

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Material listings are in alphabetical order and are not intended to show preference. All numbers are for reference only and may change due to manufacturers' updates. Substitutes or other manufacturers' products, prior to use, shall be approved equal by the City Public Works Department.

### WATER DISTRIBUTION MATERIALS

AIR RELEASE VALVES	Apco: 200 Empire: 920 Val-Matic: 38
BUTTERFLY VALVES	American-Darling: 150B Clow: F6365 F6370 DeZurik: BAW M & H: 4500 1450 Mueller: Lineseal III Pratt: Groundhog
CASING SPACERS	Cascade
CORPORATION STOPS	Ford: F1000-G Mueller: H-15008
CURB/ANGLE STOPS	Ford: KV43-W Series KV13-W Series Mueller: B-24258 H-14258 B-24265 H-14265
FIRE HYDRANTS outlets	American-Darling: B-84B 6", standard outlets B-84B 6", two 4 1/2" and two 2 1/2"  Mueller: A-423 5-1/4", standard outlets A-425 5-1/4", two 4 1/2" outlets
FITTINGS	American-Darling McWane Tyler Pipe U.S. Pipe

GATE VALVES  
(12" and smaller)

American-Darling: 500  
Clow: F6100 Series  
Mueller: A-2370 Series  
U.S. Pipe: Metroseal 250

PAINTING  
(Aerial piping, fittings and valves)

FIELD PRIMER

Glidden: Alkyd Metal Primer  
Koppers: Pug Primer  
Porter/Int'l: 284 Uprimer  
Tnemec: 37-77 Chem-Prime

FINISH (exterior)

Glidden: Alkyd Ind. Enamel  
Koppers: Glamorex 501 Enamel  
Porter/Int'l: 2410 Alkyd Gloss  
Tnemec: Tnemec-Gloss

DUCTILE IRON PIPE

American-Darling  
Griffin  
McWane  
U.S. Pipe

POLYETHYLENE TUBING

Contube  
Driscopipe  
Endot Industries  
Orangeburg  
Vanguard Plastics  
Yardley

RESTRAINED JOINTS

EBAA Iron: Mega-Lug 1100 9 (3" - 48")  
Mega-Lug 1100HD (10" - 48")  
Mega-Lug 2100 Flange Adapter (3" - 12")

TAPPING SLEEVES

American-Darling: 2800C  
Clow: F5205  
Ford: FAST  
JCM: 423  
Mueller: H-615

TAPPING VALVES

American-Darling: 86  
Clow: F6114  
Mueller: H-687

U-BRANCH CONN.

Ford: U48-43  
Mueller: H-15363

VALVE BOXES	Bingham/Taylor Foundry:	4904-L
		4905
		4905-X
	Russell Pipe & Foundry:	B121
		B125
		B129
		B132
		B134
	Tyler Pipe:	6860 Series

## WASTEWATER COLLECTION/DISTRIBUTION MATERIALS

AIR RELEASE VALVES	Apco
	Empire
	Val-Matic
AIR RELEASE/VACUUM	Apco
RELIEF VALVES	Empire
	Val-Matic
CHECK VALVES (4" and larger)	American-Darling: 50SC
	Clow: F5300 Series
	M & H: 259-02
	Mueller: A-2602
FITTINGS (ductile iron)	American-Darling
	McWane
	Tyler Pipe
	U.S. Pipe
PRECAST MANHOLES	Atlantic Precast
	Standard Precast
	Taylor Precast
MANHOLE FRAME AND COVER	U.S. Foundry: USF 1260-AK
	USF 227-AS
MANHOLE JOINTING MATERIAL	Conseal: CS102
	K.T. Snyder: Ram-Nek
MANHOLE/WET WELL (Fiberglass)	L.F. Manufacturing
SURFACE COATING	HDPE/PPR
	AGRU: Sure Grip®

## PAINTING

(Aerial piping, fittings and valves)

