

CITY OF ORLANDO

ENGINEERING STANDARDS MANUAL

Adopted by City Council
5th Edition



**CITY OF
ORLANDO**

Subsequent updates to the ESM will be posted at orlando.gov/engineeringresources.

ADOPTIONS AND MODIFICATIONS

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CHAPTER 1 – INTRODUCTION

The provisions of this manual are established in order to effectively carry out the purposes of the Code of the City of Orlando and other ordinances, policies and standards in the interests of public health, safety and welfare of the citizens of Orlando, Florida.

Section 1.01 General Provisions

- A. The standards set forth in this manual are meant to provide minimum standards for the design and construction of any facilities within the City of Orlando corporate limits. The City of Orlando accepts the specifications and standards as set forth in the latest edition of the Florida Department of Transportation’s Standard Specifications for Road and Bridge Construction Design Standards for Design, Construction, Maintenance and Utility Operations on the State Highway System, Manual of Uniform Minimum Standards For Design Construction and Maintenance for Streets and Highways (“Florida Greenbook”), Manual for Uniform Traffic Control Devices (MUTCD), The Florida Department of Transportation Design Standards Index and the “Florida Stormwater Erosion and Sedimentation Control Inspector’s Manual” except as specifically addressed in this manual. The City of Orlando also accepts the criteria of the latest editions of the Environmental Resource Permit Applicant’s Handbook Volume 1 (General and Environmental), SSRWMD Permit Information Manual, and SFWMD Permit Information Manual.
- B. This manual is not meant to be totally restrictive in nature; 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 may be overruled by requirements established for Specially Planned Areas, Historic and Traditional Neighborhood Districts and the Growth Management Plan, where applicable.
- C. 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 approval by the City Engineer or other parties as may be designated herein.
- D. All plans submitted for review must be in conformance with all Federal, State and City regulations and codes.
- E. Where a certain manufacturer is specified for a particular piece of equipment, non-specified product equals may be approved by the City Engineer, the Construction Manager, or other parties as may be designated herein, after submittal of request in writing and accompanied by supporting documentation.
- F. Unless specifically approved by the City Engineer, all construction, testing and installation costs shall be the responsibility of the developer/owner/builder of the project.
- G. Pre-design conferences and preconstruction meetings are encouraged between the developer/owner/builder, his engineer, all utilities and the City staff.
- H. Reference materials, applications and permit forms are available on the City of Orlando

website located at www.cityoforlando.net.

- I. The provisions of the latest editions, plus any addendums, of the following documents shall apply unless otherwise approved by the City Engineer or other parties as may be designated:
1. The Land Development Code (LDC) of the City of Orlando, most current edition,
 2. Florida Public Service Commission Rule 25-12 relating to gas piping to be maintained by public and private utilities, most current edition,
 3. The Florida Department of Transportation (FDOT) Standard Specifications for Road and Bridge Construction (SSRBC), most current edition,
 4. The FDOT Utility Accommodations Manual, most current edition,
 5. The FDOT Manual of Uniform Minimum Standards for Design, Construction and Maintenance for Streets and Highways (Florida Green Book), most current edition,
 6. The FDOT Design Standards for Design, Construction, Maintenance and Utility Operations on the State Highway System, most current edition,
 7. United States Department of Transportation Manual of Uniform Traffic Control Devices for Streets and Highways (MUTCD), most current edition,
 8. The St Johns River Water Management District Applicants Handbook, most current edition,
 9. The South Florida Water Management District Permit Information Manual, Volume IV, most current edition,
 10. The Florida Department of Transportation Design Standards Index, most current edition,
 11. Florida Building Code, most current edition,
 12. The Florida Department of Transportation Local Agency Specifications, most current edition.
- J. Should these criteria be overly restrictive, or not be directly applicable to a specific condition, the designer should contact the City Engineer in writing and request a variance. Variances may be granted if:
1. Approval will not result in additional threats to public safety, public expense, create nuisances, cause fraud on or victimization of the public, or conflict with existing local laws or ordinances:
 2. Approval of the variance requested will not confer on the applicant any special privilege that is denied by the Engineering Standards Manual (ESM) to other lands, buildings or structures.

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3. Literal interpretation of the provisions contained in the ESM would deprive the applicant of rights commonly enjoyed by other properties under the terms of ESM and would work unnecessary and undue hardship on the applicant. Financial loss or business competition shall not constitute grounds for approval of any variance. Purchase of property with intent to develop in violation of the restrictions of the ESM shall also not constitute grounds for approval.
 4. The approved variance is the minimum variance that will make possible the reasonable use of the land, building or structure.
 5. The submitted plans will meet the intent of the ESM.

Section 1.02 Engineering Records

Section 1.02.01 Aerial Photography Access

The Engineering Services Division manages access to recent aerial photography. These data are not sufficient for engineering level accuracy.

Inquiries about viewing and obtaining copies of aerial photographs should be directed for a nominal fee to the Engineering Records counter at 407-246-3267.

Section 1.02.02 As-Built Drawings Access

The Engineering Services Division receives as-built drawings for completed engineering and construction projects within the City of Orlando. These drawings are scanned into TIF Group IV format or PDF format and may be viewed using many common image-viewing applications. Original certified drawings are kept for five years. Older record drawings may be available in either digital or hard-copy format.

Section 1.02.03 Stormwater Mapping Access

For current information, contact Engineering Records at 407-246-3267.

Section 1.02.04 Sanitary Sewer Mapping Access

For current information, please contact the Wastewater Division at 407-246-2213.

Section 1.03 Standard GIS Maps

The City cooperates with the Orange County Property Appraiser and Orange County Government in exchanging GIS data. The following standard hard copy map products can be purchased from the Records Counter on the 8th floor of City Hall or they may be ordered and delivered via US mail if payment is made in advance. Many of these maps are also available for download in PDF format at www.cityoforlando.net/gis. Map availability is subject to change.

- Neighborhood Maps – 11"x17", 34"x44" and 8 ½"x11"
- Commissioners' District Maps – 8 ½"x11", 11"x17" and 34"x44"
- FEMA Maps – Individual FEMA zones 34"x44"
- OPD District Map – 34"x44"
- OPD Sector Maps – 34"x44" individual sectors on street map base
- Individual Commissioners' District Map – 34"x44" includes street map base

- FEMA maps based on Commissioner's District – 34"x44" includes street map base
- 2 piece Citywide map – 35.5"x52" includes street map base, Commissioners' districts, neighborhoods
- Street Map and Index – black and white (book)
- Annexation Maps – 11"x17", 34"x44"
- OFD – Fire Stations – 8 ½" x11", 22"x27"
- Historic Districts – 8 ½"x11"
- Parks Map – 8 ½"x11", 34"x44"
- Community Redevelopment Map – 8 ½" x11"
- Public Schools in Orlando – 1 1"x17"
- Orlando Zip Codes – 8 ½" x11"
- Brick Streets within Traditional City – 34" x 44"
- Traditional City – 11" x 17"

Section 1.04 Requests for Digital Data

Data requests must be initiated by submitting a written request to the Computer Cartography Manager at:

Engineering Records Section
 400 South Orange Avenue, 8th Floor, Orlando, Florida 32801
 407-246-3267
 407-246-2892 (Fax)

The request must specify the following items:

1. The date of the request.
2. Requester's name and address.
3. Requester's phone and fax numbers.
4. A detailed description of the data that are desired.
5. The preferred data format (ASCII, DWG, MIF, etc.).
6. A detailed description of the area for which data are needed (e.g., specifying North, South, East and West bounding streets, specifying a specific section or group of sections, etc.).
7. The type of media that are desired.
8. The date by which the data are needed.

Data request forms can be obtained online at www.cityoforlando.net/gis/form.htm

Staff reviews each request to determine whether the data request can be satisfied. A price quote is also prepared at that time. This information is communicated verbally to the client who can then proceed with or cancel the request. The City does not invoice for data sales under any circumstances. However, the client may elect to have the data sent via US mail provided the applicable data and postage costs have been prepaid and that a disclaimer form has been signed and returned.

Completed data requests can be picked up from the Records counter on the 8th floor of City Hall. Payment is due at the time of receipt of the data. The client is also required to sign the following disclaimer statement prior to receiving data:

GIS and CAD data that is obtained from the City of Orlando is spatially inaccurate. The City of Orlando makes no representations or guarantees as to the completeness or accuracy of these data or any related attribute data. Data is provided “as is,” without warranty of any kind, either expressed or implied, including without limitation any warranties that the data are fit for a particular purpose. The City of Orlando shall have no liability whatsoever relative to the use of provided data. Full responsibility and liability relating to the use of provided data rests with the user.

CHAPTER 2 - PERMITS

Section 2.01 Right-Of-Way (ROW) Permits

ROW permits are issued for construction staging (lifts, scaffolds, cranes, etc.), placing dumpster or temporary fence for any facility or structure; installing monitoring wells, performing soil borings, installing or repairing aerial or underground utilities (aerial cable, cable, conduit, storm sewer, sanitary sewer, service lateral, telecommunications facilities, utility poles, gas lines, water lines) and the utilization and future development of highways, roads and streets. ROW permits are required for work within any of the existing or planned rights-of-way or easements within the City of Orlando where an Engineering permit cannot be issued. These regulations shall apply to all private contractors, citizens, utility companies and to any person or group proposing to install, construct, maintain or repair any facility, utility or structure within any of the existing or planned rights-of-way or easements within the City of Orlando. Permits from other entities may be required in addition to the City Permit. Please see Chapter 4 of this Manual for utility construction standards

Information provided by the applicant in completing the Right-of Way Permit form should be type written or printed in ink. All copies of the application must be legible and all the following information must be provided:

- A. A sketch shall accompany the application. The sketch shall show a plan view of the proposed work and shall include all the information below with corresponding dimensions. If the sketch is not to scale, all relevant items including those listed below must be clearly dimensioned. This should be a line drawing folded to a size not to exceed 8 ½ inches by 14 inches.
 - 1. The centerline of the right-of-way or road to the proposed work.
 - 2. The road right-of-way width and pavement width.
 - 3. The distance from edge of pavement/back of curb to the utility.
 - 4. Sidewalks and property lines.
 - 5. The location of all other utilities within the area of work.
 - 6. Plans must clearly show the proposed areas that are to be white-lined for physical location of existing utilities.
- B. One or more typical cross sections as required to adequately reflect the vertical location of the proposed work shall also be shown.
- C. The minimum vertical clearance above or below the parkway or pavement shall also be shown.
- D. Additional information such as the location in relation to the nearest road intersection, bridges, railroad crossings or other physical features should be indicated on the sketch and identified.
- E. Provide a simple key map showing the location of this proposed facility, which shall be included either on the sketch itself or as a separate sketch to assist all concerned with the general location and should indicate the applicable section, township and range.
- F. Contractor is to attach a copy of the door hanger that will be placed on homes or

businesses that are proximate to the right-of-way work. The door hanger must provide name and contact phone number as well as the length of time that the work will be done within the right-of-way. The Contractor will place door hangers at each address within one block of the construction at a minimum of two weeks prior to the start of construction. The contractor is responsible for any damage to private improvements located within the right-of-way.

- G. Upon approval of the application and payment of the fee, one copy of the approved permit application, with attachments, will be returned to the applicant. Checks, money orders, cash or other acceptable forms of payment will be payable to the “City of Orlando” for the exact fee amount. Payment shall be made at the City of Orlando cashier’s desk at City Hall (400 S. Orange Avenue).
- H. After payment of the required fee and approval of the application, Permitting Services will issue a permit for the proposed work. The work must be performed in accordance with the terms and requirements of the duly issued permit. Additional work or revisions not authorized by the original terms of the permit will require a new permit or revision of the existing permit if applicable. The permit issued under this section must be available at all times at the work site while work is being performed.
- I. If the proposed work will impact or close a street or sidewalk, the contractor shall call the street/sidewalk closure authorization line at 407-246-3704, one week prior to start of work. An approved permit in no way provides street or sidewalk impact or closure approval.
- J. If for any reason the project is canceled or withdrawn, 25% of the permit fee or \$50 (whatever is greater) will be retained. The remainder will be refunded for permits less than one year old only. Permits older than one year will not receive a refund.

Section 2.01.01 White-Lining/Low Impact Marking

White-lining/Low Impact Marking is defined from Common Ground Alliance Best Practices, latest version (Practice Statement 5.2) “When the excavation site cannot be clearly and adequately identified on the locate ticket, the excavator designates the route and/or area to be excavated using white pre-marking prior the arrival of the locator.” The purpose of white-lining the area to be located is to allow everyone involved with the dig site to know the location of the proposed excavation. The City of Orlando strongly encourages white-lining which follows the low impact marking requirements of Chapter 556, Florida Statutes, established October 1, 2010.

Section 2.01.02 Guidelines for White-Lining

The proposed areas should be identified with non-permanent white paint or white flags, with the excavator’s company name or logo within the pre-marked areas. Pre-mark the exact area of excavation using solid lines, dashes or dots.

Section 2.01.03 Guidelines for Excavation Delineation

The following marking illustrations are examples of how excavators may choose to mark their area of proposed excavation. The use of white non-permanent marking products (paint, flags, stakes, whiskers or a combination of these) may be used to identify the excavation site.

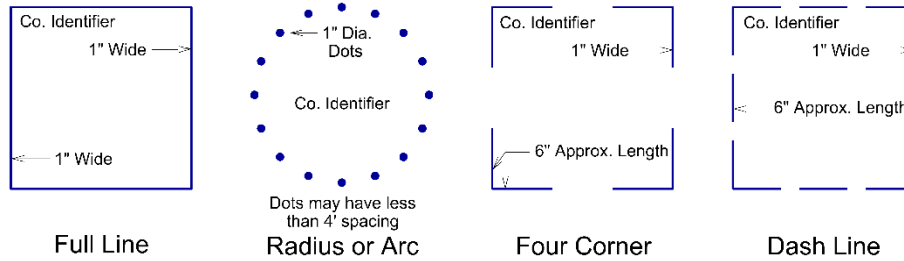
Single Point Excavation Markings

Delineate in white paint the proposed area of excavation through the use of: a continuous line, dots marking the radii or arcs, dashes marking the four corners of the project or dashes outlining the excavation project. Limit the size of each dash to approximately 6” to 12” in length and 1” in width with interval spacing approximately 4’ to 50’ apart. The maximum separation of excavation marks is to be reduced to a length that can be reasonably seen by the excavator’s operator when the terrain or excavation site conditions warrant it. Dots of approximately 1” diameter are typically used to define arcs or radii and may be placed at closer intervals in lieu of dashes.

Single Stake Marking Center Point of Excavation Site

When an excavation site is contained within a 50’ maximum radius, or less, it can be delineated with a single stake that is positioned at the proposed center of the excavation. If the excavator chooses this type of delineation, they must convey that they have delineated the excavation site with a single stake at the center of the excavation and include the radius of the site in the notification to the One Call Center. This single stake is to be white in color with the following information: excavator’s company identifier (name, abbreviations, or initials) and the radius of the excavation site in black letters on the stake or with a notice attached to the stake.

Single Point Excavations Markings



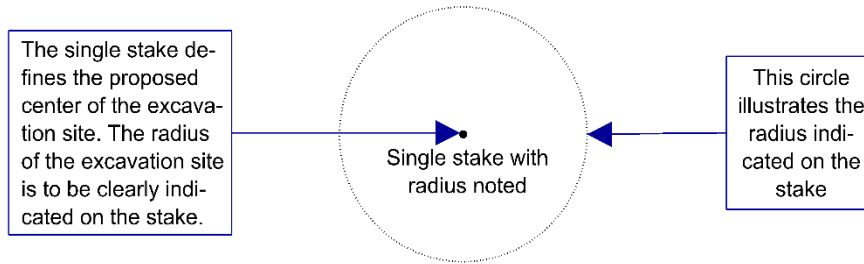
Continuous Excavation Marking

Mark in white paint the proposed centerline of planned excavation 6” to 12” x 1” arrows, approximately 4’ to 50’ apart to show direction of excavation. The maximum separation of excavation marks is to be reduced to a length that can be reasonably seen by the excavator’s operator when the terrain at an excavation site warrants it. Mark lateral excavations with occasional arrows showing excavation direction from centerline with marks at curb or property line if crossed. Dots may be used for curves and closer interval marking.

Stakes, Flags or Whiskers Excavation Markers

Delineate the proposed area of excavation through the use of: stakes, flags or whiskers to mark radius or arcs, the four corners of the project or outlining the excavation project instead of using spray paint. Limit the interval spacing to approximately 4’ to 50’. The maximum separation of excavation marks is to be reduced to a length that can be reasonably seen by the excavator’s operator when terrain at an excavation site warrants it. Stakes, flags or whiskers provided to illustrate arcs or radii may be placed at closer intervals in order to define the arc or radius. Stakes, flags or whiskers are white in color with the excavator’s company identifier (name, abbreviations, or initials) provided on the stake, flag or whisker.

Single Stake Marking Center Point of Excavation Site



Section 2.01.04 Exceptions

Emergency repairs may be performed without obtaining a permit prior to the repair. Emergency repair work shall be completed in accordance with applicable directives from the City of Orlando or other authorities as expeditiously as possible. The City of Orlando Permitting Services and Transportation Engineering Division shall be notified on all emergency repair work by 10:00 am the workday following the beginning of such repair work. An application for a Right-Of-Way Utilization Permit and payment of applicable fees shall be submitted to the Permitting Services within two working days following commencement of emergency repair work by the person, company or utility performing the emergency repair work. Repair work shall be exempt from the requirements of Section 2.01.04 for prior notification to other agencies with the exception of gas utility companies, but shall notify those agencies of the extent of repair work by 10:00AM the day following the commencement of the emergency repair work.

Section 2.01.05 Stipulations

- A. It is expressly stipulated and the permit holder agrees that permits issued under this section are a license for permissive use only. The placing of facilities upon public property pursuant to this permit shall not allow or vest any property right in the holder thereof.
- B. The rights and privileges set out in this article are granted only to the extent of the City of Orlando's right, title and interest in the land to be entered upon and used by the permit holder. The permit holder will at all times assume all risks, defend and hold harmless or indemnify the City of Orlando in any manner on account of the exercise or attempted exercise by the permit holder of the aforesaid rights and privileges.
- C. The permit holder or the agent represented by the permit holder does hereby agree to remove or relocate the utilities covered by this permit at no cost to the City upon notice by the City Engineer or upon legal notice published in not less than two weekly issues of a newspaper of general circulation in the City of Orlando. The right-of-way shall be restored to its original condition by and at the sole expense of the utility owner or its agent. The failure of a utility owner or its agent to remove or relocate such facility after the required notice shall absolve the City of Orlando from any liability for damages that may arise as a result the removal of any such utilities.
- D. The permit holder assumes full and total responsibility for compliance with this chapter, supporting regulations, additional requirements of the City Council, City of Orlando, any other local ordinances, State or Federal laws, ordinances or other directives that may apply to the proposed work.
- E. Operations permitted by this section shall normally be conducted from 7:00 am to 3:30 pm,

Monday through Friday, excluding City observed holidays. Any deviation from these hours requires prior approval from the Inspection Supervisor. Any overtime payments should be in conformance with Section 3.10 and will be billed at current manpower expense rates. A minimum of two working days notice, in writing, requesting deviation from normal working hours must be provided. Emergency repairs are excluded from this time restriction. The “Rule of Thumb” is no work is allowed in the Downtown Orlando Central Business District and on arterial or collector streets on any weekday between the hours of 7 am - 9 am and 4 pm - 6 pm. A map outlining the boundaries of The Orlando Central Business District and a listing of arterial or collector streets is available upon request from the Permitting Services, first floor of City Hall.

Section 2.01.06 Duration of Permits

A permit issued shall be construed to be a license to proceed with the work and not as authority to violate, cancel, alter, or set aside any of the provisions of the technical codes, nor shall issuance of a permit prevent the Building Official from thereafter requiring a correction of errors in plans, construction, or violations of this code. Every permit issued shall become invalid unless the work authorized by such permit is commenced within six (6) months after its issuance, or if the work authorized by such permit is suspended or abandoned for a period of six (6) months after the time the work is commenced. Not more than two (2) extensions of time, for periods not more than ninety (90) days each, may be allowed for the permit. The extension request shall be made to the Building Official in writing on company letterhead with justifiable cause demonstrated.

Note: “Commenced,” as used in this section, shall be defined as having received an approved foundation inspection. The work to qualify for this inspection shall be a complete portion of the foundation. In the case of permits not requiring a foundation, the qualifying work shall be the first stage (i.e., a complete section of framing).

“Abandoned,” as used in this section, shall be defined as not having received an approved inspection for work completed since the last inspection.

“Approved Inspection” as used in this section, shall be defined as receiving approval for an assembly of components constituting a complete portion or section of a building based on accepted construction industry standards and practices. In the case of large buildings or projects, the term “complete portion or section” shall be determined by the Building Official considering any input from the contractor, before the permit is issued. The decision of the Building Official with respect to this definition may be appealed to the Building and Fire Codes Board of Appeal in accordance with Article XXVI of Chapter 2 of the City Code.

Section 2.01.07 Notification to Other Agencies

It shall be the responsibility of the developer/owner/builder to coordinate all utilities concerning its development. All utilities shall be given notice prior to commencement of construction. Notification shall be made to the Sunshine State One-Call, Inc. by dialing 811 at least 48 hours prior to start of work.

Section 2.01.08 Inspection and Approval of Work

The City of Orlando Permitting Services shall have the right to inspect and approve materials and/or phases of work. Final inspection and acceptance of work by the City of Orlando Engineering Inspector must be obtained to document the completion of the work. Work will be considered incomplete until

that portion of the permit indicating final inspection and approval has been signed and dated by the inspector.

Section 2.01.09 Warranty/Maintenance Bond

- A. Refer to Section 3.22, Maintenance Bond Requirements.
- B. Any failure shall be repaired by the permittee, at the direction of the City Engineer, within five working days unless the urgency of the problem requires a quicker reaction time. The City of Orlando reserves the right to make emergency repairs at the expense of the permittee/security upon proper notice.

Section 2.01.10 Vending Operations

Vending operations shall be subject to the following general provisions:

- A. Vending operations are not permitted on the public right-of-way. Vending operations for purposes of this section are defined as any person engaging in the sale, trade or other exchange of materials or goods including but not limited to fruits, vegetables or other foodstuffs, souvenirs, trinkets, art objects, etc.
- B. Any person engaged in vending operations on property abutting a public right-of-way shall be required to obtain an Engineering Permit and/or Right-of-Way Permit for construction of a driveway to provide access to the site. Parking to support the vending operations will not be permitted on the public right-of-way.
- C. All Engineering and/or Right of Way Permits granted for driveways for vending operations shall be issued for a single location and shall expire one year after approval by the City Engineer. Failure to comply with the regulations contained herein shall be cause for immediate revocation of any permits granted for vending operations.

Section 2.01.11 Temporary Right-Of-Way Use

- A. The right-of-way utilization permits issued by Permitting Services to private companies, telecommunication companies, cable service providers and all other utility companies, requires that public rights-of-way will be restored to their original condition or better, within the time stipulated on the permit or as provided in City Code. The City Engineer may grant an additional extension of time upon showing of good cause. Any contractor who fails to comply with this Section shall not be issued any new permits until all violations have been satisfied.
- B. Contractors must provide photos of existing conditions of all areas that will be affected by work within the right-of-way before work is to begin, which includes but is not limited to sidewalks, driveways, curbs, landscapes, and roadways. Failure to provide photos will make the contractor responsible for repairing all damages within the work area.
- C. Contractors shall make inspection requests through the Prompt System, (407) 246-2444 or online www.cityoforlando.net/permits when work is occurring. Contractors shall have plans and permits at all times when working.
- D. Any work performed in the right-of-way, including restoration, shall be completed by the

completion date specified in the permit unless the City Engineer grants a time extension. Upon completion of the work, the public right-of-way will be restored to their original condition or better. A final inspection is required by Permitting Services.

- E. If a contractor fails to restore the public right-of-way, including but not limited to any paved surface, decorative pavers, curbs, or fixtures, to their original condition or better, or fails to complete such restoration work by the completion date specified or provided by the permit or as otherwise specified or provided by the City, the City may perform any work or undertake any other activity, which it deems necessary to complete such work and/or restore the public rights-of-way. The City reserves the right to make emergency repairs at the expense of the permittee/security. Failure to comply with this section shall be grounds for denial of future right-of-way permits for utilities until restoration is resolved.
- F. A contractor shall guarantee the restoration of any public rights-of-way which the City determines have been affected or altered by any excavation in the public rights-of-way or any break or cut in any surface of the public rights-of-way made by such contractor for a period of twenty-four (24) months following the date of completion of restoration and approval by the City. Such contractor shall take such action, where the City deems it necessary to correct any deficiencies in such restoration work within such twenty-four (24) month period, no later than five calendar days after receipt of notice from the City or such other date as may be specified by the City, and complete such action promptly but not later than the date or any other deadline established by the City. Such contractor shall be liable to the City for any costs incurred in connection with any such corrective action. Failure to comply with this section shall be grounds for denial of future right-of-way permits for utilities until restoration is resolved.
- G. The contractor shall insure that all monuments, section corners and property markers are protected. Any damage will be repaired by a licensed surveyor approved by the City Surveyor per Chapter 5.
- H. All restoration work shall be done in accordance with the City's Engineering Standards Manual, and any other applicable standards, guidelines, or City Code provisions.
- I. During the review process, an engineering permit may replace and/or be required in addition to a right-of-way permit in cases involving extended repaving/resurfacing, miscellaneous storm water system modifications or driveway reconstructions.

Section 2.02 Engineering Permits

An Engineering Permit shall be required in accordance with this section prior to the commencement of any of the activities described herein. Such permits shall be required in addition to any other permit(s) that may be required by this Chapter or the City Code. The construction, reconstruction, installation, alterations, repairs or any kind of work done under this Chapter must be in accordance with plans and specifications approved by the City Engineer.

An applicant for an Engineering Permit hereunder shall submit to the Permitting Services Division the following information as required:

1. Name and address of the owner, or agent in charge of the property comprising the

proposed work area.

2. Name and address of the party doing the work.
3. Location of the work area.
4. A complete description of the work to be done.
5. Wherever the proposed work includes or affects a public street or public parking area, a construction and maintenance plan for traffic and pedestrian signage is required. This will be reviewed by the City Transportation Engineer, to ensure pedestrian and traffic safety.
6. Such other information as the City Engineer shall find reasonably necessary to the determination of whether a permit should be issued.
7. An up-to-date one-foot contour topographical survey of the subject property with all existing improvements shown. The extent of the survey shall include the adjacent right-of-way and twenty-five feet (or further, if necessary to discern drainage patterns) onto abutting properties, completely surrounding the subject property. See Chapter 5 Survey Standards.
8. Unless digitally submitted, all engineering plans shall be formatted on 24 inch wide by 36 inch long sheets, and six sets of plans shall be submitted to the City. All engineering submittals shall include, when required by the scope of the improvements, plans for site geometry, stormwater facilities (including stormwater management report and geotechnical report), sanitary sewer laterals, erosion control, roadway, site parking, site access, traffic control signs, pavement markings, traffic signal design, maintenance of traffic plan, work zone traffic control design, site specific details and standard details. When plan and profile sheets are used, master layout sheets shall be required. Revisions to approved plans shall be accompanied with full explanations in transmittal letters and the affected revised areas shall be highlighted. All submittals shall be drawn using engineering scales.
9. Private and Public Improvement cost sheets are to include mobilization, landscaping, irrigation, debris and muck removal costs.
10. Orlando Land Development Code requirements for Final Site Plan Review not included in this list must also be submitted.

Section 2.02.01 Construction on Public Property Including Driveway Approaches

All persons desiring to construct, reconstruct, install or repair a driveway, sidewalk, pavement or other structure, in, on, under or over a public street, sidewalk or parkway or to lower, raise or change a curb within the corporate limits of the City shall obtain an Engineering Permit, as described in this chapter, at Permitting Services. All applicant disagreements with the ESM requirements must be submitted in writing to the City Engineer and/or the City Transportation Engineer, if required. A Right-of-Way Utilization Permit will also be required for utility pipes or lines, material storage or refuse containers placed within a right-of-way to facilitate construction projects.

A permit shall not be issued under this Section unless the applicant has previously filed or files with the City's Director of Finance at the time of applying for the Engineering Permit, the bond as required by City Code Article I Section 14.08 – 14.12 for contractors and 14.25 for limited specialty contractors

In any case where a permittee hereunder shall be in default or shall fail to comply with the requirements of this chapter, the City Engineer, upon proper notice, shall order the completion of the work on public property by the City and shall recover the cost from permittee as permitted by law. Completion of the work will be performed after giving proper notice to the permittee.

Section 2.02.02 Construction on Privately Owned Streets, Roadways or Parking Lots

All persons desiring to construct, reconstruct, repair, alter or grade any improved or unimproved property which is proposed or intended to be used for a private street or drive with access to public property shall first obtain an Engineering Permit from Permitting Services. Driveways and driveway approaches which are constructed, modified, altered or repaired but are located on a private street shall also be permitted by the Permitting Services.

Section 2.02.03 Construction, Repair or Alteration on Private Property

All persons desiring to make site improvements to private property by the construction, reconstruction, repair, alteration or grading shall first obtain an Engineering Permit from the Permitting Services. For the purposes of this Section, site improvements shall be defined as grading, filling or excavation of unimproved property, installation of underground infrastructure, additions or alterations to existing building or other structures requiring alterations to the ground and the construction of new buildings or other structures, including parking lots.

Section 2.02.04 Preliminary (Mass) Grading Permit

This permit authorizes site construction improvements to private property before more conventional construction permits are issued by Permitting Services. This permit will have two times the normal city permitting fee; will only be issued on a case-by-case basis; and have a very limited scope of work. It will only be granted if the owner can illustrate to the City Engineer, Planning Official and Building Official that a financial or timeline hardship can jeopardize the completion of the project. The scope of work for this kind of permit is mainly to address lengthy environmental site cleanup jobs, mitigations, soils consolidation, installation of temporary/partial master stormwater systems, stockpiling and/or other types of large earthwork related jobs, and shall not constitute a waiver of other permit requirements such as floodplain development, discretionary land use permits and tree retention and removal.

Section 2.03 Floodplain Development Permits

A Floodplain Development Permit shall be required in accordance with the provisions of this Chapter and Chapter 63, part 2C of the City Code and shall be secured prior to the commencement of any development activities for any building or structure (including placement of mobile homes) located in an area of special flood hazard. A separate Floodplain Development Permit shall be required for each building, structure or mobile home located in an area of special flood hazard. "Development" means any manmade change to improved or unimproved real estate, including but not limited to, buildings or other structures, mining, dredging, filling, grading, paving, excavating, drilling operations or permanent storage of materials or equipment.

If the project proposes to alter the boundaries of a regulatory Floodway or the configuration of the watercourse contained within the Floodway, the applicant shall submit the proposed grading and drainage plans, stormwater management plans, floodplain studies and all supporting computer modeling to the FEMA Region IV Office for a Conditional Letter of Map Revision. The project will not receive final approval until the proposed alteration of the watercourse and/or Floodway boundaries

has been approved by FEMA.

If a proposed project will alter the boundaries of the Area of Special Flood Hazard as shown on the FEMA Flood Insurance Rate Maps, the applicant shall submit the approved grading and drainage plans, stormwater management plans, floodplain studies and all supporting computer modeling to the FEMA Region IV Office for a Conditional Letter of Map Revision (CLOMR).

Within 30 days following completion of the entire project or a phase thereof, the applicant shall submit engineer's certified copies of the final, constructed grading and drainage plans and stormwater management plans to the FEMA Region IV Office for the issuance of a Final Letter of Map Revision (LOMR).

The City Engineer shall be provided with copies of all related correspondence and shall sign the required "Community Acknowledgment Form".

No development will be permitted in the designated floodway.

No development will be permitted in any Area of Special Flood Hazard designated as an unnumbered A Zone (no base flood elevation established) until a Conditional Letter of Map Revision (CLOMR) is approved by FEMA. If an engineering permit has been issued with a CLOMR, a LOMR will be required before the Certificate of Occupancy can be issued.

Section 2.03.01 Application for a Development Permit for Constructing or Substantially Improving a Structure

Applications for a Floodplain Development Permit for constructing or substantially improving a structure shall be made to Permitting Services prior to any development activities. Applications may include, but not be limited to engineering plans drawn to scale showing the nature, location, dimensions and elevations of the area in question, existing or proposed structures, earthen fill, storage of materials or equipment and drainage facilities. Specifically, the following information is required:

- A. Elevation (NAVD 88) of the proposed lowest floor (including basement) or the lowest surface of any heating or air conditioning ductwork installed below the lowest floor, of all proposed buildings or existing buildings with substantial improvements;
- B. Elevation (NAVD 88) to which any proposed non-residential building or existing buildings with substantial improvement will be flood-proofed;
- C. Signed and sealed certificate, separate from the submitted plans, from a registered professional engineer or architect stating that the non-residential flood-proofed building will meet the flood-proofing criteria in Chapter 63, Part 2C;
- D. Description of the extent to which any watercourse, swamp, marsh, lake or pond will be altered, relocated or created as a result of proposed construction;
- E. Description of the type, extent and depth of proposed fill and the elevation in relation to mean sea level of the top surface of the fill;
- F. Description of the type, extent and depth of proposed excavation in relation to mean

sea level;

- G. Plot plan, to scale, illustrating the locations of all proposed construction, fill, excavating and other aspects of the development;
- H. Copy of the proposed stormwater management report and floodplain study, if any, complete with technical supporting data.

Section 2.03.02 Floodplain Development Permit Attached to Building Permit

Whenever a Building Permit is required for a structure within an Area of Special Flood Hazard the Building Official shall also require, where applicable, the presentation of a valid Floodplain Development Permit prior to the issuance of the Building Permit. The conditions, plans, etc., attached to the issuance of the Floodplain Development Permit shall thereafter become part of the Building Permit.

The Building Official shall require submission of an Elevation Certificate signed (see Chapter 5 Survey Standards) by a registered Florida Professional Surveyor in order to determine that the structure is in compliance with the requirements of the National Flood Insurance Program (NFIP). Specifically the following procedures must be followed:

- A. As part of the final inspection, it shall be the duty of the permit holder to submit to Permitting Services, a FEMA Elevation Certificate, (latest approved form), prepared by or under the direct supervision of a registered Florida Professional Surveyor. For information on Elevation Certificates and instructions for their completion go to FEMA's website at www.fema.gov.
- B. When floodproofing is utilized (for non-residential buildings only), the permit holder shall submit the floodproofing certification at the time the exterior walls are completed to the required flood proofed elevation. Said certification shall be prepared by or under the direct supervision of a professional engineer or architect and certified by same, utilizing the FEMA Flood proofing Certificate Form No. 81-65.
- C. Failure to submit the Elevation or Floodproofing Certificate or failure to make the corrections required, shall be cause to hold the Certificate of Occupancy for the structure.

CHAPTER 3 - INSPECTION PROCEDURES

Section 3.01 Introduction

The purpose of this chapter is as follows:

- A. To provide information and guidance to project Owners, Developers and their Contractors concerning the City of Orlando's uniform requirements for construction,
- B. To notify Developers, Contractors and other interested parties of the City's requirements to maintain uniform standards throughout the City,
- C. To eliminate possible disputes which may arise during construction through a lack of adequate information, and
- D. To assist and enforce Contractor compliance with applicable Standards, Codes and Ordinances as adopted by City Council, without regard as to whether the construction, development, improvement or renovation occurs on public property or private property.

Section 3.02 City Codes and Standards

All construction within the corporate limits of the City of Orlando shall conform to and comply with the reference texts listed in section 1.01.

Approval of construction plans by the City in no way constitutes a waiver of health and safety standards or Federal and State laws. The health and safety of the citizens of Orlando is of major concern to the City and takes precedence over any of the approved plans and/or any agreements that may be in effect concerning the project.

Section 3.03 Project Address

Each project is tracked by its street address. Should it become necessary to correct or change an address that is shown on the permit, it is the sole responsibility of the Contractor/Developer to contact City of Orlando Engineering Records Office at (407) 246-3267 and make all necessary corrections. The Contractor/Developer shall obtain an individual address for each structure to be constructed. Address permits are issued through the Permitting Services in consultation with Engineering Records. Failure to show the correct address on the permit will cause delays in issuance of the final acceptance for the project.

Section 3.04 Video Work In Progress

Contractor is to set up either an FTP site or video the progress of the construction. The video is to include the progress of all work being performed on projects that will be turned over to the City of Orlando at the end of the construction. The video should include visual evidence that work is constructed in accordance with the approved construction documents when the final product is not open and obvious. The Contractor is to set up the equipment in such a manner that all construction operations are visible during each stage. It is not recommended that video be shot from the top of buildings because the visual evidence on the ground is not clear. The contractor should provide video documentation of pipe installation, backfilling and compaction operations; road base,

substructure and surface course installation and compaction for curb construction; utility installation and backfilling; and sidewalk construction. On private improvements, the City is interested in areas that impact the City of Orlando infrastructure such as utility tie-ins, driveway entrances, and sidewalks.

A time stamp must be shown on the video and the contractor must also check the video frequently to make sure it is in working order. All videos are to be handed over to Permitting Services daily. Videos must be submitted in DVD format, and have on the DVD case the contractor's name, project name, date of video and location of the video (such as structure number, type of pipe, etc.).

Section 3.05 Project Checklists

The following checklists are used, as applicable, for projects in the City of Orlando.

Section 3.05.01 Construction Plans Submittal Checklist:

1. Signed and sealed construction plans, four copies minimum.
2. FDEP approvals and permits for sanitary sewers.
3. Review by Parks for tree removal permits.
4. Recorded Plat
5. Payment of permit fees to the City of Orlando.
6. Payment of Concurrency Fees to the City of Orlando (if applicable).
7. Payment of the Sewer Benefit Fees to the City of Orlando (if applicable).
8. Payment of Transportation Impact Fees to City of Orlando (if applicable).
9. Floor elevations at least one foot above base flood elevation for structures in the floodplain.
10. FDOT permits when sidewalk or driveway approach is on, or drainage discharge is into State right-of-way.
11. Orange County permits when sidewalk or driveway approach is on, or drainage discharge is into County right-of-way.
12. Sidewalks and wheelchair ramps shall be constructed in accordance with applicable codes and standards as further described in the City of Orlando Land Development Code and/or the Americans with Disabilities Act (ADA).
13. All concrete within the City right-of-way shall be 3000 psi minimum.
14. Identification and street numbers must be fully visible from the street.
15. Drainage plans showing all details. Calculations and geotechnical reports (if

applicable).

16. Restoration of publicly owned lands disturbed during construction and the sodding of the retention areas and parkways.
17. Compliance with the Manual of Uniform Traffic Control Devices (MUTCD) and with all federal and state guidelines listed in Section 1.01-I of this document.
18. Erosion and Sedimentation Control Plan or SWPPP.
19. Water Management District approval (if applicable).
20. Recorded Conservation easement (if applicable), including Dewatering Permit, if applicable.
21. FDEP – Notice of Intent to Use the Generic Permit for Discharge of Groundwater for Dewatering Operations, at sites where dewatering will occur.
22. City Wastewater, Industrial Waste Pre-Treatment Groundwater Permit at contaminated sites.
23. City Stormwater Dewatering Discharge Permit, uncontaminated sites.

Section 3.05.02 Public Improvements Checklist

1. Sanitary sewer inspected and accepted.
2. Storm sewer inspected and accepted.
3. Roadways inspected and accepted.
4. Traffic control devices in place, inspected and approved by Transportation Engineering and/or Traffic Operations Section (Signals).
5. Landscaping and irrigation inspected and accepted.
6. Sidewalks and handicap ramps inspected and accepted.
7. Curbs and gutters inspected and accepted.
8. Solid Waste facilities inspected and approved (if applicable).
9. Operation & Maintenance Manuals (4 copies required) provided by Contractor to the Construction Manager, when applicable.
10. Warranties submitted and accepted.
11. Materials testing reports (daily and monthly progress) submitted and approved.
12. As-Built Survey submitted and accepted (see Chapter 5 Survey Standards).

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13. Verification by Permitting Services of payment of fees.
 14. FDOT and/or Orange County project acceptance, when applicable.
 15. Locate markings have been removed fully from site and surrounding areas.
 16. Punch list items completed.
 17. Stormwater laser profile and report.
 18. Manifest documenting entire stormwater system was cleaned following completion of project.

Section 3.05.03 Commercial Project Checklist

1. Sanitary sewer inspected and approved.
2. Storm sewers and retention facilities inspected and approved.
3. Landscaping and irrigation completed, inspected and approved.
4. Roadways and parking lots inspected and approved.
5. Traffic control devices in place, inspected and approved to include pavement markings, signs, stop bars, handicap striping, etc.
6. Solid Waste facilities inspected and approved (if applicable).
7. Sidewalks and handicap ramps inspected and approved.
8. Materials testing reports review both during construction and at final.
9. As-Built Survey submitted and accepted (see Chapter 5 Survey Standards).
10. Verification by the Permitting Services of payment of fees.
11. FDEP and FDOT and Orange County acceptance when applicable.
12. Stormwater laser profile report.
13. Locate markings have been removed fully from site and surrounding areas.
14. Punch list items completed and accepted.
15. Final Inspection Certificate (for capital improvement projects)
16. Manifest documenting entire stormwater system vactored after completion of project.

Section 3.06 Approved Plans

In accordance with applicable City Codes, the contractor shall maintain the final approved permitted set of project plans on site at all times during the course of construction from the first day of the project until final acceptance of the project. These plans are for the use of all contractors, sub-contractors and vendors and also for the review of all City personnel during construction and must be available for their use in the performance of inspections. Failure to comply with this requirement constitutes a breach of permit requirements and is justification for suspension of the work and/or revocation of the permits. Plans are to be maintained in good condition throughout the duration of the project. Approved plans shall not be modified without approved revisions submitted to Permitting Services.

Revisions by the Owner/Contractor/Developer to the approved permitted plans shall be submitted to all applicable government agencies for approval prior to construction of the revision. Non-compliance will cause the revisions to be null and void and will result in non-acceptance of the work in place. Any and all revisions to the approved plans shall be submitted to the Permitting Services and approval obtained prior to implementing/constructing the revised portion of the project. It is not the policy of inspection services to suspend work due to revisions of the plans resulting from varying field conditions, field changes due to conflicts with existing facilities, or other normal occurrences. However, it is the sole responsibility of the Contractor/Developer /Owner to submit the revised plans to the Permitting Services for approval.

Acceptance of the project is based upon the projects conformance with the approved plans and City Codes. Construction not conforming to those approved plans and Codes will not be accepted until all revisions are approved by the City of Orlando and all other appropriate governmental entities. A copy of all proposed revisions being submitted for approval through any governmental agency shall be sent to Permitting Services.

Section 3.07 Right-Of-Way Utilization

Orlando's City Code requires that the Contractor obtain a Right-of-Way Utilization Permit for all construction operations that occur within the public right-of-way (Chapter 65.601). This permit can be obtained from the Permitting Services. See the Permits chapter of this manual for more information.

Twenty-four hours prior to beginning your project you must contact the Permitting Services, Prompt System (407-246-4444) to schedule an inspection. This is necessary to insure that an inspector is scheduled for inspections of your work activities. The Engineering Inspector shall be responsible for inspecting work within the scope of these provisions to see that the right-of-way is restored properly including the removal of utility locates. The job shall be inspected against the provisions of the approved plans, and the City Engineer shall not issue a certificate of Completion until all such provisions are met and any required tests are performed and accepted.

The contractor shall have all materials inspected before being installed, concealed or covered. The contractor shall inform the Engineering Inspector 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 3.08 Required Inspections

The City Engineer (or other appropriate official) shall carry out inspection and testing of all improvements during construction and following the completion of each stage of construction to ensure compliance with the approved plat or plan. Representatives of the City shall visit the project site to make a visual inspection of the progress of the work and methods of construction. If it is determined that it was not done in accordance with the approved construction documents, the City will notify the Contractor and the Developer/Owner and request that the necessary corrections be made or tests performed to assure compliance with the approved construction documents. The City Engineer or the Inspection Supervisor may issue stop work orders if corrections are not made as instructed.

The City of Orlando uses an automated inspection scheduling system “Prompt” and online services to schedule inspections. “Prompt” is accessed by calling (407)-246-4444. To schedule online go to www.cityoforlando.net/permits. To schedule an inspection the system requires your permit number and an inspection code found in the Prompt instruction brochure. For more information or a copy of the “Prompt” brochure call (407) 246-2271. Failure by the Contractor to schedule inspections will delay the project and can result in non-acceptance by the City of the work in place. All required inspections on City-owned projects shall be scheduled with the appropriate Capital Improvements Construction Manager or Field Representative. Contractor/Owner/Developer will be responsible to uncover any work not inspected and approved prior to burial.