FIELD PRIMER	Glidden: Alkyd Metal Primer Koppers: Pug Primer Porter/Int'l: 284 Uprimer Tnemec: 37-77 Chem-Prime
FINISH (exterior)	Glidden: Alkyd Ind. Enamel Koppers: Glamorex 501 Enamel Porter/Int'l: 2410 Alkyd Gloss Tnemec: Tnemec-Gloss
DUCTILE IRON PIPE	American-Darling Griffin McWane U.S. Pipe
PVC PIPE (force main and gravity lines)	CPS CANTEX Capco Pipe CertainTeed Diamond Plastics J-M Pipe North American
PLUG VALVES	Clow: F5412 F5413 M & H: 820 Pratt: PV Val-Matic: 5800 5900
RESTRAINED JOINTS	EBAA Iron: Mega-Lug
TAPPING SLEEVES	American-Darling: 2800C Ford: FAST JCM: 423 Mueller: H-615 Clow: F5205
TAPPING VALVES	American-Darling: 86 Clow: F6114 Mueller: H-687

VALVE BOXES  
Halliday Products  
Tyler Pipe  
U.S. Foundry

**WASTEWATER PUMP STATIONS MATERIALS**

CONTROL PANELS  
Quality Control  
Sta-Con

CHART RECORDERS  
Bristol Babcock: Series 4392

DRAIN LINE CHECK  
VALVES  
Red Valve: Tidal-Flex

FLOW METER  
Fisher Porter  
Rosemont

GENERATOR CIRCUIT  
BREAKERS  
Square D  
Westinghouse

GENERATOR SYSTEMS  
Caterpillar  
Onan (Cummins)

LIGHTENING/SURGE  
SURPRESSORS  
Leviton: TVSS 32277 DY3

LOCKS  
Master (Rekeyable)

PRESSURE GAUGES  
Ashcroft  
Wika

SUBMERSIBLE  
PRESSURE TRANSDUCER  
U.S. Filter Consolidated

SUBMERSIBLE PUMPS  
ABS  
Fairbanks Morse  
Flygt

WET WELL ACCESS  
FRAMES AND COVERS  
Bilco  
Halliday Products  
U.S. Foundry

**CONTROL PANEL COMPONENTS AND ACCESSORIES**

ALARM HORN (AH)  
Edwards  
Wheelock: EH-EL2-R

ALARM LIGHT (AL)	Ingram: LRX-40
CONTROL CIRCUIT BREAKER	Square D: FAL 12015 Westinghouse
CONTROL CIRCUIT TRANSFORMER (120 - 24V)	Square D: 9070KF75D23 Westinghouse
DUPLEX RECEPTACLE GFI (DR)	Leviton: 6599-I Square D
ELAPSED TIME METER (ETM)	Engler: 711-0017 Hecon
EMERGENCY CIRCUIT BREAKER (ECB)	Square D Westinghouse
FUSES (F)	Bussmann Gould-Shawmut
FLASHER (FL)	SSAC: FS-312 Sta-Con
FLOAT REGULATOR	Flygt Roto-Float
GENERATOR RECEPTACLE	
230V, 200A, 3P, 4W	Crouse-Hinds: AR-2042
230V, 100A, 3P, 4W	Pyle National: JRE-4100
460V, 200A, 3P, 4W	Crouse-Hinds: AR-2042-S22
HAND-AUTO-OFF SELECTOR (HOA)	Square D: 9001-SKS Westinghouse: PB1HOA
HORN SILENCE BUTTON (HSS)	Square D: 9001-SKR-1U Westinghouse: PB1AAH
TEMPERATURE FAILURE LIGHT (MT)	Dialco
MAIN CIRCUIT BREAKER (MCB)	Square D Westinghouse
MAIN CIRCUIT TRANSFORMERS (MCT)	Square D: 500SV43F Westinghouse: S10N04A51M

MOTOR CIRCUIT BREAKER (MB)	Square D Westinghouse
MOTOR STARTER (MS)	Furnas: ESP-100 Square D: D-8536 Westinghouse: A-200
OVERLOAD HEATER (OL)	Furnas Square D Westinghouse
PHASE MONITOR (PM)	Diversified MPC
PILOT LIGHT (PL)	Dialco: 803-1710 Littlelite: 930504X
PUMP AUTOMATIC ALTERNATOR (PAA)	Diversified: KRPA-11AG-24 KRPA-11DG-12 MPC
RADIO UNIT	Motorola
RELAY (R)	Eagle Signal: 22 Series Porter Brumfield: KRPA-11AN
RUN INDICATOR (RL)	Dialco Littlelite: 930504X
SCADA RTU	U.S. Filter Consolidated