Section 3.08.01 Items Requiring Inspection and Approval

It is the sole responsibility of the Contractor/Developer/Owner to properly schedule the required inspections. A 24-hour notice is required to schedule an inspection.

- A. Gravity Sanitary Sewer Systems
 - 1. House Lateral Connections
 - 2. Commercial Lateral Connections
 - 3. Pipe Line Installation and Materials
 - 4. Manholes and Clean Outs
 - 5. Reconnections and/or Renovations
 - 6. Materials Testing
 - 7. Line Testing

- B. Force Mains
 - 1. Pipeline Installation and Materials
 - 2. Air Release Valves
 - 3. Structures
 - 4. Pressure Tests
 - 5. Soils Testing

- C. Pump Stations
 - 1. All Structure installation and Materials
 - 2. Pipes and Connections
 - 3. Mechanical Equipment and Installation

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4. Instrumentation Equipment and installation
 5. Electrical Equipment, Materials and Installation
 6. Startup of Station to include the warranties and O & M Manuals
- D. Stormwater Management Systems
1. Pipeline Installation and Materials
 2. Structures Installation and Materials
 3. Exfiltration and Underdrain Installation and Materials
 4. Retention/Detention Facilities
 5. Swales
 6. Fences
- E. Roadways and Parking Lots
1. Base and Sub-base Materials and Installation
 2. Asphalt or Concrete Surfaces Installation and Materials
 3. Curbs
 4. Sidewalks
 5. Handicap Ramps and Facilities
 6. Curbs and Gutters
 7. Traffic Control Signage and Pavement Markings
 8. Maintenance of Traffic (vehicular and pedestrian)
- F. Solid Waste Facilities
1. Dumpster Pad Installation and Materials
 2. Location
 3. Address

Section 3.09 Reinspection Fees

Permitting Services will assess a reinspection fee upon disapproval of an inspection. All questions pertaining to the reinspection fee schedule should be addressed to Permitting Services.

Permitting Services shall withhold further inspections until such time as the outstanding fees are paid. This may include, but is not limited to, holding the Certificate of Occupancy on any structure and/or acceptance of the infrastructure for the project. Further information may be obtained from Permitting Services.

Section 3.10 Overtime Reimbursements and/or After Hours Work

Should Permitting Services personnel be required to be present on the project site beyond the normal hours, Permitting Services shall seek to recover its actual cost from the permit holder. The responsible party is the entity, person, corporation and/or company named on the permit as being the party entitled to make improvements under the conditions of the permit.

Requests for overtime (after hours) inspections must be submitted in writing on your company letterhead. The letter must have in the subject line the project name, address, and permit number. The first paragraph should contain the requested inspection date and time, type of inspection and the

inspector's name, if known. Include the reason for an after-hours inspection as opposed to a regular working hours inspection. The second paragraph must include the sentence, "We are willing to reimburse the City of Orlando for all overtime charges incurred."

Section 3.11 Inspection Schedules

Except as noted in the permit conditions, all inspections at the site shall be performed during normal working hours. Normal working hours are between 7:30 a.m. and 3:30 p.m., exclusive of weekends and holidays. The Contractor may schedule inspections other than the normal working hours only after giving written notice to Permitting Services 48 hours prior to the work requiring inspection.

Section 3.12 Materials Testing

City Codes and applicable standards require material testing as an integral part of all construction within the corporate limits. Testing shall be of sufficient quantity to present an actual representation of the work as installed.

All testing shall be at the direction of the inspector. Testing which is not performed at the direction of the inspector shall not be considered as acceptable.

In special cases in which the Contractor or the Owner/Developer is responsible for contracting a testing lab, the lab shall be licensed to do business in the City of Orlando. It is the Contractor's and/or the Owner/Developer's responsibility to submit copies of all daily test reports to the inspector. Copies of all progress reports shall be submitted to Inspection Services for review and inclusion into the project files. Failure to comply will cause delays to the project close-out. In some cases Inspection Services may need to verify test data. Should this be necessary, the contractor shall be responsible for the cost of those additional tests.

In all cases in which the City is responsible for the materials testing all requests for tests shall be scheduled through the inspector. Should the contractor elect to schedule on site testing directly through the testing lab on his own, he will have accepted the responsibility for payment of those tests. In all cases where retests or roadway coring are necessary, the Contractor/Developer shall reimburse the City for the actual cost of those tests plus an administrative fee. The Contractor/Developer is also responsible for any minimum trips. The Contractor is responsible for being ready for materials testing when testing company is called.

Please be advised Inspection Services shall not authorize payment for any testing not scheduled through the inspector or the Inspection Supervisor's office. In the case of retests, the retest fees shall be paid in full prior to the release of the project.

Section 3.13 Temporary Erosion and Sediment Control

The Contractor shall provide, maintain and remove temporary erosion and sedimentation controls according to the Stormwater Pollution Prevention Plan (SWPPP) as required by Florida Department of Environmental Protection (FDEP). The SWPPP shall be developed according to FDEP Document No. 62-621.300(4) (a) entitled "Generic Permit for Stormwater Discharge from Large and Small

Construction Activity.” The SWPPP shall be approved by the City of Orlando prior to construction and shall be submitted to Permitting Services by the Contractor prior to construction. All projects that will disturb 1 acre of land or more shall submit a "Notice of Intent," FDEP Form 62-621-300(4) (b) to FDEP and obtain the acknowledgement letter with the FDEP identification number of the project prior to any construction activity. All projects that disturb ground of any size shall have a SWPPP approved by the City of Orlando. The Contractor is responsible for keeping the FDEP permit acknowledgement letter and the SWPPP at the project site at all times for projects over one acre. Contractor personnel that directly manage the construction project must obtain a FDEP Stormwater, Erosion and Sedimentation Control Certificate prior to beginning of project or within 30 calendar days of commencement.

Temporary controls will be implemented to prevent soil erosion from the construction site caused by stormwater runoff, soil tracking by equipment, and/or wind. Temporary controls shall be implemented as shown on the SWPPP. Best Management Practices (BMPs) included in the SWPPP such as installation of silt fence, measures at construction entrances and exits that prevent soil tracking, dust control, and stabilizing of stockpiles shall be installed and maintained by the Contractor. The Contractor shall be responsible for implementing any additional BMPs that are necessary to comply with Federal, State and Local requirements at no additional cost. The Contractor shall notify the Engineer of any required changes and modify the SWPPP accordingly.

Sedimentation control shall be implemented according to the SWPPP and must prevent turbid stormwater runoff greater than 29 Nephelometric Turbidity Units (NTUs) above background levels from leaving the construction site. BMPs shall be installed and maintained by the Contractor according to the SWPPP. NO HAY BALES shall be used. Dewatering must be done by installing well point systems or any other approved method that will only discharge clear water with a turbidity level below allowable standards. The Contractor shall be responsible for implementing any additional BMPs that are necessary to comply with Federal, State and Local requirements at no additional cost. The Contractor shall notify the Engineer of any required changes and modify the SWPPP accordingly.

The Contractor shall clean debris and soil from all new and existing storm sewer pipes and structures within the project site after the construction is completed. The Contractor shall clean debris and soil from all existing storm sewer pipes and structures outside the project area if these materials originated from the construction site. The Contractor shall remove any soil deposits at outfalls from pipes in lakes or ponds that were caused by the construction. The Contractor shall remove all erosion control equipment after site is stabilized and storm system is cleaned.

Section 3.14 Site Cleanup

The project site will at all times be maintained by the contractor in a state of cleanliness for the health and safety of persons working on or visiting the site and those persons living adjacent to the construction site. Site cleanliness shall not be limited to the on-site conditions. The contractor shall remove materials and debris from public roadways and/or other public facilities as may become necessary during the course of the project. All refuse and excess scrap materials shall be disposed of in a proper manner. The site shall be kept as clean as possible during construction.

Once the project has progressed to a point where Inspection Services begins to approve building

finals, the Contractor/Owner/Developer shall maintain the roadways and part of the site that are open to the general public free of soils and other materials which may have migrated to that area. In addition to on-going maintenance of the roadways and public areas, the Contractor/Owner/Developer shall isolate on-going construction and the hazards therein from the public.

All portions of the project open to the general public shall be fenced, barricaded and otherwise protected from all construction activity through whatever means acceptable to the City inspector. Failure to comply will result in the withholding of finals on the project and could result in work delays.

The Developer/Owner shall prohibit, by the proper use of MUTCD approved closures and devices, public traffic from using all newly constructed roadways until they are accepted and approved to be open during construction. All newly constructed public roads are the responsibility of the Developer/Owner until such time it is approved and turned over to the City of Orlando. It is also highly recommended that all construction traffic be routed through a separate designated and controlled construction entrance.

Section 3.15 Sanitary Sewer Requirements

All plans must be approved and stamped by the Wastewater Division. The FDEP permits and approval for the sanitary sewer must be in place or a letter of intent to issue the permit must be filed with Inspection Services before construction begins.

All construction activities involving the construction of sanitary facilities require a preconstruction meeting. The preconstruction meeting shall be scheduled through Permitting Services (or Capital Improvements for City projects).

Section 3.16 Stormwater Requirements

Prior to the commencement of construction activities, all easements shall be recorded, all applicable permits shall be "in hand" and/or letters of intent to issue from governing agencies such as Water Management Districts, FDEP, etc. Except in the case of a hold harmless agreement where the easements can be recorded after construction begins. Permitting Services may accept the letter of intent to issue the permit in cases where the issuance of the actual permit is delayed for reasons beyond the control of the Owner/Builder/Developer.

In all cases, construction of storm water facilities requires a preconstruction meeting. The preconstruction meeting shall be scheduled through Permitting Services or Capital Improvements.

Section 3.17 Traffic Control

The Transportation Engineering Services Division reviews and approves plans of all transportation facilities constructed within the City of Orlando. Both publicly and privately owned facilities are within the jurisdiction of the Transportation Engineering Services Division and will be designed and constructed in conformance with the applicable guidelines as adopted by the City of Orlando. Compliance with MUTCD is mandatory within the corporate limits of the City of Orlando. Traffic control plans shall be approved by the Transportation Engineering Services Division before the issuance of permits. The contractor shall be responsible for insuring each employee supervising the selection and placement of Maintenance of Traffic (MOT) Control Devices shall be properly trained

by attending and successfully completing a Florida Department of Transportation (FDOT) approved MOT course. The training shall be at a level applicable to the employee's level of involvement. Copies of certifications shall be provided to the City Transportation Engineering Division prior to implementing any phase of MOT. All inquiries regarding traffic control and transportation issues during construction shall be addressed to the Traffic Control Manager at (407) 246-3704.

Section 3.18 Solid Waste Collection

All commercial developments shall have adequate solid waste collection areas with adequate access and egress, independent of parking and loading facilities. Screens, dumpster pads and access drives shall meet the most current edition of the Orlando Land Development Code. Dumpster pad and compactor pad details can be found in the ESM Details.

All dumpster pad locations and enclosures shall be approved and accepted by the Solid Waste Management Collection Services prior to acceptance by Inspection Services. Failure to obtain approval of the pad location and/or the approach could result in the refusal of Solid Waste Management to service the project and/or the holding of the Certificate of Occupancy until such time as the Contractor corrects any problems in a manner acceptable to Solid Waste Management Collection Services.

Section 3.19 Project Close-Out

In order to avoid close-out delays, several times during the course of the project you will be prompted by city personnel to submit items to the Inspector for inclusion into the project files. Following these guidelines will improve the chances that your project will be closed out on time and accordance with your schedule. Any questions you may have regarding the project status can be answered by the Inspection Supervisor or your inspector. Feel free to contact these persons whenever questions arise.

Prior to the final inspection by City personnel, including other City agencies in addition to Permitting Services personnel, the following items shall be required prior to scheduling the final inspection: (Private improvements)

- A. As-Built Drawings, see Survey Standards for requirements
- B. Densities – Test Inspection Reports
- C. Engineer's certifications
- D. FDEP clearance for Wastewater Collection
- E. Payment of retest and overtime fees and After Hours fees (for Capital Improvements personnel)
- F. Manifest documenting that entire stormwater system was cleaned following completion of project
- G. Stormwater pipe laser profiles DVD and report from Engineer.

Section 3.20 Administrative Close-Out

Upon completion of the project, Permitting Services shall conduct a final on-site inspection. A punch list will be issued upon completion of the final inspection. Items listed shall be corrected by the Owner/Builder/Developer and approved by the City prior to final acceptance of the project. During this time frame the FDEP certifications for the sanitary sewer should be filed with the Permitting Services. These documents are to be submitted to the Engineering Plans Examiner responsible for the project. Along with the FDEP certifications, the Owner is required to submit documentation verifying the actual cost of construction using contractor pay requests. Please be advised that Permitting Services will not release the final acceptance or Certificate of Occupancy on any projects which show an outstanding balance. Further information concerning the requirements of the City Engineer's Office can be obtained by contacting Permitting Services by phone (407) 246-2271.

Section 3.21 Completion and Acceptance of Improvements to be Maintained by the City

Permitting Services, on behalf of the City Engineer, accepts improvements by issuing a Letter of Completion. The City Engineer shall be required to issue a Certificate of Completion only if the Owner/Builder/Developer has:

1. Complied with all requirements listed in the "As-Built Drawings" section;
2. Posted a maintenance bond in accordance with the "Maintenance Bond Requirements" section;
3. Submitted results of any tests that the City Engineer may require;
4. Submitted an FDEP "Cleared for Use" letter to Permitting Services;
5. Submitted an Engineer's Letter of Certification to the Permitting Services;
6. Submitted itemized cost sheet to the Permitting Services for all facilities dedicated to the City;
7. Documentation that the City Engineer has conducted satisfactory inspections of the improvements to be accepted; Submitted the laser profile DVD and reports as well as the Engineer of Record certifying that the storm system is constructed and functioning in accordance with the design.
8. Submitted a fixed assets form signed and sealed by Engineer of Record.
9. Submitted manifest documenting entire stormwater system vacated after completion of project.

Section 3.22 Maintenance Bond Requirements

Prior to acceptance of the required improvements by the City Engineer through the issuance of a Letter of Completion, the developer/builder shall post a Maintenance Bond for the repair or correction of material defects or failures of the improvements for a period of two years following their acceptance.

The Maintenance Bond shall be in an amount equal to 15% of the actual construction cost of all the improvements or 100% of construction cost of utilities to cover sufficient replacement and shall consist of a bond, equivalent cash deposit with the City, certificate of deposit, irrevocable letter of credit by a Florida bank, a cashier's check or a certified check drawn upon a Florida bank, all forms can be found on www.cityoforlando.net. The City Engineer shall create, maintain and provide approved forms for each type of Maintenance Bond described immediately above. The Owner/Builder/Developer must use said approved Maintenance Bond forms and may not modify said approved forms in any way. Any change or modification to such forms shall be disregarded and shall be unlawful. Upon default, the City Council, City Engineer or other applicable public body may exercise its rights under the Maintenance Bond upon two days written notice by certified mail, return receipt requested, to the parties to the instrument.

No less than ninety days before the expiration of the Maintenance Period, the Owner/Builder/Developer is required to notify, in writing, to Permitting Services and the Division Manager of the City of Orlando's Streets and Stormwater Division of impending expiration and to request that Permitting Services and other departments perform a final inspection of the accepted improvements. Attached to this notification must be certified, signed and sealed copies of the as-builts of the project, as well as the engineer's certification of completion. The City shall then conduct such final inspection within thirty to sixty days before the expiration. If the City Engineer determines during the final inspection that the improvements are in satisfactory condition and repair, then the Maintenance Bond shall be permitted to expire and the Owner/Builder/Developer shall be released from further obligations under this section. If the City Engineer determines during the final inspection that the improvements are not in satisfactory condition or repair, the City Engineer may require the Owner/Builder/Developer to correct said deficiency, maintenance problem, etc. Failure of the Owner/Builder/Developer to correct said deficiency shall automatically result in a default of the Maintenance Bond and continued civil liability against the Owner/Builder/Developer. Similarly, the Owner/Builder/Developer's failure to notify the City Engineer or Division Manager of the City of Orlando's Streets and Stormwater Division of the Maintenance Bond expiration date and to request final inspection, shall also result in automatic default of the Maintenance Bond and continued civil liability for deficiencies discovered after expiration of the Maintenance Bond.

Section 3.23 Performance Guarantee Requirements

City Code states no final subdivision plat shall be approved unless a performance guarantee is filed with the City in accordance with the section for the installation of required improvements. The Developer is responsible for the performance guarantee; however, the performance guarantee may be posted by either the Developer or the Contractor. The performance guarantee shall comply with all statutory requirements and shall be approved as satisfactory by the City Attorney as to form and manner of execution.

The amount of the performance guarantee shall be equal to the maximum estimated cost for the installation of the uncompleted portion of the required improvements adjusted for inflation during the maximum effective period of the guarantee based upon a bid or an estimate by the Engineer of Record and subject to approval of the City Engineer. In no case shall the amount be less than 110% of the current construction costs of such improvements. The guarantee shall consist of a bond, equivalent cash deposit with the City, construction loan agreement with a recognized lending institution, certificate of deposit or irrevocable letter of credit by a Florida bank, a cashier's check or a certified check upon a Florida bank all forms are available at www.cityoforlando.net.

The effective period of the performance guarantee shall not exceed one year from the date of approval of the Final Subdivision Plat or Final Site Plan.

The City Council may grant one or more extensions for an additional one-year effective period of the performance guarantee for good cause shown. However, the City Engineer shall review the performance guarantee and may require renegotiation of the amount of guarantee of the extension period. The City Council may at any time during the effective period accept a substitution of principal, sureties or other parties, upon recommendation by the City Attorney.

Whenever the required improvements have not been installed according to the terms of the performance guarantee and no extension or substitution has been granted, the City Council may, upon thirty days written notice to the parties to the instrument, declare the performance guarantee to be in default and exercise the City's rights there under. Upon default, no building permits or other approvals shall be granted for the development until the City Engineer determines that adequate progress has been made toward completing the remaining improvements.

Section 3.24 As-Built Drawings

An As-Built drawing is a record drawing updated periodically during construction that accurately depicts any material changes, location and direction of utilities, changes in slope/elevation in parking areas or any other deviations from the approved plans. As-Built Surveys will conform to the requirements set forth in Chapter 5 - Survey Standards for Public and Private Development.

All projects constructed within the corporate limits of the City of Orlando, which are dedicated to the public or are privately owned and connected to publicly owned facilities, are required to submit three sets of as-built drawings and two electronic copies in Microstation DGN file or an AutoCAD DWG file to Permitting Services for review and incorporation into the project files.

The first set of files must be in PDF format. The PDF file must have bookmarks that will clearly identify each sheet in the file. The digital files must have the following characteristics:

The second set of files must be in one the following file formats: DXF, DGN, DWG or SHP (ESRI). Text documents like energy calculations can be submitted in PDF format. The Coordinate system must be in Florida State Plane Coordinates, Zone Florida East, NAD 83, in U.S. Survey feet. There must be either a separate index that explains what is contained in each layer of the file or the layer name itself must be self explanatory.

Section 3.25 Sanctions

If the Developer/Builder's Professional Engineer fails to comply with any of the requirements described in this Chapter, then the City Engineer may choose one of the following sanctions:

- A. Refuse to allow building permits to be issued for any or all of the development;
- B. Refuse to issue Certificates of Occupancy for any or all of the development; or
- C. Refuse to issue a Letter of Completion for the improvements.

CHAPTER 4 - UTILITY ACCOMMODATION STANDARDS

Section 4.01 General Regulations

The primary concern in the design and location of utility installations is protection of the right-of-way and the safety of the City of Orlando user. The placement of utilities within the public rights-of-way and public easements shall be in accordance with all applicable codes and current industry standards. It shall be up to the contractor to coordinate all utilities concerning the project. All utilities shall be given notice prior to commencement of construction. Notification shall be made to the Sunshine One-Call system at 811 at least 48 hours prior to the start of work.

- A. As a general rule, a minimum of one lane of traffic must be maintained at all times and adequate safety precautions taken. Any street, lane or sidewalk closure will require a traffic plan submitted at least seven days in advance of the proposed closure and approved by the City. If a detour is contemplated, the complete detour route must be indicated. Inclusive dates of the proposed closure must be firm.
- B. Prior to closing the street to traffic, the appropriate City agencies including police, emergency (rescue, fire, etc.) and traffic control agencies shall be notified. The traffic control manager must be called 24 hours prior to the closure at (407) 246-3704.
- C. Traffic control devices in accordance with accepted practices the Manual for Uniform Traffic Control Devices (MUTCD) and the FDOT Design Standards Index 600 series.
- D. Only one pole line will be permitted on each side of the right-of-way. No pole lines shall be placed within median areas of roadways or driveways. Only single-pole support systems will be permitted within the rights-of-way. Any exception must be amply justified and approved by the City Engineer.
- E. 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.
- F. Attachments to structures such as bridges shall be carefully reviewed and may be considered under one or more of the following conditions:
 - 1. Will not create a potential hazard;
 - 2. Will not affect the integrity of the structure;
 - 3. Will not adversely affect aesthetics of the structure;
 - 4. Will not hinder maintenance operations;
 - 5. Will not block the view of traffic control devices;
 - 6. Will maintain minimum ground clearance equal to that required for the structure;
 - 7. The utility line should be in conduit so that maintenance can be accomplished from ends of structure without hindrance to the public;
 - 8. No consideration will be given to approving flammable fluid pressure lines;
 - 9. If other locations are reasonable, attachment to the structure will not be allowed. Each attachment will be considered on its own merits.

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- G. Public right-of-way shall be restored to its original or better condition. The following guidelines are established for this purpose.
1. At such locations where City signs and reflectors will interfere with proposed construction, the permittee or his consultants will notify the City twenty-four (24) hours in advance of starting work. All signs and reflectors will be removed or relocated only by City personnel. Any signs or reflectors damaged, destroyed, removed, or relocated will be replaced at the expense of the permittee. No private signs of any type will be permitted within the right-of-way.
 2. Trees and/or shrubs destroyed during construction are subject to being replaced by the permittee as directed by the City. All debris shall be removed by the permittee at his expense. Dust control shall be mandatory. All vegetation shall be provided the maximum protection as required by the Code of the City of Orlando.
 3. Sodding operations are to begin as soon as fine grading and weather conditions permit, as directed by the City. Any yards or part of the right-of-way in front of private property that has a grass mat shall be re-sodded with like sod to existing or better condition.
 4. The indiscriminate cutting of trees or disfiguring of any, feature of scenic value shall not be permitted. This includes other methods such as the use of herbicides. 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. City tree removal permits shall be obtained from the City's Parks Division.
 5. All utility locate markings must be completely cleaned around the area of the permitted project at the contractor's expense.
- H. All landscaping within public rights-of-way and public easements shall comply with the following provisions:
1. The permittee shall not hold the City responsible for any damage to the plants during subsequent right-of-way construction.
 2. Plants in a median island within one hundred (100) feet of a crossover nose shall follow the FDOT Design Standard Index 546 "Sight Distance at Intersections" requirements for installation and clear sight distances.
 3. A minimum four (4) foot mowing strip shall be maintained between the plants and the curb or sidewalks/bike paths. If plants are desired in this mowing strip, they shall be kept under twenty-four (24) inches. At no time shall clear sight distance as established by the Florida Greenbook be compromised.
 4. Unless otherwise permitted or approved, no rock boulders, above ground utility facilities, stationary signs, or above ground monuments shall be allowed in the medians.
 5. 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.

6. Trees planted within the right-of-way on high speed roadways shall be reviewed for any special requirements by the City's Parks Division and the City Engineer.
7. Sprinkler heads and irrigation systems installed adjacent to public roadways and sidewalks shall be designed to ensure 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 away from the edge of pavement to prevent damage by vehicles leaving the pavement.

Section 4.02 Construction Standards

Utility lines of all kinds shall be constructed and installed beneath the surface of the ground unless it is determined by the City Engineer that soil, topographical or any other compelling conditions make the installation of such utility lines as prescribed herein impractical. It shall be the owner'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 for communication utilities may be required at the discretion of the City Engineer. Special consideration shall be given to the placement of existing overhead utilities underground in redevelopment and infill project areas.

- A. All street, curb, sidewalk, driveway curb, etc. construction shall be in accordance with Chapter 6, Site Development Standards, of this Manual.
- B. Storm drainage pipe shall be in accordance with Chapter 7, Stormwater Management, of this manual.
- C. All open cuts are to be restored utilizing the Thermal Bond method, cost of restoration is the responsibility of the utility contractor.
 1. The City specifies a method of pavement restoration known as the Thermal Bond method. This process consists of adding asphalt to the pavement cut and compacting the material to be flush with the surrounding asphalt surface. The entire surface of the newly applied asphalt is then heated, reworked and regraded along with the existing asphalt along the perimeter of pavement cut. The two surfaces are then "welded" together to form a seamless patch and a consistent, level asphalt surface. The utility contractor and the restoration contractor agree to mutually warrantee the restored pavement surface for a period of two years. Should the pavement surface fail or exhibit displacement greater than ½ inch vertically during this period, the utility contractor will be required to restore the pavement surface.
- D. All overhead installations will comply with the current standards established by the FDOT SSRBC and FDOT Utility Accommodation Manual, latest edition, and National Electric Code, latest edition. Poles or other structures to support aerial installations shall be installed at the right-of-way line or as close as practical.
- E. Any deviation from approved materials, location or operation shall be grounds for stopping

work. Furthermore, work shall be allowed only after the installation is deemed acceptable.

- F. The following general provisions, including the proper sight distance requirements, shall be followed:
1. Light and utility poles shall be at least eighteen (18) feet from edge of pavement or at right-of-way line. Poles are permitted to within twelve (12) feet from edge of the travel lane, provided the pole is behind a barrier or a frangible base in accordance with the FDOT Design Standards Manual. A minimum distance of ten (10) feet will be required from the edge of pavement on deceleration and acceleration lanes. Where design permits, fourteen (14) foot clearance shall be used. In curb and gutter sections, set poles at the right-of-way line with a four (4) foot minimum from face of non-mountable curb to front of pole. Poles shall not be permitted in medians except for temporary construction purposes, and only if incorporated within a suitable barrier system.
 2. Non-single family mail boxes, newspaper boxes, fire hydrants, and other obstructions shall be placed on private property or at the right-of-way line where possible. Privately owned boxes, and other privately owned obstructions are placed at the owner's expense and liability, and shall be removed/ relocated if directed to do so by the City Engineer. Fire hydrants shall be placed no closer to the roadway than eight (8) feet unless otherwise approved by the City Engineer.
 3. Crossings (aerial) shall be in accordance with the National Electrical Safety Code, and the point of maximum design sag of the lowest attachment shall be a minimum of eighteen (18) feet over roadways and driveway crossings and shall not interfere with existing or planned signal installation. Crossings (underground) shall be at a minimum vertical clearance thirty-six (36) inches below top of roadway pavement or top of ground, whichever is lower, including ditch grade.
- G. Devices such as signal-strain poles, fire hydrants, 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.
- H. On projects where the four-foot minimum offset would place the utility or other obstruction in substantial conflict with the sidewalk/bikepath and, in the case of power poles, would create an unreasonable conflict with requirements of the National Electrical Safety Code and other alternatives are deemed impractical, the minimum may be reduced to 32" from back of curb. Each case where this deviation is proposed must be approved by the City Engineer.
- I. Where possible, excavation will not be allowed within four (4) feet of the edge of the pavement. This will necessitate that the utility be placed a sufficient distance from the pavement and excavation 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 two (2) feet of the back of the curb with special approval from the City Engineer.
- J. These criteria 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.

Section 4.03 Right-Of-Way Crossing Standards

Section 4.03.01 Streets Crossed Without Open Cutting of the Pavement

Generally, crossings under paved surfaces will be made without cutting the pavement. Pavement cuts will be considered only when pavement restoration will be accomplished using Thermal Bond Repair method and flowable fill and permission must be specifically granted on the permit. The primary consideration in evaluating results for any open street cuts will be the safety and convenience of the public.

- A. Subterranean crossings may be made by boring, jacking, pushing, pulling, driving or some combination of these having a positive horizontal and vertical control. Jetting, except for hydraulic compaction or tunneling is prohibited within City of Orlando right-of-way. Pits required for these crossings must be constructed no closer than six feet from the edge of the traveled way. If the crossing displaces the surface of the roadway by any measurable amount, that section of roadway plus 25 feet on either side of the crossing will be removed and reconstructed to City specifications by the contractor.
- B. Casings or conduits for crossings of planned or proposed roads, in planned rights-of-way, that are to be installed during the road construction by the road contractor will not require separate permit. However, they shall be installed in accordance with these regulations. If these crossings are to be installed by anyone other than the road contractor, separate permitting is required.
- C. All pipe must be jacked with the end open or bored-and-jacked and extended a minimum of six feet beyond the edge of the traveled way or as directed by the City Engineer.
- D. All such crossings shall be a continuous operation and be completed and the pits back filled prior to ceasing the operation.
- E. Casings will be required for underground utilities crossing under existing pavement where the carrier conduit is of insufficient strength due to composition or depth of cover.
- F. Casings shall be new prime steel pipe conforming to the requirements of ASTM Designation A-139. The minimum casing pipe size and wall thickness shall be as shown in Table 4.1 for the carrier pipe size indicated:

Table 4.1
Minimum Casing Pipe Diameter

Carrier Pipe (Nominal Size-Inches)	Casing Pipe (Outside Dia.-Inches)	Casing Pipe (Wall Thickness-Inches)
4"	12"	0.250"
6"	14"	0.250"
8"	16"	0.250"
10"	18"	0.250"
12"	20"	0.250"
14"	22"	0.250"

16"	24"	0.250"
18"	28"	0.312"
20"	30"	0.312"
24"	34"	0.375"

Section 4.03.02 Streets Crossed with Open Cutting in Pavement

The provisions set forth in this section shall be applicable to all underground piping installations, regardless of location, unless prior approval is received from the City Engineer for special design considerations. All construction shall be governed by OSHA Safety and Health Regulations for Construction and the Florida Trench Safety and Health Act shall be complied with at all times.

A. Materials

1. Wood sheeting, when left in place, shall be pressure treated. Prior to abandonment, the sheeting shall be cut to a level that is thirty-six (36) inches below the finished grade. Recommended for temporary use for private development and not in roadway.
2. Steel sheeting, when left in place, shall be as specified in ASTM A328. Prior to abandonment, the sheeting shall be cut to a level that is thirty-six (36) inches below the finished grade. For steel sheeting requirements see Section 8.

B. Workmanship

1. Utility Bedding

- a. Class B (Minimum Utility Bedding): The bottom of the trench shall be shaped to provide firm bedding for the pipe. The pipe shall be firmly bedded in undisturbed firm soil, or hand shaped unyielding material.
- b. Class A (Special Utility Bedding): Should special bedding be required due to depth of cover, impact loadings, or other conditions, "Class A" bedding shall be installed.

2. Unsuitable Material Below Trench Grade

Soil unsuitable for a proper foundation encountered at or below trench grade, such as muck or other deleterious material, shall be removed for the full width of the trench and to the depth required to reach suitable foundation material unless special design considerations received prior approval from the City Engineer. Contractor shall notify City Engineer whenever unsuitable material is observed.

3. Extra Utility Bedding Material

When rock or other non-cushioning material is encountered at trench grade, excavation shall be extended to 6 inches below the outside of the bottom of the utility, and a cushion composed of an equal mixture of sand and FDOT Number 57 stone shall be provided.

4. Sheeting and Bracing

In order to prevent damage to property, injury to persons, erosion, cave-ins or excessive trench widths, adequate sheeting and bracing shall be provided in accordance with OSHA regulations and The Florida Trench Safety Act.

5. Excavated Material

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

6. Material Disposal

Excess, unsuitable, and cleared or grubbed material resulting from the installation, shall be removed from the work site and disposed of at locations secured by the contractor. Excess material shall be disposed of in accordance with current City, County, State and Federal regulations.

7. Borrow

Should there be insufficient satisfactory material from the excavations to meet the requirements for fill material, borrow shall be obtained from a source secured by the contractor, and approved by the City Engineer.

8. Dewatering

All installations shall be laid dry unless otherwise approved by the City Engineer. A dewatering system shall be utilized in accordance with good standard practices and must be efficient enough to lower the water level in advance of the excavation and maintain it continuously to keep the trench bottom and sides firm and dry. A dewatering plan, showing the point of discharge and the method, shall be approved prior to construction. Dewatering permits must be obtained by FDEP and the applicable Water Management District in accordance with their respective requirements prior to start of work that requires dewatering. No polluted waters shall be discharged into sanitary sewers, stormwater systems, or waterbodies. Discharged waters may be subject to testing for compliance with FDEP and NPDES requirements.

9. Obstructions

It shall be the contractor's responsibility to be aware of all existing conditions by contacting Sunshine One-Call locates to locate all utilities along the proposed utility alignment in order to avoid conflicts. Where actual conflicts are unavoidable, work shall be coordinated with the facility owner and performed so as to cause as little interference as possible with the service rendered by the facility disturbed.

C. Backfill

All open cuts in the roadway section of the right-of-way within the City of Orlando shall be repaired using flowable fill as backfill. This controlled low strength material shall be designed to meet the FDOT SSRBC design standard.

Protective concrete slabs may be required for shallow installations and shall be approved by the City Engineer, to protect the installed pipe against excessive loads.

D. Roadway and Pavement Restoration

1. Where the only practical installation requires pavement removal, the following restoration policy shall apply:

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- a. Pavement or roadway surfaces cut or damaged shall be replaced by the contractor in equal or better condition than the original, including stabilization, base course, surface course, curb and gutter or other appurtenances and sidewalks. The contractor shall obtain the necessary permits prior to any roadway work. Additionally, the contractor shall provide advance notice to the appropriate authority, including Permitting Services, as required, prior to construction operations.
 - b. The materials of construction and method of installation, along with the proposed restoration design for items not referred to or specified herein, shall receive prior approval from the City Engineer.
 - c. Where existing asphalt pavement is removed; the surfacing material shall be saw cut prior to trench excavation, leaving a uniform and straight edge, with minimum disturbance to the remaining adjacent surfacing. Pavers in specialty streetscapes shall not be cut, but removed and replaced or reset back to original condition. The width of cut of this phase of existing pavement removal shall be the minimum necessary to allow for installation of the utilities. Surface restoration shall be performed by using the Thermal Bond method. Patching limits are to be determined during permitting application procedure. Longitudinal cuts to be restored to include a minimum width of one lane including lane lines. Transverse cuts will be restored including 25 feet on either side of the cut limit unless conditions dictate a more effective course of action. In some cases, it may be necessary to mill the existing asphalt surface around the perimeter of the restoration to match surface elevations.
 - d. Density test locations shall be random locations and shall be spaced not more than three hundred feet apart where the trench cut is continuous. Tests shall be required for each lane of the traveled way for the first lift, second lift and the base. For each 300-foot section, a minimum of one test per lane is required for the first lift (up to one foot above the utility). Testing for the second lift backfill under the traveled way shall be a minimum of one test per lane at two-foot vertical intervals for each crossing or 300-foot section.
 1. Tests for second lift backfill in other areas will be at the discretion of the City Engineer.
 2. A minimum of one density test per lane for the base course for each road crossing shall be required.
 3. Concrete compressive strength tests may be required at the option of the City Engineer.
 4. If any test results are unsatisfactory, the permittee shall re-excavate and re-compact the backfill at his expense until the desired compaction is obtained. Additional compaction tests shall be made to each side of an unsatisfactory test, as directed by the City Engineer, to determine the extent of re-excavation or re-compaction necessary.

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5. Open cuts of traveled ways of any size will require satisfactory density tests and submission of reports by a geotechnical engineer, licensed in Florida, to the City Engineer prior to resurfacing or final restoration.

Section 4.03.03 Canal and Ditch Crossings

- A. The minimum depth of cover for crossings under facilities identified as part of the City of Orlando's primary drainage system and City approved secondary facilities, which are of comparable size to the primary facilities, shall be 60 inches from the top of the pipe to the design or existing, actual canal or ditch bottom elevation, whichever is lower. The depth of cover for crossing under all other canals and ditches shall be 36 inches from the top of the pipe to the design or existing canal or ditch bottom elevation, whichever is lower.
- B. The minimum vertical distance for crossings over any waterways shall be 24 inches from the bottom of the pipe to the existing Base Flood Elevation. The 24 inch minimum vertical distance shall be implemented for the length of the crossing from the top of bank to top of bank. The crossing shall not increase the existing 100-year flood elevation. A childproof barrier shall be required for crossings over waterways. The crossing shall not impede maintenance equipment or maintenance operations or the waterways.

Section 4.04 Inspections

- A. The permittee shall notify the Permitting Services at least twenty four hours prior to beginning work and prior to commencing any subterranean road crossing whether by opening, Horizontal Directional Drill jack & bore or some combination of these. The contractor is to call the Prompt system at (407) 246-4444 for inspections. The Engineering Inspector will visit the site on which the work is to start. The inspector may check materials at this time.
- B. Underground facilities (buried cable, water lines, etc.) will not be covered until approved by the inspector. Cable facilities need not be left exposed when buried by the direct burial process when the contractor has provided references demonstrating capability of competence of construction standards. The City reserves the right to require exposure of installation to inspect correct depth of cover.
- C. Backfill, pavement cuts, restoration, testing, etc., will be inspected as outlined in the applicable section of this article.
- D. Failure of the permittee to obtain the appropriate inspections prior to proceeding with work shall not relieve the permittee from re-excavation or other measures necessary for the inspection of the work.
- E. All items found not to be in compliance with this section will be immediately corrected by the permittee.
- F. The plans and permit shall be kept on the site of the work until completion of the project. When permit has been issued, the approved permitted construction drawing shall be kept on site and shall be open to inspection by the City Engineer or duly authorized persons.

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- G. Work shall be considered to be active progress when the permit has received an approved inspection within 180 days.
 - H. When permit has been issued, the approved construction drawing shall be kept on site and shall be open to inspection by the City Engineer or duly authorized persons.

Section 4.05 Maintenance of Traffic

- A. Authorization is required for all construction or maintenance activities that require the closure of any street, travel lane, public alley or sidewalk within the City. Authorization can be obtained from the Transportation Engineering Services Division at (407) 246-3704. Authorization is not required under the following conditions:
 - 1. When construction or maintenance activities occur in a single lane and the duration of the restriction will not exceed 60 minutes as long as two-way traffic is maintained utilizing proper MUTCD traffic control devices and techniques. (Note: existing traffic conditions and location may result in work hour restrictions as determined by the City Transportation Engineer).
 - 2. During emergency conditions wherein health safety and welfare of the public is in jeopardy.
- B. Unless otherwise provided, all roads within the limits of the permit shall be kept open to all traffic by the permittee. When approved by the City Transportation Engineer, traffic may be bypassed over an approved detour route. The permittee shall keep the portion of the project being used by the public, whether it is through traffic or local traffic, in such condition that traffic will be adequately accommodated. The permittee shall furnish, erect and maintain barricades, warning signs, delineators, flagmen or pilot cars in accordance with the manual of uniform traffic control devices (MUTCD) published by the Florida Department of Transportation. The permittee shall also provide and maintain in a safe condition, temporary approaches or crossings and intersections with trails, roads, streets, businesses, parking lots, residences, garages and farms. The permittee shall bear all expenses of maintaining the traffic over the section of road undergoing construction and of constructing and maintaining such approaches, crossings, intersections and other features as may be necessary. Materials stored at the site of the work shall be placed so as to cause no obstruction to vehicular or pedestrian traffic.
- C. The Owner/Developer/Contractor is required to submit a Maintenance of Traffic (MOT) traffic control plan to the Transportation Engineering Services Division as an attachment to the construction permit plans submittal, for approval prior to commencement of construction activities on all roadways and within all rights-of-way within the corporate limits of the City of Orlando. This plan is required on all publicly owned roadways and any privately owned roadway that is accessed by the general public. The MOT plan submittal must be signed and sealed by a Professional Engineer registered in the State of Florida.
- D. Detour plan processing information for non-emergency road closures, such as described above, is available from the City Transportation Engineering Services Division.
- E. When an open cut of a city road has been authorized and a detour traffic route has not been requested or approved by the City Transportation Engineer, no lane closure will be

authorized prior to 9:30 a.m. or later than 3:00 p.m. without specific and individual approval. In the case of a two-way/two lane road, one lane traffic may be authorized during this period. In the case of a two-way/four lane road, two-way/two lane traffic will normally be required.

- F. Appropriate signage in conformance with the MUTCD will be required at all construction/installation sites within the road right-of-way.

Section 4.06 Restoration and Cleanup

- A. The permittee shall insure that all monuments, section corners and property marks shall be protected and perpetuated in accordance with the surveying standards established by this manual (see Chapter 5 Survey Standards).
- B. The permittee shall be liable for all damage, injury or loss to persons or property of any character resulting from any act of commission, omission, neglect or misconduct in the performance of work by the permittee, his employees or agents. The permittee shall be further liable for damage, injury or loss to persons or property arising from or as result of defective work or materials.
- C. Where any work disturbs the area outside the roadway, the permittee shall insure that the area is completely restored in a manner acceptable to the City.
- D. Existing utilities that are damaged, destroyed or temporarily removed by the permittee shall be replaced or repaired by the permittee at the direction of the owner with no expense to the City or the damaged utility owner.
- E. The permittee shall insure that work site cleanup and property restoration follows construction/installation operations without delay. In order to maintain an acceptable site, debris and waste material shall be removed from the site immediately and daily trenching shall be coordinated to provide a minimum overnight protected trench opening. Site maintenance, along with ongoing cleanup and final property restoration shall be subject to the direction and approval of the City Engineer.
- F. Restoration of sidewalks, concrete curb, driveways and similar items shall be subject to the following:
 - 1. Repair of these items requires that a saw cut be made at the nearest joints and all concrete within the area be removed and replaced with like material to a condition equal to or better than existing at the commencement of construction. In the event of longitudinal driveway cuts, the damaged concrete shall be removed and replaced to the first adjacent joint.
 - 2. Asphaltic concrete shall be repaired or replaced by saw cutting the asphalt and base for the entire width and replacing the base and asphalt in accordance with the open street cut requirements.
- G. Pavement markings shall be subject to the following:
 - 1. Utility companies or contractors having permitted construction within paved sections of roadways that disturb or destroy current pavement markings shall be

required to replace such pavement markings with approved reflectorized paint or plastic marking material as required by Chapter 8 of this manual and to restore such markings to their original condition.

2. When new turn, bypass, deceleration and/or acceleration lanes are to be constructed, a striping plan shall be included in the engineering submittal for approval by the Traffic Engineer. Striping shall be completed by the developer in accordance with the approved plans.
3. All markings due to utility locates are to be removed completely. Markings located outside of permitted area are to be removed as well. It is the contractor's responsibility to remove the markings.

Section 4.07 Safety and Convenience

The safety provisions of applicable laws, ordinances, building codes and construction codes shall be observed. Machinery, equipment and other hazards shall be guarded in accordance with the safety provisions of the Manual of Accident Prevention of Construction published by the Associated General Contractors of America, to the extent that such provisions are not in contradiction with applicable laws.

- A. The permittee will take all reasonable precautions for and be responsible for initiating maintaining and supervising all programs relating to the safety of all persons and property affected by or involved in the performance of his work under a Right-Of-Way Utilization Permit. The permittee will take all reasonable precautions to prevent damage, injury or loss to:
 1. All persons who may be affected by the performance of his work, including employees.
 2. All materials and equipment at the work site location.
 3. All property at or surrounding the work site.
- B. In any emergency affecting the safety of persons or property, the permittee will act with reasonable care and discretion to prevent any threatened damage, injury or loss.

Section 4.08 Landscaping and Irrigation Systems

- A. Landscaping and irrigation systems for work coming under this section shall be subject to the following general provisions:
 1. Installation of any landscaping and irrigation systems and/or related materials within dedicated or planned public rights-of-way is prohibited without the express approval of the City Engineer. This approval shall be based on the issuance of a Plumbing Permit for irrigation systems and an approved landscape plan for landscaping authorizing such installation or construction. The construction plans are to conform to the most current Florida Building Code. Maintenance of any of the aforementioned projects will be the sole responsibility of the system owner(s).
 2. Persons and equipment maintaining any authorized landscaping or irrigation systems must perform such maintenance work in a manner so as not to create safety

hazards or obstruct vision or normal traffic flow.

3. If, in the opinion of the City Engineer, damages in or adjacent to the right-of-way are deemed to have been caused by construction of a landscaping or irrigation system, restoration will be the responsibility of the permittee during and after construction and for the length of the required warranty period.

B. Landscaping under this section shall be subject to the following:

1. No landscaping or improvement to existing landscaping shall be authorized to be planted or constructed within the right-of-way unless construction plans have been approved by the City Engineer through the Permitting Services Division.
2. Landscaping in a median island and within one hundred feet of either end shall be installed at and maintained at a maximum height of twenty-four inches above road grade centerline. Normally trees will not be authorized to be installed in medians, unless clear recovery zone and clear sight distance requirements are met.
3. A four-foot mowing strip should be maintained between plantings and the curbs wherever possible.
4. No rocks, boulders, railroad cross ties, heavy timbers or other obstructions shall be used within the right-of-way without special and specific written permission.
5. For limited access divided highways or roads, or undivided highways or roads (four or more lanes) having a minimum design speed of fifty miles per hour, trees shall be a minimum of thirty feet from the edge of the through lane or eighteen feet minimum from the edge of an auxiliary lane.
6. On divided or undivided City highways or roads, trees will not be authorized to be planted in the clear recovery zone adjacent to the traveled way shown in the Manual of Uniform Minimum Standards for Design Construction and Maintenance for Streets and Highways (green book) as published by the Florida Department of Transportation.
7. Poisonous plants shall not be planted in any planned or dedicated public right-of-way.
8. Landscaping planned for either the parkway or median strip will not be authorized if, in the opinion of the City Engineer, such installation would create a safety hazard or sight obstruction. See section 4.02 for construction standards.
9. Root barriers may be considered if landscaping is installed within certain distances of City utility lines.

C. Irrigation systems coming under this section shall be subject to the following:

1. No irrigation systems or appurtenances thereto shall be placed within the right-of-way unless construction plans have been approved and a valid permit has been issued to a City or State licensed contractor. The construction plans are to

conform to the most current Florida Building Code.

2. The sprinkler system must be installed in such a manner so that it will not create a traffic or safety hazard.
3. Road crossings will be made in accordance with this chapter. Any deviation from these regulations shall result in issuance of a violation notice and possible revocation of the permit.
4. Minimum cover, other than under the road bed, for irrigation systems shall be twelve inches if piping is used and six inches if a feeder hose with drip line is used. Required cover of any irrigation system or appurtenances, under the road bed, may be found in this chapter.
5. No jetting (air, water, etc.) is authorized within any right-of-way in the City of Orlando.
6. Pumps, wells, electrical control devices and other associated items relating to irrigation systems, unless specifically approved by the City Engineer, will not be installed in public rights-of-way. When approved, all controllers, well heads and electrical control panels shall be enclosed in a below-grade vault, with a solid top flush with grade.
7. Irrigation systems will not be authorized, either in public rights-of-way or on private property, which are designed or constructed to irrigate parkway strips by directing water flow from sprinkler heads over sidewalks and/or bike paths. Unauthorized irrigation systems such as herein described will be subject to legal action and penalty as prescribed by law.

CHAPTER 5 - SURVEY STANDARDS

NOTE: *All surveys submitted to the City of Orlando require a raised embossed seal with signature or a verifiable digital document containing a digital seal and signature as defined in Florida Administrative Code 5J-17.062 for the survey to be considered valid.*

Section 5.01 Record Plat Review Process – Engineering Services Division

One of the functions of the City of Orlando Survey Services Section is to review Record Plats prior to approval by the City for conformance with the additional City of Orlando platting requirements, as well as conformance with Florida Statute (FS) Chapter 177 prior to final approval by the City Surveyor.

When plat review reveals errors and omissions, a letter detailing them will be sent to the Professional Surveyor and Mapper (PSM) signing and sealing the plat. Also comments are provided through ProjectDox, the City' digital review process. A copy will also be sent to the Plans Examiner processing the plat. If, during subsequent review, errors and omissions continue to occur, the PSM in responsible charge may be required to meet with the City Surveyor.

Prior to the field inspection of Permanent Reference Monuments (PRM's) the PSM in responsible charge will be contacted by the office of Survey Services and an inspection will be scheduled. If the field inspection fails, the PSM in responsible charge will be required to contact the office of surveying services and schedule a meeting at the site for additional inspections.

Section 5.02 City of Orlando Record Plat Requirements

The Permitting Services Division processes final record plats through the City agencies for review and approval and ultimate recording of the final mylar of the plat at the Orange County Comptroller's Office. A copy of our checklist used to review each plat can be found on the City of Orlando website, the end of this chapter and included with all subdivision applications. The checklist contains a summary of the requirements of FS Chapter 177 Parts 1 and 3, and additional plat requirements by the City of Orlando per FS 177.011. It is required that the Surveyor and Mapper in responsible charge acknowledge the use of our check list by submitting an executed copy, signed and sealed along with the plat submittal to the City of Orlando.

Section 5.03 As-Built Survey Requirements

Definition of As-Built Survey as defined in 5J-17.050 of the Florida Administrative Code: a survey performed to obtain horizontal and/or vertical dimensional data so that constructed improvements may be located and delineated; also known as a Record Survey.

Per 5J-17.052 of Florida Administrative Code:

Minimum Technical Standards (Standards of Practice): Specific Survey, Map, and Report Requirements. As-Built/Record Survey: (a) when performing as-built or record surveys, the surveyor and mapper shall obtain field measurements of vertical or horizontal dimensions of constructed improvements so that the constructed facility can be delineated in such a way that the location of the construction may be compared with the construction plans. (b) when the surveyor and mapper prepare as-built maps they will clearly show by symbols, notations, or delineations, those constructed improvements located by the survey. (c) All maps prepared shall meet applicable minimum technical standards. (d) The vertical and horizontal accuracy of the measurements made

shall be such that it may be determined whether the improvements were constructed consistent with planned locations.

- I. All development in the City of Orlando, both Public and Private require an As-built Survey.
 - A. All **PUBLIC** improvement projects constructed in the City of Orlando require an as-built survey prepared by a Florida Licensed Professional Surveyor and Mapper (PSM). The requirements have been commonly referred to as City Standards Section #01050, which is a reference to the front end documents of the City construction documents.

1. Scope of Work

- a. Provide surveying and field engineering services for the project:
 - i. Professional surveying and mapping work required for the execution of the contract, including verification of existing survey data, and production of the As-built Survey.
 - ii. Civil, structural or other professional engineering services required by the contract documents or as required in order to execute the Contractor's construction methods.
- b. Survey Services
 - i. The Contractor shall retain the services of a Florida Licensed PSM, who is licensed and approved by the City Surveyor, to provide professional surveying and mapping services to maintain survey control, layout and stake the layout needed for construction. This includes performing the progressive as-built survey during the construction process. A Final As-built Survey, signed and sealed will be required at the completion of the project.
- c. Field Engineering Services
 - i. The design for construction drawings (such as design of shoring, protection of existing structures and bracing for formwork) shall be designed, signed and sealed by a professional engineer licensed in the State of Florida.
 - ii. When requested by the Construction Manager or as specified in the contract documents, inspections or tests shall be performed under the supervision of a Florida licensed professional engineer. The licensed professional

engineer shall sign and seal these inspections or tests.

2. IMPLEMENTATION

a. Qualifications of Surveyor and Mapper

- i. The Florida Licensed PSM, who is proposed by the Contractor to provide services for the project, is subject to the approval of the Design Engineer and the City Surveyor. Prior to any services being performed, the Contractor shall submit the name and address of any proposed licensed professional and a written acknowledgement from the PSM stating that they have the hardware, software and adequate scope of services in their agreement with the Contractor to fully comply with the requirements of this specification. These submittals shall be provided to the Construction Manager prior to the Notice to Proceed. It is recommended that the PSM attend the Preconstruction meeting. It is mandatory that any PSM who has not previously performed work for the City in the past attend the Preconstruction meeting.

b. Project Survey Requirements

- i. The surveyor shall locate, reference and preserve existing horizontal and vertical control points, including any property corners shown on the construction plan drawings prior to starting any construction work. If the PSM performing the work finds any discrepancies that will affect the project, the Contractor must immediately report these findings to the Construction Manager and the City Surveyor. All survey work shall meet the requirements as defined in Florida Administrative Code 5J-17-050(10) as referenced in the beginning of this section. Reference and preserve all survey points during construction. If survey points are disturbed, it is the responsibility of the Contractor's PSM to reset the points at the Contractor's expense. Copies of the PSM's field notes and/or electronic files for point replacement shall be provided to the City Surveyor through the Construction Manager.

- a. The PSM shall locate all improvements for the project as-built survey using Florida State Plane Coordinates, Zone Florida East, North American Datum of 1983 for the horizontal datum and the North American Vertical Datum of 1988 for the vertical datum, with a reference to the horizontal control points and vertical benchmarks as referenced on the construction plans. The City will

provide the Contractor with electronic files of the construction plan drawings to be used by the PSM in complying with these specifications.

- b. The construction layout shall be established from the reference points shown or listed on the construction plan drawings. The accuracy of any method of staking shall be the responsibility of the Contractor. All construction layout staking shall be done such as to provide for easy verification of the work by the City. Maintain stakes and/or markings on the ground identifying the stations for the construction baseline at a minimum of 100-foot intervals or as required by the Construction Manager during construction.
- ii. Use survey control points to layout such work tasks as the following:
 - a. Clearing, grubbing, work limits, right-of-way lines and easements.
 - b. Foundations, column locations and all work associated with structures.
 - c. Locations for pipelines and all associated structures and appurtenances.
 - d. Road work:
 - i. Stakes for grading, fill, curbs, radii, sidewalks and all other work requiring specific horizontal and/or vertical alignment.
 - ii. Gravity utility pipe slope and invert elevations to assure precise location.
 - e. Locations and elevations required for any other Project work.
 - f. A Florida licensed PSM shall reference and replace any project control points, boundary corners, benchmarks, section corners, and any other control monuments that may be lost or destroyed, at no additional cost to the City. Establish replacement points based on the original survey control or as directed by the City Surveyor. Copies of all reference field notes

and/or electronic files for point replacement must be submitted to the City Surveyor through the Construction Manager.

- B. All **PRIVATE** development projects constructed in the City of Orlando require an as-built survey prepared by a Florida Licensed Professional Surveyor and Mapper (PSM). The requirements for the as-built survey are exactly the same as the requirements for Public Improvement projects except for the public construction requirements and the agreements between the PSM, the Contractor and the Construction Manager as defined in the previous section A.
1. A licensed PSM shall reference and replace any project control points, boundary corners, benchmarks, section corners and any other control monuments that may be lost or destroyed, at no additional cost to the City. Establish replacement points based on the original survey control or as directed by the City Surveyor. Copies of all reference field notes and/or electronic files for point replacement shall be submitted to the City Surveyor.
 2. The PSM shall locate all improvements for the project as-built survey using Florida State Plane Coordinates, Zone Florida East, North American Datum of 1983 for the horizontal datum and North American Vertical Datum of 1988 for the vertical datum, with a reference to the horizontal control points and vertical benchmarks as referenced on the construction plans.
- C. Accuracy of all constructed public stormwater and sanitary sewer improvements, and those connected to the public system, shall be within 0.5 feet (+/-6") horizontally and 0.2 feet (+/-2.4") vertically of the location depicted on the construction plan drawings. In no event, shall sanitary sewers be constructed on slopes flatter than the minimum slopes as stipulated in Chapter 9 of this manual, nor shall minimum clearance criteria be violated. For Public Improvement projects the Contractor shall require the PSM to include a statement on the as-built survey that all constructed improvements are within the specified tolerances unless specifically noted as not being within the construction tolerance. These variances shall be brought to the owner's attention with an asterisk and note next to the as-built information shown on the as-built survey. All as-built storm and sanitary improvements for both **PUBLIC** and **Private** construction must be drawn on a layer beginning with V-STRM for storm pipes, structures and hardware, and a layer beginning with V-SSWR for sanitary sewer pipes, structures and hardware.
- D. As-Built Survey Requirements for Both **Public** and **Private** Improvements
- a. The Contractor or developer shall require the Florida Licensed PSM to locate all improvements for the project as-built survey using Florida State Plane Coordinates, Zone Florida East, North American Datum of 1983, for horizontal datum and North American Vertical Datum of 1988 for vertical datum as referenced on the construction plans, unless another datum is

specified on said plans. This includes referencing the control points to the specified datum or datums upon which they are based. The Contractor or developer shall obtain an electronic copy of the construction plan drawing files for use as a base for the as-built survey for the PSM. The as-built survey shall clearly show the designed and constructed locations and vertical data for ease of comparison between planned and constructed improvements. This shall be accomplished by adding the as-built information on a separate CAD levels or layers, while keeping all the design call-outs and construct requirements visible in grayscale. The as-built information shall be labeled as such and be shown with a bolder text weight in order to be easily identifiable. The as-built survey shall include all storm and sanitary sewers and structures, clean-outs, potable and reclaimed water mains, meters, valves, force mains, gas mains, irrigation lines (2-inch and larger), process piping, electric and communication duct banks, traffic and pedestrian signals, pull boxes, cabinets, transformers, structures, drainage conveyance systems, retention ponds, fences, pavement, curbs, sidewalks, driveways, relocated utilities, appurtenances and buildings. All planned improvements referenced by station and offset on the plans, shall also be referenced on the as-built survey in the same manner. All constructed improvements that have location and/or elevation information called-out on the plans, shall have the same information identified on the as-built survey. If a structure information table was provided on the plans, then the as-built information shall be shown in the table. Design call-outs shall have a thin strike line through the design call-out and **all** as-built information must be labeled (or abbreviated "AB") and be shown in a bolder text that is completely legible. Pavement and drainage flow line elevation shots shall be taken at minimum 25' intervals and grade breaks. As-built survey shots shall be taken at the same locations as shown on the plans for ease of comparison. Any variations from required material sizes or types shall also be noted. All as-built storm and sanitary improvements must be drawn on a layer beginning with V-STRM for storm pipes and structures and a layer beginning with V-SSWR for sanitary sewer pipes, structures and hardware.

E. Submittal Requirements for Private As-built Surveys

- a. The developer shall submit an as-built survey signed and sealed on each page and also submit identically matching electronic files in PDF format and in the same CAD file format as the original design. The as-built survey may also be certified with a signature and seal on the cover, only if the certification includes the entire as-built survey and then denotes the pages upon which the certification covers. This includes indicating the horizontal and vertical locations of all constructed improvements. This must include sufficient information and notes to easily determine if the improvements were constructed in conformance with the construction plans approved by Permitting. All submittals shall include the construction plan's cover sheet and include the surveyor's statement regarding the constructed improvements located. The cover shall consist of the surveyor's identification and the name of the company clearly identified, an index of sheets containing as-built survey data, and the surveyor's

notes if using the cover as the certification for the entire as-built survey. If the cover certification is used, the surveyor's notes must state that the cover certification is for the entire as-built and must be accompanied with the rest of the sheets to be valid. In addition, the certification should clearly denote which pages the certification covers. If the cover certification is not used, all pages containing as-built information must be signed and sealed individually. Any page that does not contain as-built survey data shall have a note that states: "SHEET CONTAINS NO AS-BUILT DATA".

- a. The submittal must include drawing files with layers that are easily discernible and have reference files and other pertinent information included with the submittal. A signed and sealed document is required with each submittal.

F. Submittal Requirements for Public Improvement As-built Surveys

- a. The Contractor shall submit a copy of the current monthly updated as-built survey ("Progressive As-built Survey"), signed and sealed on each page and also submit identically matching electronic files in PDF format and in the same CAD file format as the original design. The as-built survey may also be certified with a signature and seal on the cover, only if the certification includes the entire as-built survey and then denotes the pages upon which the certification covers. The "Progressive As-built Survey" shall be submitted to the Construction Manager with each application for payment and indicate the horizontal and vertical locations of all constructed improvements to date. This must include sufficient information and notes to easily determine if the improvements were constructed in conformance with the contract documents. The "Progressive As-built Survey" submittals shall include the construction plan's cover sheet and include the surveyor's statement regarding the constructed improvements being within the specified tolerances or, if not indicating the variances as described below in paragraph I.c. The Contractor's submission of a "Progressive As-built Survey" or "Final As-built Survey", as applicable and acceptable to the Construction Manager and the City Surveyor, with its application for payment, is a condition precedent to the Engineer of Record's payment recommendation to the City, pursuant to Article 14 of the General Conditions. If no construction has been performed during the period, the Contractor shall provide documentation of such in accordance with the requirements of the Construction Manager. The cover shall consist of the surveyor's identification and the name of the company clearly identified, an index of sheets containing as-built survey data and the surveyor's notes if using the cover as the certification for the entire as-built survey. If the cover certification is used, the surveyor's notes must state that the cover certification is for the entire as-built and must be accompanied with the rest of the sheets to be valid. In addition, the certification should clearly denote which pages the certification covers. If the cover certification is not used, all pages containing as-built information must be signed and sealed individually.

Any page that does not contain as-built survey data shall have a note that states: "SHEET CONTAINS NO AS-BUILT DATA".

- b. The Contractor shall submit a minimum of three (3) signed and sealed sets of the final as-built survey incorporating all work performed under the Contract Documents ("**Final As-Built Survey**") with the application for final payment, as well as identically matching electronic files in PDF format and in the same CAD file format as the original design (Microstation or AutoCAD Civil3d). Electronic file submittals that have more than one file or a file for each plan sheet, shall have an index and/or a logical file name containing a description of the file's contents. The final conformed construction plan drawings shall be used as the basis for the as-built survey. The sets shall be in design plan format containing a complete set of all of the original plan sheets. The PSM shall only sign and seal those sheets containing as-built survey information. Failure to provide accurate survey information in the proper format requested may result in the City determining the as-built survey is incomplete.
- c. At Final Completion of the project, the Contractor shall submit field marked-up drawings showing all other constructed improvements not included in the as-built survey as required above. This includes improvements such as, but not limited to, irrigation lines smaller than 2-inches, sprinkler heads, miscellaneous wiring, site furnishings and traffic control loops. This only applies to variations from what is shown on the drawings. These mark-up drawings shall be compiled on a clean set of the original drawings.
- d. If unidentified utilities (not shown on the drawings) are encountered during the installation of the work, their horizontal and vertical location shall be included in the as-built survey. Provide the name and type of utility, the size and material type of pipe, conduit or structure and if known, the status (active or inactive) of the utility.
- e. The Contractor shall submit documentation to verify the accuracy of field surveying work at the request of the Construction Manager or City Surveyor.
- f. The Contractor shall submit certificate(s), signed by a licensed Professional Engineer or Professional Surveyor and Mapper, certifying that elevations and locations of improvements are in conformance with the contract documents, or if not in conformance, certify as to variances from the contract documents. The Professional Engineer must have a note stating that the information certified is based on an as-built survey.

Section 5.04 City Surveying Services Resources

Professional Surveying and Mapping services are performed at the direction of the City Surveyor to support City Staffs and Departments. The City Surveyor prior to commencement must approve requests for services.

Copies of benchmarks, historical surveys, field notes, right-of-way maps, as-builts, site plans, control points and data may be available on the Survey Services web site and/or upon request at (407) 246-2788 and/or from Engineering Records at (407) 246-3267.

Section 5.05 Disturbance of Surveying Monuments

If any surveying monuments and/or control points located within the City limits are to be disturbed during a development project, the following procedures shall apply:

- A. The developer shall notify the City Surveyor of the planned disturbance in writing, at least 24 days prior to commencing construction.
- B. Prior to commencement of development, the City Surveyor or his designee, shall at the developer's expense; establish reference ties to said monument(s) outside the limits of the proposed development area, and may, at the City Surveyor's discretion, remove the monument. Copies of field notes and/or digital files shall be submitted to the City Surveyor.
- C. Within 14 days following completion of development, the developer shall notify the City Surveyor of said completion, in writing.
- D. Within 90 days following receipt of notice of completion of development, the City Surveyor or his designee, shall at the developer's expense reinstall said monument(s) at its original or appropriate offset position. If State Plane Coordinate Values were assigned to the monument(s), State Plane Coordinate Values shall, at the developer's expense, be established on the new position to Second Order, Class II accuracy and published by the City Surveyor.
- E. If any Orange County Geographic information System monument is disturbed in violation of the procedure above, it shall be considered a violation of this Chapter subject to Code Enforcement in accordance with Chapter 5 of City Code. In such cases, the property owner and developer/builder shall be held jointly and individually responsible.

Section 5.06 Platting Requirements

All subdivision and record plats submitted to the City of Orlando must conform to Florida Statute Chapter 177 Part I and Part III, in addition to any additional municipal requirements granted in s. 177.071. Additional City platting requirements can be found in Chapter 65 of the City of Orlando Municipal Code.

Section 5.07 Florida Statute 177 Part III Certification of Corners

1) Every surveyor and mapper not under contract to the department for the execution of this act who, in any survey or resurvey made under his or her direction, identifies, recovers, reestablishes, re-monuments, restores, or uses as control a public land survey corner or corner accessory must, within 90 days after completion of the survey, file with the department a certified corner record for each such corner or corner accessory, unless the corner or its accessories are substantially as described in a previously filed corner record. The record shall be signed, embossed with the official seal of the surveyor and mapper, and produced on material suitable for reproduction or microfilming. The 90-day limitation may be extended with permission of the department. All such certified corner records shall be accepted and filed with the department without further inspection or approval of any public body or officer, if prepared in accordance with the criteria set forth in subsection (3).

2) In every case in which a certified corner record of a public land survey corner is filed under the provisions of this act, the surveyor and mapper must reconstruct or rehabilitate the monument of such corner and accessories to such corner, so as to make them as permanent as is reasonably possible and to facilitate their location in the future.

Section 5.08 City of Orlando Official Survey Services Plat Check List

City of Orlando Additional Surveying Requirements For Plats Per Florida Statute 177.011

- 1. The plat contains a metes and bounds legal description of the parent tract including the area.
- 2. The plat boundary is tied to 2 public land survey corners as defined in FS 177.503 and CCR numbers shown.
- 3. Copies of closure report for the parent boundary and all interior parcels and easements are included and have a relative error of closure no less than 1' in 10,000'.
- 4. A Location map including North arrow, scale and adjacent streets is included on the cover sheet.
- 5. All text is a minimum size of .10"
- 6. The sheet size is 24" x 30" with no less than ½" margins on the top, bottom and right sides and 3" margin on the left side.
- 7. The scale of the plat is 1"= 200' or larger.
- 8. 4" X 4" X 24" concrete monuments including a metal cap marker stamped PRM with an LB or LS number must be placed at each change of direction along the parent boundary of the plat. When right-of-way dedications are being made the monuments shall be placed at the intersection of the parent boundary and the new right-of-way. The City Surveyor prior to submittal must approve any variation of this additional requirement.
- 9. The boundary survey must be supported by the title opinion or certification submitted with the plat and must include the zone classification for the parent boundary as designated on the most current FEMA FIRM.
- 10. The title opinion shall be of an attorney at law licensed in Florida, or a certification by an abstractor, or a title company referencing that record title to the land as described and shown on the plat is in the name of the person, persons, corporation, or entity executing the dedication. The title opinion or certification shall also reference all mortgages not satisfied or released of record, nor otherwise terminated by law. The title opinion or certification shall also reference all existing easements and encumbrances of record.
- 11. Chapter 59 Statement shown on Cover sheet.
- 12. A Topographic Survey of the parent parcel based upon NAVD 88 datum is included in the submittal.
- 13. The primary name of the subdivision shall be shown in the dedication with a font clearly different than the word "Dedication"
- 14. Orange County 911 shall approve the subdivision name and all street names prior to being shown upon the plat. Verification of Plat Names should be made in the Orange County Comptrollers Public Records search to confirm there isn't a plat with the same name prior to submittal.
- 15. All Contiguous property including Streets shall be labeled with Plat Book and Page, Document number and/or instrument number. This includes labeling documents creating the Streets and labeling "Not Platted" for any streets that were not created by plat. Any recording information is welcome.
- 16. All lots shall be numbered either by progressive numbers or, if in blocks, progressively numbered in each block beginning with the number "one".17.
- 17. A copy of the Statement of Lien Settlement must be provided to the Office of Permitting Services Division prior to recording of the plat.

Signature of Surveyor and Mapper Preparing Plat (Seal)

Date

CHAPTER 6 - SITE DEVELOPMENT STANDARDS

Section 6.01 Clearing and Grubbing

The work covered by this section consists of clearing and grubbing and the removal of the resultant products and debris within the areas of the rights-of-way, easements and all other construction areas. Dust control is mandatory. All appropriate permits shall be obtained prior to start of activity. Tree removal permits can be obtained by Parks and Recreation.

A. Clearing and Grubbing

Existing trees and other vegetation that are designated to remain shall be protected in accordance with Chapter 60 of the Code of the City of Orlando. Contractor is to trim, protect, and leave standing desirable trees. Trim branches of trees extending over the roadway area to give a clear height of 16 feet above roadway.

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 FDEP 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 two feet below the subgrade.

B. Disposal of Materials

Materials shall be disposed of in accordance with current City, County, State and Federal Regulations. All clearing and grubbing within the City of Orlando will comply with FDOT Standard Specifications for Roadway and Bridge Construction, most current edition.

Section 6.02 Earthwork

The work covered by this section 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.

All earthwork within the City of Orlando will comply with FDOT Standard Specifications for Road and Bridge Construction and FDOT Design Standards for Design, Construction, Maintenance and Utility Operations on the State Highway System, most current edition.

Section 6.03 Subgrade

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

All subgrade installed within the City of Orlando will comply with FDOT Standard Specifications for Road and Bridge Construction, most current edition. Limerock Cement Base is allowable upon review and acceptance of specification.

Section 6.04 Soil Cement and Limerock Cement (Durarock) Base

The work specified in this section consists of the construction of a base course composed of a combination of soil, portland cement and water; proportioned, mixed, shaped, compacted, finished and cured in accordance with these specifications and in reasonably close conformity with the lines, grades, thickness and typical cross sections shown in the plans. Soil cement shall meet a compressive strength of 300 psi, minimum.

All soil cement installed within the City of Orlando will comply with FDOT Local Agency Specifications, most current edition.

Section 6.05 Limerock Base

The work specified in this section 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.

All limerock base installed within the City of Orlando will comply with FDOT Standard Specifications for Road and Bridge Construction, most current edition.

Section 6.06 Graded Crushed/Reclaimed Concrete Aggregate Base

Use graded crushed reclaimed concrete aggregate material as a 1:1 substitution for the base thickness, provided the crushed concrete has a Limerock Bearing Ratio of 120 when compacted to a minimum of 98% of the Modified Proctor maximum dry density (ASTM D 1557). The material must also meet the following gradation criteria: produced by City of Orlando/Orange County approved sources, which yields a satisfactory mixture meeting all of the requirements of these specifications.

Use graded crushed concrete aggregate base material of uniform quality throughout, that is free from organic matter, shale, lumps, remnant steel, clay balls, and having a Limerock Bearing Ratio value of not less than **120**.

Graded crushed concrete aggregate base material shall meet the following gradation:

Sieve Size	Percent by Weight Passing
2 Inch (50.0 mm)	100
3/4 inch (19.0mm)	65 to 95
3/8 inch (9.5 mm)	40 to 85
No. 4 (4.75)	25 to 65
No. 10 (2.00 mm)	20 to 50
No. 50 (300 mm)	5 to 35
No. 200 (75 mm)	0 to 10

Graded crushed concrete aggregate may be referred to hereinafter as “aggregate.”

The Contractor may use graded crushed concrete aggregate from any of the approved sources, but only from one supplier on any one Contract, unless approved by the Engineer. The reclaimed concrete aggregate gradation shall be sampled by a licensed geotechnical engineer at the source and laboratory tested before it is delivered to the site in order to obtain initial approval from the City. Further quality control testing shall be performed at the frequencies specified below to ensure that the delivered and placed product complies with these specifications. The reclaimed concrete aggregate base shall be asbestos-free, non-plastic and free of all materials that fall under the category of solid waste or hazardous materials as defined by the State of Florida and the City of Orlando. Reclaimed concrete aggregate base shall meet all Florida Department of Environmental Protection permit requirements which pertain to construction demolition and recycling of these materials. Reclaimed concrete aggregate base shall be substantially free of other deleterious materials which are not classified as solid waste or hazardous materials. The following limits shall not be exceeded:

Bituminous Concrete	1% by weight
Bricks	1% by weight
Wood or other organic substances	0.1% by weight
Heavy metals (except lead)	0.1% by weight
Lead	5 parts per million
Reinforcing steel and welded wire fabric	0.1% by weight
Plaster or gypsum board	0.1% by weight

The reclaimed concrete aggregate gradation shall be verified again on the first load delivered to the site, and thereafter at a frequency of one gradation per 200 cubic yards. The LBR testing shall be performed at a frequency of one test per 400 cubic yards of material delivered to the site.

Section 6.07 Prime and Tack Coats for Base Courses

The work specified in this section 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. All limerock, soil cement, and crushed concrete aggregate base courses are to be primed and tack coated.

All prime and tack coats installed within the City of Orlando will comply with FDOT Standard Specifications for Road and Bridge Construction, most current edition.

Section 6.08 Asphalt Pavement Surfaces

The work specified in this Section consists of the application of an asphaltic concrete surface course composed of a mixture of aggregates and, if necessary, mineral filler and asphalt cement to produce the desired stability 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.

All asphalt pavement installed within the City of Orlando will comply with FDOT Standard Specifications for Road and Bridge Construction, FDOT Design Standards for Design, Construction, Maintenance and Utility Operations on the State Highway System, most current edition and FDOT Local Agency Specifications, most current. Type S-1 and S-III structural/surface courses are acceptable provided they conform to the latest edition in which they are referenced.

Section 6.09 Concrete Pavement Surfaces

Rigid pavement consists of constructing 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 incidental necessary for the proposed rigid pavement construction in accordance with the approved drawings and specification.

All rigid pavement installed within the City of Orlando will comply with FDOT Standard Specifications for Road and Bridge Construction, FDOT Design Standards for Construction, Maintenance and Utility Operations on the State Highway System, most current edition.

Section 6.10 Pavement Design

Pavement sections proposed for construction shall be supported by a pavement design signed and sealed by a Professional Engineer registered to practice in the State of Florida. The pavement design should consider future traffic loading as well as construction traffic. Drainage will be considered critical, particularly where stabilized subgrades are utilized and where water is imported for irrigation on medians and parkways. Where seasonal high groundwater levels are within two-feet of any base layer or irrigated medians and parkways are planned, the addition of strip drains and underdrain sections to prevent water from damaging pavement layers will be required.

A minimum of 1 ½ in. initial lift is required for type S Asphalt Concrete. For private development and public improvement projects where vertical construction is occurring (large development projects), the contractor shall place the initial lift then once vertical construction is completed the

final lift shall be placed. A final inspection of all pavement will be done in conjunction with the final building inspection.

Minimum structural number for all flexible pavements is 2.1.

Section 6.11 Brick Paving Surfaces

The work specified in this section shall govern the installation of brick paving within roadways and other vehicular traveled areas including but not limited to driveways and parking areas. Brick paving will not be allowed within handicap parking stalls or the sidewalk section of driveways.

A) Materials

1. Brick

New 2- $\frac{3}{4}$ " bricks shall be purchased from a City approved source, by the Contractor. Bricks shall meet the requirements outlined in ASTM C-1272 "Standard Specifications for Heavy Vehicular Paving Brick", Type F. All colors and textures of bricks/pavers shall be approved by the City Engineer or his Designee for compatibility with pavement markings. Other approvals may be required from the Downtown Development Board, Historic Preservation Board and/or the Appearance Review Officer. For work on private parking lots and driving areas, other standards may apply.

2. Subgrade

A minimum 12-inch thick stabilized subgrade shall be required. The stabilized subgrade shall have a minimum Limerock Bearing Ratio of 40. Generally, local materials shall be tested for compliance with the required Limerock Bearing Ratio. If the natural soils do not meet the required stability, uniformly mix to sufficient depth cohesive borrow material for stabilization with the in-place soils to produce the required bearing value. Compact the stabilized subgrade in both the cut and fill areas to a density of 95% minimum density as required by AASHTO T-180. The subgrade shall be shaped to within 1/4 inch of the cross section grade shown on the drawings prior to making the density tests. Density tests shall be performed before other work proceeds. The required density and cross section shall be maintained until the material has been spread.

3. Base Course

The base course, if required, shall comply with the appropriate sections of this manual.

4. Setting Bed

The setting bed shall be carefully screened, leveled, and compacted prior to receiving the brick. The sand used in the bedding course should be washed, angular sand conforming to Table 6.1. Bedding sand conforming to ASTM C 33 Specifications for Concrete Aggregate is recommended. Limestone screenings should not be used as they do not compact uniformly, are normally too soft, are moisture sensitive, and

some may cause staining to the brick pavers.

Table 6.1 Bedding Course Sand

Sieve Size	Percent Passing
3/8 in. (9.5 mm)	100
No. 4 (4.75 mm)	95 to 100
No. 8 (2.36 mm)	80 to 100
No. 16 (1.18 mm)	50 to 85
No. 30 (600 um)	25 to 60
No. 50 (300 um)	10 to 30
No. 100 (150 um)	2 to 10

B) Construction

The brick shall be set 1/2 inch higher than the planned final grade. When laying the brick, allow a 1/16 inch joint between the bricks for layout of full and half courses. The brick shall be hand cut and fitted hand tight with joints not to exceed 3/16 inch for cut brick only. Vertical joints shall not exceed 1/4 inch. Compact brick with a dual drum, hand operated, vibratory roller. The surface plane for finished work shall not exceed a tolerance of 1/2 inch in 10 feet when tested with a 10 foot straightedge.

1. Local Streets

Local streets, as defined in Chapter 8 of this manual, may be constructed using 2 3/4" brick over a 1 1/4" bedding sand layer over an approved subbase.

2. Collector Streets and Above

Collector streets and above, as defined in Chapter 8 of this manual, must include a 6" limerock base course between the subbase and bedding sand layer.

C) Joint Treatment

A dry mixture of jointing sand shall be swept over the paved surface in two directions until all joints are filled. The surface shall then be flooded with water at low pressure. This procedure shall be performed at least twice or until the joints have a smooth full surface.

All sand shall be removed from paved area after the joint treatment by thoroughly sweeping the entire work area and removing from the site.

Table 6.2
Jointing Sand

Sieve Size	Percent Passing Natural Sand	Percent Passing Manufactured Sand
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No. 4 (4.75 mm)	100	100
No. 8 (2.36 mm)	95 to 100	95 to 100
No. 16 (1.18 mm)	70 to 100	70 to 100
No. 30 (600 um)	40 to 75	40 to 75
No. 50 (300 um)	10 to 35	20 to 40
No. 100 (150 um)	2 to 15	10 to 25
No. 200 (75 um)	-	0 to 10

Section 6.11.01 Abandonment of Brick Streets

Within ninety (90) days of the City Council Abandonment approval the owner/developer shall be responsible for the removal, shrink-wrapping and palletizing of all bricks. The bricks shall be delivered to the City's brick stockpiles on metal pallets by contacting the Streets and Stormwater Division at (407) 246-2238 for delivery information.

Section 6.12 Sidewalks/Bike Paths, Concrete Curb, Etc.

The work specified in this section consists of the construction of curb, curb and gutter, or sidewalks/bike paths of portland cement concrete, and specialty treatments if specified. Such work shall be constructed in accordance with this Manual and in conformity with the lines, grades, dimensions and notes shown on the plans. Sidewalks/bike paths shall have a minimum of 1/4 inch per foot positive slope from the top of curb or edge of pavement including any parkway between the roadway or curb and the sidewalk, unless otherwise specifically approved by the City Engineer.

All curbs, curb and gutters, or sidewalks/bike paths installed within the City of Orlando will comply with FDOT Standard Specifications for Road and Bridge Construction, FDOT Design Standards for Design Construction, Maintenance and Utility Operations on State Highway Systems, most current edition.

A. Curbs and Gutters

Type D concrete curb and FDOT Type F concrete curb and gutter are preferred in the City of Orlando. FDOT types A, B and D are acceptable for median curb conditions with no drainage conveyance related purpose. The use of Type D curb will only be approved where the longitudinal pavement edge slope exceeds 0.50%. The minimum longitudinal slope for all pavement is 0.30%. Type E concrete curb may be used on the outside margins of raised medians, gutter pan shall outfall to match the pavement cross slope. A vertical concrete curbing or an approved equivalent shall be required along the perimeter of all paved areas within the proposed project for drainage, landscape, protection, and traffic control. Where no curb is required due to pavement cross-section (e.g., inverted crown), the use of ribbon curbs is required.

B. Handicap Ramps

In 1993 the Florida Legislature enacted the "Florida Americans with Disability Accessibility Implementation Act." The purpose and intent of this Act (Sections 553.501 – 553.513, Florida Statutes) is to incorporate into the laws of Florida the accessibility requirements of the Americans with Disabilities Act of 1990, Public Law No. 101-336, 42 U.S.C. Section 12101 et. Seq. ADA, while at the same time to maintain those provisions of Florida law that

are more stringent than the ADA accessibility guidelines, that is, those provisions which are more favorable to the needs of the disabled. In 1997 the legislature amended the Act to complete the move to establish consistency of the Florida accessibility building code to the Federal ADA Accessibility Guidelines as adopted by the Department of Justice at 28 CFE part 36, Appendix A. Nothing in Section 553.501 – 553.513 is intended to expand or diminish the defenses available to a place of public accommodation under the Americans with Disabilities Act and the federal Americans with Disabilities Act Accessibility Guidelines, including, but not limited to, the readily achievable standard, and the standards applicable to alterations to places of public accommodation.

Ramps shall be required at all intersections and be in compliance with Americans with Disability Act (A.D.A.) guidelines as prescribed by law. 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. Landings shall be provided at the tops of curb ramps. The landing clear length shall be 48 inches minimum. In areas of heavy pedestrian traffic, or where sidewalk cafes, streetscape standards or other obstructions require it, the landing dimension may be increased to 60 inches. The landing clear width shall be at least as wide as the curb ramp, excluding flared sides, leading to the landing. In alterations, where there is no landing at the top of curb ramps, curb ramp flares shall be provided and shall not be steeper than 1:12. Curb ramps and the flared sides of curb ramps shall be located so that they do not project into vehicular traffic lanes, parking spaces, or parking access aisles. Curb ramps at marked crossings shall be wholly contained within the markings, excluding any flared sides.

Ramps shall be constructed in accordance with the FDOT Roadway and Traffic Design Standards and the Florida Accessibility Code for Building Construction, most current edition. Placement of ramps shall be coordinated with the City Engineer.

Any raised islands in crossings shall be cut through level with the street and have curb ramps at both sides. Each curb ramp shall have a level area 48 inches long min. by 36 inches wide min. at the top of the curb ramp in the part of the island intersected by the crossings. Each 48 inch min. by 36 inch min. area shall be oriented so that the 48 inch min. length is in the direction of the running slope of the curb ramp it serves. The 48 inch min. by 36 inch min. areas and the accessible route shall be permitted to overlap.

C. Wheel Stops

Protective concrete curbing will be provided along the perimeter of all paved parking and storage areas, except as the City Engineer determines to be unnecessary or impractical. Concrete wheel stops will be required in areas where continuous curb is deemed unnecessary or impractical.

D. Protective Barriers

In conditions where the horizontal and vertical distances of the walkway surface of egress are deemed unsafe by the City Engineer or an authorized representative, the contractor shall install a protective barrier (handrail, guardrail, barrier wall) to ensure public safety. The contractor must safeguard the path of travel from a building and any hazardous conditions.

Section 6.13 Chain Link Fence

The work specified in this section consists of furnishing and erecting chain link fence in accordance with the lines, grades, notes and typical sections shown in the plans. 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.

All chain link fence and gates installed within the City of Orlando right-of-way shall be FDOT "Fence Type B" as specified in FDOT Roadway and Traffic Design Standards, most current edition. 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. Other standards may be approved on a case-by-case basis.

Section 6.14 Erosion and Sedimentation Control

Sediment is defined as solid material having a particle size of 0.02 millimeters or greater, including, but not limited to, all organic and non-organic substances and debris. Erosion is the process of transporting these deleterious substances from one location on the surface of the land to another location by the dynamic force of moving air or water.

Erosion during and immediately following the construction phase is a major contributor to the siltation of drainage ways, swamps and lakes and is a major factor in the degradation of the water quality in these water bodies. The eroded soil not only clogs drainage ways and reduces holding capacity of retention/detention facilities, but also transports organic debris and chemical nutrients to water bodies, reducing water quality and contributing to subsequent eutrophication. Stormwater control measures to minimize the impact of this erosion sedimentation shall be incorporated in the plan of development for all projects in the City of Orlando, and detailed description of these measures included with the final engineering plans submittal.

Section 6.14.01 Temporary Erosion Control

An erosion control plan and a detailed description of the measures to be undertaken during construction to control erosion within the limits of the project and to prevent the deposition of sediments in off-site systems or receiving water bodies will be submitted with the final engineering plans of the development. Off-site activities during the construction phase like placing construction trailers, staging, satellite temporary employee parking areas, etc. will require having a complete erosion control plan. Modifications to the SWPPP and NPDES may be required.

A. Erosion Control Plan

The erosion control plan, details and calculations shall document all the measures necessary to limit the transport of sediments outside the limits of the project to that volume and amount existing prior to the commencement of construction. Provision must be made to preserve the integrity and capacity of check weirs, sediment basins, slope drains, grading patterns, etc. to meet this requirement throughout the construction.

The erosion control plan shall be drawn to an appropriate scale and shall include sufficient information to evaluate the environmental characteristics of the affected areas, the potential impacts of the proposed grading on water resources, and measures proposed to

minimize soil erosion and off-site sedimentation. The owner/developer shall perform all clearing, grading, drainage, construction, and development in strict accordance with the approved plan. In addition, the following information shall be included in an erosion control plan.

1. A project narrative.
2. An attached vicinity map showing the location of the site in relationship to the surrounding area's watercourses, water bodies and other significant geographic features, and roads and other significant structures.
3. An indication of the scale used.
4. The name, address, and telephone number of the owner and/or developer of the property where the land disturbing activity is proposed.
5. Contours for the existing and proposed topography.
6. The proposed grading or land disturbance activity including: the surface area involved, excess spoil material, use of borrow material, and specific limits of disturbance.
7. A clear and definite delineation of any areas of vegetation or trees to be saved.
8. A clear and definite delineation of any wetlands, natural or artificial water storage detention areas, and drainage ditches on the site.
9. A clear and definite delineation of any one hundred (100) year floodplain on or near the site.
10. Storm drainage system, including quantities of flow and site conditions around all points of surface water discharge from the site.
11. Erosion and sediment control provisions to minimize on-site erosion and prevent off-site sedimentation, including provisions to preserve topsoil and limit disturbance.
12. Design details for both temporary and permanent erosion control structures.
13. A chronological construction schedule and time frame including, as a minimum, the following activities:
 - a. Clearing and grubbing for those areas necessary for installation of perimeter erosion control devices.
 - b. Construction of perimeter erosion control devices.
 - c. Remaining interior site clearing and grubbing.
 - d. Installation of permanent and temporary stabilization measures.

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- e. Road grading.
 - f. Grading for the remainder of the site.
 - g. Utility installation and whether storm drains will be used or blocked after construction.
 - h. Building, parking lot, and site construction.
 - i. Final grading, landscaping or stabilization.
 - j. Implementation and maintenance of final erosion control structures.
 - k. Removal of temporary erosion control devices.
- 14. A signed statement on the plan by the owner, developer, and contractor that any clearing, grading, construction, or development, or all of these, will be done pursuant to the plan.
 - 15. A description of, and specifications for, sediment retention structures.
 - 16. A description of, and specifications for, surface runoff and erosion control devices.
 - 17. A description of vegetative measures.

The applicant may propose the use of any erosion and sediment control techniques in a Final Plan provided such techniques are proven to be as or more effective than the equivalent best management practices contained in the standards specified in this manual.

Erosion and sediment control measures are to be placed prior to soil disturbance or as the first step in construction. These measures must remain in place and maintained in good condition until construction is complete, soils are stabilized and vegetation has been established.

Erosion control is performance based, so measures additional to what is indicated on approved plans may be needed as required to prevent off-site impacts.

B. Stockpiling Material

No excavating material shall be stockpiled in a manner as to direct runoff directly off the project site or into any adjacent water body or stormwater collection facility.

C. 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 by wind and/or water erosion.

D. 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. This includes inlets and catch basins on the project site and those offsite that receive runoff from the project site.

E. Perimeter Control

Properly trenched silt fence or other approved perimeter controls shall be placed along all perimeters of the project site, which is down gradient of any disturbed soil. Projects adjacent to wetland areas must use staked turbidity barriers as control measure to prevent fine sediment particles from entering wetland.

F. Daily Inspections

Daily inspections shall be made by the contractor to determine the effectiveness of erosion/sediment control efforts. Any necessary remedies shall be performed immediately.

G. Construction Entrances

All designated entrances and exits for the construction site shall be stabilized using filter fabric and gravel or other pre-approved methods to prevent off-site tracking of sediments.

The contractor shall promptly remove all mud, dirt or other materials tracked or spilled onto existing public roads and facilities, due to construction.

H. Dewatering Activities

Dewatering activities will not result in any discharge of turbid water from the project site. To be in compliance, water must be 29 NTU (Nephelometric Turbidity Units) above natural background conditions. Dewatering permits from FDEP and the applicable Water Management District must be obtained prior to City granting permission to discharging into public system. If analytical results from groundwater samples determine that site is contaminated, a City Wastewater Industrial Waste Pre-Treatment Groundwater Permit must be obtained for proper disposal into City Sanitary system.

At all times during excavation, installation and construction, contractors must keep excavations free from standing water and stabilize trenches and embankments to prevent collapse, soil erosion and transport.

When required, sumps shall be located outside of load-bearing areas so bearing surfaces remain undisturbed. The contractor is responsible for obtaining all dewatering permits from the Florida Department of Environmental Protection (FDEP) and the applicable water management district prior to discharging groundwater into a public system or natural conveyance.

Prior to initiating any work, groundwater samples must be analyzed to ensure that no contamination or unacceptable pollution constituent levels exist per FDEP's current, published discharge standards. All collection, reporting and records retention methods,

required by FDEP, must be adhered to. Prior to discharging groundwater into the City's stormwater systems or natural conveyances, permission must be received by the City Stormwater Compliance Section, and will be based on analytical results of the proposed untreated discharge water.

If sampling identifies contamination, the contractor must obtain a City Wastewater Industrial Waste Pre-Treatment Groundwater Permit for proper disposal into the City's sanitary system. Dewatering activities must not result in any discharge of turbid water from the project site into the public system. To remain in compliance, discharges must not exceed 29 NTU's (Nephelometric Turbidity Units) above natural conditions in a receiving surface water body. Following the completion of dewatering activities, contractors must completely fill all well point holes with flowable fill or pea gravel.

I. Temporary Protection

All temporary protection shall be maintained until permanent measures are in place and established.

1. Temporary Seeding

Areas opened by construction operations and that are not anticipated to be dressed and receive final grassing treatment within thirty-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 a minimum of 30 pounds per acre.

2. Temporary Seeding and Mulching

Slopes steeper than 6:1 that fall within the category established in note A. above shall additionally receive mulching of approximately 2 inches loose measure of mulch material cut into the soil of the seeded area to a depth of 4 inches.

3. Temporary Grassing

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

4. Temporary Regrassing

If, after fourteen-days, the temporary grassed areas have not attained a minimum of 75% good grass cover, the area will be reworked and additional seed applied sufficient to establish the desired vegetation cover.

J. 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.

Section 6.14.02 Permanent Erosion Control

The erosion control facilities of the project should 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, and discharge facilities from these basins shall be provided with a skimming device to trap floatable debris.

All permanent soil erosion control measures for all slopes, channels, and any disturbed land areas shall be completed within 15 calendar days after final grading.

A. Permanent Seeding

All areas, which have been disturbed by the construction, will, as a minimum, be seeded. Seed shall have minimum 90% purity and 85% germination as indicated on the label. If necessary, the application of amendments, such as dolomitic limestone will be used to correct the Ph factor to within the limits of 6.0-7.0. The grass seed shall be uniformly spread at the following rates while the soil is moist:

Bahia grasses	10 lb/1000 ft ²
Bermuda grass	2 lb/1000ft ² (hulled) or 4 lb/1000 ft ² (un-hulled)
Carpet grass	2 lb/1000ft ²
Centipede grass	2 lb/1000ft ²

The grass seed mixture shall include the addition of 30 parts rye in the winter season. Soils should be scarified prior to seeding and rolled after seeding to achieve a uniform firm planting bed and reduce erosion. Any fertilization shall conform to label rates or recommended rates supplied by County Extension Service based on site-specific soil test.

B. Permanent Seeding and Mulching

In addition to the minimum requirement of A. above, slopes of 6:1 to 4:1 inclusive will be mulched with a uniform thickness of approximately 2 inches, loose measure, of mulch material incorporated into the soil by mixing to a depth of 4 inches.

C. Permanent Sodding

All retention/detention basins shall be sodded at least down to the normal water line. All exposed areas within public rights-of-way will be solid sodded. Other areas with slopes steeper than 4:1 will be sodded. Contractor will be responsible to maintain all sodded areas until firmly rooted and accepted by the City.

D. Strip Sodding

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

E. Regrassing

All grassed areas will 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 re-grassed.

F. Additional Fertilization and Soil Amendments

Grassed areas not accepted within 90-days of their completion shall require soil test to determine soil amendments or proper fertilizer application required for establishment of turf grass. Soil amendments of fertilizer will be used as needed to establish the turf grass.

CHAPTER 7 - STORMWATER MANAGEMENT

Section 7.01 Introduction

The purpose of this chapter is to provide criteria for the design, rehabilitation and review of existing and/or proposed stormwater management systems within the limits of the City.

- A. All construction requires a building permit from the City of Orlando. The applicant shall submit four (4) copies of the following information for review:
1. Existing lot topographic survey and proposed lot grading plan must be submitted for all new single family dwelling units, duplex family dwelling units, and residential additions. If lot-grading change is proposed or existing drainage patterns are altered, the site plan shall be designed to accommodate existing drainage patterns and ensure future drainage does not adversely impact adjacent properties. Drainage and site plans shall be signed and sealed by an engineer registered in the State of Florida. Survey data shall be gathered to least 25 feet from property line or as far offsite as required to assure offsite drainage patterns are maintained and been able to design adequate drainage conveyance systems as applicable.
 2. Maintain post-development stormwater runoff discharge rates to pre-development runoff discharge rates, especially when existing drainage flows from one private property to another.
 3. Site grading shall not impede, concentrate or re-route existing drainage from adjacent properties. If fill is to be added, grades on neighboring properties must be obtained to document potential impacts to these properties. To import dirt or fill within city infill lots is discouraged. A detailed drainage/grading plan and site plans shall be signed and sealed by an engineer registered in the State of Florida if any cut/fill or addition/modifications to existing drainage systems is proposed.
 4. Roof drainage must be collected and conveyed to gutters on lots for which the side yard setback is less than ten feet. Site plan must show where the roof downspouts are located. These downspouts should direct the water away from the building and adjacent lots. Connection of roof drains directly to the storm sewer may be required. Any connections to the gutters through the curb face shall be with ductile iron pipe from back of sidewalk to curb face.
 5. Design the drainage for sheet flow to lawn or pervious landscaped areas of the site. Stormwater ponds are not allowed on residential lots, but this shall not preclude the use of Low Impact Development (LID) standards.
 6. Sod or other approved ground cover must be installed at time of final inspection.

B. Redevelopment Projects

Any proposed project to be built in the City of Orlando which alters the existing topographic characteristics will be required to conform to the requirements of this chapter. Projects which

meet one of the following requirements will be exempt from the stormwater management permitting requirements of this chapter.

1. Lots, parcels, units, etc., which are part of a larger tract which has an approved drainage plan in conformity with this chapter;
 2. Consists only of landscaping or resurfacing elements that do not alter surface drainage patterns.
- C. Projects which satisfy all of the following requirements will be exempt from the stormwater detention requirements of this chapter. Stormwater treatment by retrofitting to provide retention volume for pollution abatement will still be required where:
1. The increase in runoff volume (during a 25-year, 24-hour storm) caused by development is less than the volume required for pollution abatement; and
 2. Project is not located in a natural water body, floodplain or any other area of critical environmental concern; and
 3. Project consists entirely of redevelopment of existing impervious surfaces.

For redevelopment projects, stormwater management facilities for pollution abatement shall be provided for all contiguous properties under a single ownership to the extent that surface drainage is altered. Pollution abatement criteria shall be in accordance with the criteria of the applicable water management district for new development.

Alterations of surface drainage (with the exception of resurfacing and landscaping elements only) is defined as: changing the flow patterns within the redevelopment area; changing the mode of transport from overland flow or open channel to a closed conduit, etc.; changing an impervious surface's character (from building to parking, wet bottom pond or a new building or vice versa); changing the character of a parking surface (from shell base to asphalt, etc.); or remodeling of an existing building which changes its footprint or number of floors.

D. Outside Agency Coordination

While this Chapter is intended to be the minimum standard, guidelines and criteria for the design of stormwater management systems in the City of Orlando, other regulatory agencies and/or governmental entities by State statutes or by political boundaries also have jurisdiction. Most of these agencies or governmental entities have established design criteria for stormwater management.

In some cases, established design parameters of those agencies contain conflicting standards or criteria. In the case of conflicting criteria, it is the intent of this Manual to have the most stringent regulations govern.

The following agencies and governmental entities may have jurisdiction within the City of Orlando:

- South Florida Water Management District
- St. Johns River Water Management District
- Florida Department of Transportation

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- Florida Department of Environmental Protection
 - Orange County Environmental Protection Department
 - Orange County Public Works Department
 - U.S. Army Corps of Engineers

Section 7.02 Submittal Requirements

A. Pre-application Conference

The Consultant may, if desired, meet with a City representative in order to discuss the potential development and the desired approach to stormwater management. Contact the Permitting Services to schedule a meeting. Information the consultant will be required to bring to a meeting includes:

1. A general location map delineating the project and other physiographic information (i.e., nearby streets, storm drainage and water bodies).
2. A map of the project and vicinity at a scale no smaller than 1" = 200', unless otherwise approved by the City Engineer, which shall show the following information:
 - a. Project boundary.
 - b. Existing topography of the project at one (1) foot contour intervals and, if relief is slight, additional spot elevations so that existing drainage patterns can be clearly established. Contours shall extend at least twenty-five feet beyond all property lines, or to roadway centerlines, whichever is greater, but in any event shall extend sufficiently beyond project limits so that drainage patterns can be discerned. Also contained on this map shall be the receiving storm drainage system, and the names of the water body and major watershed to which the project contributes. Off-site drainage entering the site in the pre-development condition shall be incorporated into the stormwater management system or routed around the system on the applicant's property or other legally established route. Off-site flood elevations cannot be made worse in any circumstance.
 - c. The drainage boundary of the area of any lands outside the project limits contributing runoff to the project. Under no circumstance will new development be allowed to alter off-site drainage, both upstream and downstream, unless mutually agreed to by the City and all affected property owners.
 - d. Soil types on-site, including hydrologic classification.
 - e. 100-year flood elevation and boundary (if applicable) for the project.
 - f. Preliminary pre-development runoff analysis in accordance with the applicable section of this chapter.

B. Preliminary Engineering Submittal

A preliminary engineering submittal for (design review only) will contain the following minimum information for review:

1. A drawing of the proposed land use and land cover, including acreage and percentage of impervious surfaces.
2. Description of vegetative cover. Wetland areas should be identified.
3. Proposed construction phase(s) of project (if applicable).
4. Proposed developed drainage basin boundaries, showing the direction of flows; areas of each basin; percentage each of soil classification within each drainage basin; and off-site drainage areas which will be contributing flow to the site.
5. Rights-of-way and easements for the system (if applicable).
6. Location of stormwater retention and detention facilities, including size, design capacity, side slopes, depth of pond and retained/detained stormwater under design conditions. Requested information may be conceptual given the nature of a preliminary submittal.
7. Off-site receiving system(s) for the discharge(s) from the project. Discharge from the site shall be at tailwater conditions defined in Section 7.04.
8. Location and size of internal storm drainage facilities.
9. Typical roadway widths for each street classification, including cross slopes. Inlet locations.

C. Final Engineering Submittal

Final stormwater management plans and specifications with the design analysis will be submitted for an Engineering Permit and shall include as a minimum the following:

1. Geotechnical report
2. Pre-development and post-development runoff calculations including:
 - a. Runoff characteristics (e.g., runoff curve number or runoff coefficient).
 - b. Normal wet season water table elevations.
 - c. Curve number selection and infiltration potential shall be based on a recommendation from an on-site analysis of site soils by a qualified geotechnical engineer. Infiltration potential and the extent of each soil type found on the site must be included.
 - d. Time of concentration calculations. A minimum time of concentration of fifteen minutes shall be used for single-family or

duplex residential developments, and ten minutes for all other developments.

- e. Design storm, including duration, frequency, precipitation and type of distribution.
3. Stage-storage computations of any storage areas such as retention/detention facilities used, including the computations showing the effect of a 100-year storm, of a duration to be determined at the pre-application conference.
4. Stage-storage-discharge computations for any retention/detention facilities at the control point (e.g., weir), including the computations showing the effect of the 100-year storm.
5. Drawdown curve for retention/detention facilities to substantiate design, including water balance analysis and a complete soils study by a qualified geotechnical engineer.
6. Water surface profiles in all drainage systems (for projects greater than 10 acres in area) for the design storm event(s).
7. A description of the methodology, assumptions, parameters, and a copy of all such computations used to analyze the system shall be included with the submittal. A copy of the computer printout shall be submitted to the City. Software used in the development of the application, if not an acceptable industry standard, shall be submitted to the City Engineer for approval.
8. Complete description of measures to be implemented during the construction period to mitigate adverse quantity and quality impacts off-site.
9. Any temporary construction which may affect the on-site and/or off-site stormwater management system prior to completion of the project.
10. Computations showing that the spacing of inlets is in conformity with the maximum allowable water spread on pavement as defined in Section 7.05.
11. A certification signed by the Engineer, licensed in the State of Florida, responsible for the design which will read as follows:

"I hereby certify that to the best of my knowledge and belief, the design of the Stormwater Management System for the project known as: (Project Name) meets all of the requirements and has been designed substantially in accordance with the City of Orlando Stormwater Management Criteria."
12. A statement designating the proposed entity (if not the City of Orlando) which will be responsible for the operation and maintenance of the Stormwater Management System. Attached to the statement will be a

defined maintenance and funding program to ensure said system will function for the purpose for which it was intended. If the entity responsible for the operation and maintenance is not the entity for which the engineering plans, specifications and design analysis was submitted, then prior to plan approval, a letter will be also required stating who the entity will be and its agreement to conform to the defined maintenance program.

Section 7.03 Monitoring

All new stormwater retention/detention facilities will be evaluated by the City Engineer for the system's ability to prevent degradation of receiving waters. If deemed necessary by the City Engineer, a water quality monitoring program may be required.

A. Required Monitoring Program

If the City Engineer requires a water quality monitoring program, the permittee will be advised in writing. Reasons for a monitoring program include, but are not limited to, the following:

1. Indications are that the pollution abatement practices incorporated into the design of the drainage system are not functioning properly.
2. Degradation of quality in receiving waters, regardless of the pollutant removal efficiency of the drainage system.

The reason for monitoring requirement will be explained by the City Engineer's letter.

B. Sampling Schedule

Although specifics may vary from project to project, samples will normally be collected at discharge locations. A typical sampling schedule will consist of samples collected once per month during the wet season; however this may vary among projects. Some permittees may be required to collect samples during storm events in addition to monthly sampling. Rate of discharge at the time of sample collection and total monthly discharge each month for the duration of the permit may also be required. Parameters of interest will normally include those listed in Chapter 17-3, Florida Administrative Code, plus the nutrients nitrogen and phosphorus.

C. Time Limits of Monitoring Program

The water quality monitoring program shall be determined by the City Engineer and shall continue until such time as it can be determined that the facility is functioning as intended. If not functioning as intended, the owner shall be required take corrective measures to alleviate the problems.

D. Future Monitoring Requirements

Projects not requiring monitoring at time of approval may have monitoring requirements imposed in the future. If water quality problems develop, permittees may be required to determine the quality of stormwater water they are discharging to the City system.

Section 7.04 Stormwater Management System Components

The criteria contained in this section are intended to provide the designer with guidelines to establish design storm conditions while meeting the primary goal of accomplishing the City of Orlando's stormwater management objectives.

The design for stormwater management systems are herein organized according to the following hierarchy:

1. Pollution Abatement & Flow Attenuation
2. Flood Prone Areas
3. Primary Conveyance Facilities
4. Secondary Conveyance Facilities
5. Tertiary Conveyance Facilities
6. Roadway Conveyance

Private stormwater systems are any stormwater management systems designed to treat developed property including internal roadways, parking, sidewalks, landscaping and building areas.

Primary water control facilities are named lakes, regional stormwater management facilities as designated by the City of Orlando and the conveyance facilities that connect them.

Secondary conveyance facilities are all stormwater systems that drain areas greater than ten acres and are not part of the primary system as defined above.

Tertiary conveyance facilities are all stormwater systems that drain areas smaller than ten acres.

Roadway conveyance facilities are the surface components of roadways that are intended to remove and convey stormwater runoff from traveled areas of roadways. The ability of urban roadways to effectively remove and convey stormwater runoff is governed by inlets and surface geometry of the roadway.

Section 7.04.01 Pollution Abatement & Flow Attenuation

All projects constructed in the City of Orlando, except those specifically exempted in Section 7.01, will be required to provide a stormwater management system for pollution abatement and flood protection. The system shall conform to the design requirements of the water management district within which the property is located, with the following exceptions:

St. Johns River Water Management District

Flow attenuation for the 25-year, 24-hour storm will be required on projects for which SJRWMD requires a permit, but does not require this evaluation.

For wet detention facilities, littoral zone requirements will not be waived in lieu of providing additional permanent pool volume.

South Florida Water Management District

No exemption from pollution abatement requirements will be provided for rooftops, non-vehicular impervious surfaces, or water management areas or water features having permanent water surfaces.

Dry detention is not allowed. Wet detention shall be constructed in accordance with the requirements of SJRWMD, with the exception that littoral zone requirements will not be waived in lieu of providing additional permanent pool volume.

Section 7.04.02 Flood Prone Areas

The floodplain is that area subject to inundation during the 100-year; storm event or as delineated on the official Flood Insurance Rate Maps. The floodway is that portion of the floodplain that must remain clear of encroachment in order to limit the increase in flood stage to one foot.

Encroachment will be allowed within the one hundred (100) year floodplain, when accompanied with the creation of compensating storage.

1. All development within or affected by the 100-year floodplain as delineated on the official Flood Insurance Rate Maps (FIRM), or as determined by the City Engineer, shall comply with the following requirements:
2. The proposed finished floor elevations shall be a minimum of one foot above the Base Flood Elevation (BFE) of the floodplain within which said floor elevations lie or to which they are hydraulically connected, and at least one foot above the 100-year flood elevation of the stormwater pond if not an established BFE.
3. For commercial or industrial developments, flood proofing may be substituted in lieu of elevating the lowest floor.
4. Compensating storage must be provided for all floodwater displaced by development below the elevation of the 100-year flood. Generally, compensating storage must be calculated between the existing 100-year flood elevation and the wet season water table elevation. The latter elevation must be determined by a qualified geotechnical engineer, and this report shall identify the historical wet season water table; recommend bottom elevations for compensating storage areas; and address the ability of said areas to remain available for floodwater storage. Overland connection to the floodplain (no piped connections) is required unless separation between floodplains already exists. Potential compensating storage in stormwater ponds between the maintained water elevation and main control structure elevation shall not be considered unless it can be demonstrated that this volume is available for floodwater storage.
5. Special attention must be given to the project area's relationship with the floodplain. An "active" site contributes a pre-development runoff volume in excess of that which is stored on the site during the 100-year storm. A "passive" site contributes a runoff volume less than that which is stored on the site during the 100-year storm. Passive sites must provide special

assurances that encroachment is not occurring due to the construction of the development or its ponds. Compensating storage may be claimed in the retention/detention ponds provided it is above the maintained water elevations, and berm elevations are such that the pond system can be inundated during the 100-year storm and still provide 25-year flood protection.

6. No development will be permitted in any Area of Special Flood Hazard designated as an unnumbered A Zone (no base flood elevation established) until a Letter of Map Revision or Conditional Letter of Map Revision is approved by FEMA.
7. No development will be permitted in the designated floodway.

Section 7.04.03 Primary Conveyance Facilities

Primary conveyance facilities are defined as systems designated as outfalls from, or connections between, natural lakes and artificial regional detention facilities. When the proposed facility is designed as, or becomes a part of, a primary conveyance facility, the following criteria shall be used for design purposes.

A. Design Storm

A 25-year, 24-hour storm event (rainfall depth 8.60 inches) shall be used for primary conveyance facilities design. In addition, a check of the system using a 100-year, 3-day event shall be made to determine the flood stage resulting from the system's design.

Design storm rainfall distribution for the 25-year, 24-hour event shall be in accordance with the water management district within which the project is located. Pre- and Post-development hydrologic analyses must use the same rainfall distribution.

B. Flow Determination Design flows may be determined in any of the following ways:

1. Flow Gage Data - Actual recorded flows may be used for design discharge. An accepted frequency statistical analysis must be performed on the data to determine the 25-year, 24-hour occurrence.
2. Santa Barbara Urban Hydrograph Method.
3. SCS Unit Hydrograph Method.
4. Other recognized hydrograph methods.

Pre- and Post-development hydrologic analyses must use the same hydrograph method.

C. Design Tailwater Conditions

Design tailwater conditions shall be based on the average of the maintained water and the 25-year, 24-hour peak stage, provided this elevation is not lower than the main weir crest elevation.

D. Maximum Hydraulic Grade Line

When designed as a storm sewer system along a roadway, primary conveyance facilities shall be designed such that the 25-year, 6-hour hydraulic grade line does not exceed the gutter elevation.

E. Antecedent Moisture Condition (AMC)

All runoff calculations shall be based on Antecedent Moisture Condition (AMC) II.

Section 7.04.04 Secondary Conveyance Facilities

Secondary conveyance facilities are drainage systems, not defined as primary, in the City of Orlando which drain areas greater than 10 acres. The following hydrologic design parameters shall apply to secondary conveyance facilities.

A. Design Storm

A 10-year; 6-hour storm event (rainfall 5.2 inches) shall be used for secondary conveyance facilities, with a 25-year, 6-hour storm event (5.7 inches) used as a check.

Rainfall distribution for the 6-hour storms shall be the SCS Type B distribution or the Orange County distribution.

Pre- and Post-development hydrologic analyses must use the same rainfall distribution.

B. Flow Determination

The design flow may be determined by one of the following accepted methods:

1. Santa Barbara Urban Hydrograph Method
2. SCS Unit Hydrograph Method
3. Other recognized hydrograph Methods

Pre-development and post-development hydrologic analyses must use the same hydrograph method.

C. Design Tailwater Conditions

Design tailwater conditions shall be based on the average of the maintained water elevation and the 25-year, 24-hour peak stage, provided this elevation is not lower than the main weir crest elevation.

D. Maximum Hydraulic Grade Line

For 10-year, 6-hour design conditions, the maximum elevation of the hydraulic grade line shall be no closer than 1.0 foot below the gutter elevation for any inlet in the project system. In addition, the system shall be checked for a 25-year, 6-hour storm event. The hydraulic grade shall not be higher than the gutter elevation for this event.

E. Antecedent Moisture Condition (AMC)

All runoff calculations shall be based on AMC II.

Section 7.04.05 Tertiary Conveyance Facilities

Tertiary conveyance facilities are defined as systems which have a total drainage basin area equal to or less than 10 acres. The following design criteria shall be used for tertiary conveyance facilities.

A. Design Storm

The design storm shall be based on a 10-year storm event.

1. The Rational Method (rainfall intensity for 10-year storm)
2. Santa Barbara Urban Hydrograph Method (10-year, 6-hour design storm)
3. Other recognized hydrograph methods
4. Pre- and Post-development hydrologic analyses must use the same hydrograph method and rainfall distribution.

B. Flow Determination

1. The Rational Method
2. Santa Barbara Urban Hydrograph Method
3. Other recognized hydrograph methods

Pre and Post development hydrologic analyses must use the same hydrograph method.

C. Design Tailwater Condition

Design tailwater conditions shall be based on the average of the maintained water level and 25-year, 24-hour peak stage, provided the resulting elevation is not lower than the main weir crest elevation.

D. Maximum Hydraulic Grade Line

For 10-year design conditions, the maximum allowable hydraulic grade line shall be 1.0 foot below the gutter elevation. A system check for the 25-year, 6-hour storm will allow the hydraulic grade line at the gutter elevation.

Section 7.04.06 Roadway Conveyance Facilities

Roadways constitute the most upstream components of engineered stormwater collection systems, and as such, must adhere to certain design criteria. Roadways, as defined in Chapter 61 of the Orlando

City Code, shall be designed under the following criteria:

A. Design Storm

Roadway design shall be based on the following:

1. Arterial Streets - 10-year occurrence or 10-year, 6-hour storm event.
2. Collector Streets - 5-year occurrence or 5-year, 6-hour storm event.
3. Minor Streets - 3-year occurrence or 3-year, 6-hour storm.

Pre-development and post-development hydrologic analyses must use the same rainfall distribution.

B. Flow Determination

Flows may be determined by the Rational Formula or other hydrograph methods.

C. Flow Spread

Under design conditions, flow will be allowed to spread a maximum of 12 feet in the outside travel lane. Under no circumstance will the flow be allowed to exceed a clearance of one inch from the top of curb.

Section 7.05 Hydraulic Design Criteria

This section shall be utilized in the design of the collection and conveyance portion of any stormwater management facility to be constructed and to be maintained by the City.

Section 7.05.01 Roadway (Pavement) Drainage Design

Good pavement drainage design consists of the proper selection of grades, cross slopes, curb types, inlet locations, etc., to remove the design storm rainfall from the pavement in a cost-effective manner while preserving the safety, traffic capacity and integrity of the highway and street system. Additionally, drainage design shall also consider the protection and convenience of pedestrian traffic.

These factors are generally considered to be satisfied, provided that undue spreads of water are removed from the vehicular and pedestrian traveled ways and that siltation at pavement low points is not allowed to occur. The guidelines included herein will accomplish these objectives.

A. Minimum Groundwater and High Water Clearances

All arterial, collector, and local streets shall be designed to provide a minimum of two feet (2') between the bottom of the base to a standing surface water condition or seasonal high groundwater table. A standing surface water condition is considered to be surface water remaining in drainage ways one week. A seasonal high groundwater table is defined as that which occurs during the wettest portion of the year. Any water surface encroachment within 2 feet of the bottom of the base course will require the construction of an underdrain system. Additionally, no inlet shall be placed lower than one foot above the main weir crest in the receiving water.

B. Minimum Roadway Grades

A minimum grade of 0.30% where curb and gutter is proposed or 0.50% for vertical curb sections shall be maintained for all longitudinal slopes and 0.50% for all curb returns.

C. Minimum Roadway Cross-Slope

For drainage purposes, minimum cross slopes and/or super elevation rates of 0.0208 ft/ft (1/4"/ft) shall be utilized for design of all roadways.

D. Curb and Gutter

All highways and streets within the City of Orlando shall utilize an approved curb or curb and gutter section as a means of conveying runoff from pavement and abutting lands to inlet structures. When used on the high side of a roadway, the gutter shall slope in the same direction as the pavement.

E. Open Roadway Ditches or Swales

Open roadway ditches or swales are not considered as an acceptable method of conveying pavement runoff and other stormwater when used parallel to the roadway. Open ditches or swales may be used as outfalls for storm sewer systems, if they meet the definition and criteria set forth by the appropriate water management district.

F. Design Frequency

The design frequency to be utilized for the design of pavement drainage shall be as follows:

Arterial Streets	10-year occurrence or 10-year, 6-hour storm;
Collector Streets	5-year occurrence or 5-year, 6-hour storm;
Local Streets	3-year occurrence or 3-year, 6-hour storm.

G. Runoff Determination

The peak rates of runoff for which the pavement drainage system must be designed may be determined by the Rational Method.

H. Stormwater Spread into Traveled Lane

Inlets shall be spaced at all low points, intersections and along continuous grades so as to prevent the spread of water from exceeding tolerable limits. The acceptable tolerable limit within the City is one travel lane width. For two-lane roadways with 24 feet of pavement, a twelve-foot (12') spread measured from the face of curb is considered acceptable. For multi-lane facilities with no paved shoulders, a twelve foot (12') spread is also considered the maximum spread. For roadways with parking lanes or paved shoulders, the maximum spread shall be measured from the face of curb to the centerline of the outermost lane. However, the depth of flow at the gutter shall be such that one inch of clearance is maintained between the top of curb and design water surface.

I. Allowable Length of Gutter Flow to First Inlet

A maximum distance of four hundred feet (400') shall be allowed for flow in a curb and gutter section to the first point of removal from the pavement by an inlet. A lesser distance may be dictated by the water spread criteria included above. No impervious area in excess of 0.5 acre shall be allowed to sheet flow onto public right-of-way and shall be intercepted by

inlets at the right-of-way line.

J. Inlet Types

The curb inlet types to be used in the City shall be Inlet Types 1 through 6 depending on site constraints. Inlet details can be found in FDOT Design Standards Manual.

K. Materials

Concrete shall be Class I and have a minimum compressive strength of 3000 psi at 28 days. The mortar for masonry shall be of portland cement and sand mixed in the proportions of one part cement to three parts of sand. At the option of the Contractor, high early strength cement may be used.

L. 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 the ESM that structures be constructed of precast concrete or cast in place concrete. All clay brick used shall conform to the current ASTM Designation C-55 Grade P-11.

M. Precast Inlets and Manhole

Precast manholes, inlets and junction boxes shall be in accordance with FDOT Standard Specifications for Road and Bridge Construction, current edition. Top elevation adjustment of the manhole top shall be adjustable between six inches and twelve inches using precast concrete rings, cast in-place concrete or bricks laid in place with mortar. Vertical walls of manhole entrances shall not exceed 19 inches in length including the ring and cover.

N. Placing Pipe

The inlet and outlet pipes shall be constructed 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.

O. Flow Channels

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. 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. Channelization shall not be required if in conflict with the installation of gates or valves required by permit or for periodic maintenance.

P. Manhole Covers and Rings

Covers and rings for stormwater manholes shall conform to Pamrex model number CDPA60EH. Except for private systems, the cover shall have the wording and logo "City of Orlando" and application cast in the top in accordance with the ESM Details. The application wording shall state "Storm Sewer".

Q. Minimum Inlet Interception Rates

All inlets shall be located such that a minimum of 80% of the approaching gutter water flow is intercepted by the inlet with no more than 20% of the flow bypassing the inlet.

R. Low Point Inlets

All inlets at low points (sumps) shall be designed to intercept 100% of the design flow without exceeding the allowable spread of water onto the traveled lanes as defined above. On

arterial and collector roadways, in order to prevent siltation and to provide for a safety factor against clogging of a single inlet in a sump location, the applicant shall construct multiple inlets at all sump locations. Preferably three inlets should be constructed on each side of the roadway, one at the low point and one on each side at a point 0.2 feet higher than the low point. This multiple inlet sump design is also desirable but not mandatory on local streets.

S. Miscellaneous Inlet Placement

For maintenance purposes, no curb inlets shall be placed within the radius of curb returns, and the applicant must demonstrate adequate protection of inlets from damage.

For curb returns with radii less than 30 feet, a 30 foot radius shall be assumed to determine inlet placement. Inlets shall be placed to intercept flow prior to pedestrian crossing or bicycle facilities. Inlets shall be placed at all points where the cross slope on a roadway reverses from a negative to a positive to prevent stormwater from crossing the roadway. No stormwater runoff will be allowed to sheet flow into the roadway gutter from impervious areas outside of the roadway limits larger than one-half acre. This flow will be intercepted by inlets prior to or at the right-of-way line.

T. Valley Gutters

The use of valley gutters to convey stormwater across and/or through intersections is prohibited. Valley gutters may be used at locations where alleys intersect streets but only to convey flow parallel to the street.

Section 7.05.02 Storm Sewer Design

The purpose of this section is to outline, in general, the criteria governing the design of all storm sewer systems constructed within the City of Orlando. These criteria are intended to govern not only new systems being constructed by governmental agencies and private developers, but also the analysis and/or redesign of existing systems. The designer is encouraged to utilize the latest design data and information available. However, in those cases where it differs significantly from that included herein, approval from the City Engineer must be received prior to plan submission or more preferably at the pre-application conference.

A. Design Discharges

The determination of design flows for a storm sewer system serving any classification of facility shall be in accordance with the methods and procedures as set forth in Section 7.03.

B. Materials and Installation

All storm sewer piping materials installed within the City of Orlando will comply with FDOT SSRBC and FDOT Roadway and Traffic Design Standards, most current edition. Only rigid pipe material shall be allowed beneath publicly maintained roadway pavement.

Any contractor installing HDPE pipe or other flexible pipe on private development within the City of Orlando will be certified by the pipe manufacturer as qualified to install said piping material. A copy of the certification must accompany the engineering permit submittal. See laser profiling requirements of this chapter.

All pipe joints for all types of pipe and pipe material shall be wrapped per FDOT Design Standard Manual Index Number 280.

C. Minimum Pipe Size

The minimum size pipe to be used in storm sewer systems is 15 inches in diameter. Designs shall be based upon six-inch increments in sizes above 18 inches.

D. Maximum and Minimum Pipe Slopes

All storm sewers shall be designed and constructed to produce a minimum mean velocity of 3.0 fps. No storm sewer system or portion thereof will be designed to produce velocities in excess of 10 fps.

E. Maximum Lengths of Pipe

The following maximum runs of pipe shall be used when spacing access structures of any type.

Pipe Diameter*	Maximum Run
Less than 24"	300 feet
24" or Larger	400 feet

*(Or minimum dimension of elliptical pipe or box culvert)

F. Miscellaneous Minimum Pipe Clearances

The following minimum clearances shall be used when determining pipe elevations. Should it be impossible to maintain these separations, then adequate means must be utilized to protect both the storm sewer system and the obstructing facility.

Description

Bottom Roadway Base to Outside Pipe	1.0 ft.
Between Storm Sewer and Other Utility or Obstruction	1.0 ft.
Intersecting Manhole, Sanitary Line to Bottom of Manhole	1.0 ft.

G. Time of Concentration

A minimum time of concentration to be utilized in storm sewer computations shall be 15 minutes for single-family and duplex-residential projects, and 10 minutes for all other developments.

H. Manhole Losses

The following manhole losses shall be used provided all structures are constructed with smooth flow channels to a depth equal to half the diameter of the largest pipe. This requirement is waived for structures having only one connecting pipe.

Use greater of:

- a) 20% of the difference between the highest and lowest velocity heads
- b) 0.10 foot

If no channelization is provided, the designer shall use the greater of:

- a) 50% of the difference between the highest and lowest velocity heads
- b) 0.30 foot

Manhole losses shall be applied only at surcharged structures.

I. Laying Pipe

All pipes shall be carefully laid, true to the lines and grades as shown on the plans. FDOT Standard Specifications Section 430.7 Specific Requirements for Concrete Pipe, latest edition, shall apply for installations beneath public maintained roadways. The provisions of Section 430 in its entirety shall apply to other installations. All pipe shall be laid in the absence of standing water unless specifically authorized otherwise by the City Engineer, or his designee.

J. Testing

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

Section 7.05.03 Culvert Design

Culverts are required to convey stormwater discharges contained in open ditches, swales and lakes under roadways and other obstructions. Designing of culvert facilities involves the consideration of all the design factors included for storm sewer systems plus the allowance for entrance and exit losses that can drastically affect headwater elevations caused by culvert installations. Additionally, particular attention should be given to the downstream water surface elevation, i.e., tailwater in culvert design in order to arrive at a reasonable estimate of the headwater design flow conditions. The criteria listed below provide the designer with general and specific guidelines.

A. Design Discharges

The determination of design flows for a culvert installation serving any classification of facility shall be in accordance with the methods and procedures set forth in this chapter.

B. Allowable Materials

All storm sewer piping materials installed within the City of Orlando will comply with FDOT Standard Specifications for Road and Bridge Construction, most current edition and FDOT Design Standards, most current edition. Only rigid pipe material shall be allowed beneath publicly maintained roadway pavement.

Any contractor installing HDPE pipe or other flexible pipe on private development within the City of Orlando will be certified by the pipe manufacturer as qualified to install said piping material. A copy of the certification must accompany the Engineering Permit submittal. See laser profiling requirements of this chapter.

All pipe joints for all types of pipe and pipe material be wrapped per FDOT Roadway and Traffic Design Standard Index Number 280.

Rip-rap headwalls shall be made from burlap bags or grout-filled fabric form, not mixed in place paper bags.

C. Minimum Pipe Size

The minimum size of pipes to be used for culvert installations shall be 18 inches when the entrance to the facility is covered by a grate or protected from debris, and 24 inches when

an endwall is utilized as the inlet structure.

D. Maximum and Minimum Pipe Slopes

All culverts shall be designed and constructed to produce a minimum mean velocity of 3.0 fps. The maximum bed slope shall be a slope that produces a velocity not exceeding six feet per second. The barrel cross-section shall have sufficient area so that flow velocity does not exceed 10 feet per second under design conditions.

E. Maximum Lengths of Culvert

The following maximum runs of pipe shall be used when spacing access structures of any type.

Pipe Diameter (or Minimum Dimension of Elliptical Pipe or Box Culvert)	Maximum Run
Less than 24"	300 ft
24" or Larger	400 ft

F. All culvert installations shall be designed taking into consideration the tailwater of the receiving facility or body of water.

G. Allowable Headwater

The allowable headwater of a culvert installation should be set by the designer for an economical installation; however, it should never exceed the highwater clearances required in Section 7.05.01 Roadway (Pavement) Drainage Design. When endwalls are used, preferably the headwater should not exceed the top of the endwall at the entrance. If the top of the endwall is inundated, then special protection of the roadway embankment and/or ditch slope may be necessary for erosion protection.

H. Testing

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

Section 7.05.04 Pipe Inspection

Pipe inspection shall be performed in accordance with FDOT Standard Specifications Section 430-4.8, Pipe Inspection, latest edition. For pipe larger than 48 inches in diameter, the pipe may be walked, but video documentation of the inspection must be provided. Pipe certification shall be provided.

If no defects are observed, the following signed and sealed certification shall be used:

I, or a representative under my direction, have reviewed the drainage pipe inspection videos and laser profile reports (the latter if pipe other than reinforced concrete pipe has been used outside of publicly maintained roadway areas) for the drainage system pipes.

Based on review of the roadway drainage system and related discharge piping inspection reports, I certify that to the best of my knowledge, information and belief, the drainage system improvements for the _____ project have been constructed substantially in conformance with the specifications of the City of Orlando Engineering Standards Manual and comply with those specifications as to joint tolerance, leakage and deflection. Copies of the DVDs for the initial and post-repair video inspections are included with this submittal.

If defects are observed, the following signed and sealed certification shall be used:

I, or a representative under my direction, have reviewed the drainage pipe inspection videos and laser profile reports (the latter if pipe other than reinforced concrete pipe has been used outside of publicly maintained roadway areas) for the drainage system pipes. Defects in the drainage system piping were observed during review of the video inspection reports. Prior to repair, methods and procedures were submitted to the City and approved on _____. Defects were remedied in accordance with the approved methods and procedures on _____. Based on review of the roadway drainage system and related discharge piping inspection reports and post-repair inspection reports, I certify that to the best of my knowledge, information and belief, the drainage system improvements for the _____ project have been constructed substantially in conformance with the specifications of the City of Orlando Engineering Standards Manual and comply with those specifications as to joint tolerance, leakage and deflection. Copies of the DVDs for the initial and post-repair video inspections are included with this submittal.

Section 7.05.05 Open Channel Design

Grass swales and open channels may be used in lieu of a closed conduit system to convey stormwater runoff outside of dedicated roadway and street rights-of-way when sufficient drainage easements or rights-of-way are available; when groundwater control is desirable; when sufficient cover for closed systems is not available; where economy of construction can be demonstrated for temporary conveyance for phased projects, and where open drainage facilities are compatible with surrounding land uses. Open conveyance systems are often desirable to assist in the mitigation of pollution problems. The use of grass swales and open channels will be reviewed on an individual basis and the use of them is generally not preferable.

A grass swale is defined as a trench which:

- a. Has a top width-to-depth ratio of the cross-section equal to or greater than 12:1, or side slopes equal to or flatter than 3 feet horizontal to 1 foot vertical and,
- b. Contains continuous areas of standing or flowing water following a rainfall event and,
- c. Planted with or has stabilized vegetation and,
- d. Is designed to take into account the soil erodibility, soil percolation, slope, slope length, and drainage area so as to prevent erosion, and reduce pollutant concentration of any discharge.

The design of open swales must meet the design requirements of the applicable Water Management

District.

Section 7.05.06 Freeboard, Side Slopes, Fencing & Maintenance Berms

Freeboard requirement may be waived for ponds which are located at low points within the project area and are not subject to potential catastrophic failure (e.g., downstream side of pond constructed on fill next to a wetland, natural stream or canal). Minimum road elevations shall be constructed no lower than the 25-year, 24-hour peak stage or main control elevation, whichever is greater.

Side slopes - Maximum side slopes shall be constructed as follows unless otherwise approved by the City Engineer, vertical walls will be on a case by case basis:

Facility	Side Slopes
Dry Retention	4:1
Wet Retention/Detention	No Fence –slopes 4:1 and flatter With Fence - slopes steeper than 4:1
Commercial	No Fence - Wet Bottom Pond and slopes flatter than 4:1 With Fence for slopes steeper than 4:1
Ditch or Canal	4:1 (Deeper than 3') 2.5:1 (Less than 3' deep)

Maintenance Berms – Adequate maintenance berms shall be provided around Stormwater Management Systems in accordance with the followings:

Facility	Minimum Unobstructed Maintenance Berm Required
Up to 20' wide ditch or canal	15' on one side
20' to 50' wide ditch or canal	15' per side
Greater than 50' wide	20' per side
Ponds with fencing	20' around perimeter
Ponds without fencing	10' around perimeter (berm width may be further reduced provided access and maintainability are demonstrated)

Section 7.05.07 Maintenance of Privately Owned Stormwater Systems

All stormwater management systems constructed in the City of Orlando will be required to be maintained by their respective property owners for pollution abatement, conveyance and flood protection. The systems shall conform to the original design requirements at all times. Any changes to the stormwater system must be permitted through the City and the appropriate

water management district. In cases of conflicting criteria, it is the intent of this Manual to have the most stringent regulations govern.

All contractors or field personnel performing earthwork maintenance must be certified by the FDEP in Stormwater, Erosion, and Sedimentation Control or by a comparable program from another state. Verification of certification may be requested by the City.

All maintenance and repair activities occurring on privately-owned stormwater systems are to be performed according to the guidelines set forth by this document and in the current edition of FDOT's Standard Specifications for Roads and Bridge Construction and any permitted conditions from applicable Federal, State and/or agencies of the State.

All erosion and sedimentation control measures must be installed before maintenance activities begin and be maintained for duration of the project. Modifications to control measures may be required during project based on site conditions. All measures must remain in place until City Inspector grants permission for the removal at the completion of the project. Any dewatering must obtain all necessary permits and authorization by City Stormwater section. The City reserves the right to require stringent control measures to ensure proper water quality or flood protection. For water quality violations, work will cease until the violation is addressed and corrected.

1. Wet and Dry Pond Maintenance

- A. Pond configuration must be maintained to its original length, width and depth as designed and approved, according to plans.
- B. Vegetation on slopes and pond bottom should be routinely mowed. All woody stem plants and cattails (*Typha sp.*) must be removed, including their associated root systems.
- C. Submerged species of vegetation (e.g. Hydrilla (*Hydrilla verticulata*), East Indian Hygrophila (*Hydgrophila polysperma*), etc.) must be removed or may be treated when growth becomes excessive.
- D. Eroded or unstabilized areas must be redressed and secured with sod or vegetation depicted in the plans.
- E. Trash and debris should be routinely removed.
- F. Control structure shall be in maintained as set forth in Section 7.06.06.

2. Swale Maintenance

- A. Swale configuration must be maintained to its original length, width and depth as designed and approved, according to plans.
- B. Check dams and other velocity dissipation devices must be maintained to original design.
- C. Vegetation on slopes should be routinely mowed. All woody stem plants and cattails (*Typha sp.*) must be removed, including their associated root systems.

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- D. Swale configuration must be maintained to its original length, width and depth as Eroded or unstabilized areas must be redressed and secured with sod.
 - E. Trash and debris should be routinely removed.
 - F. Stormwater flow cannot be impeded or reduced by any natural or manmade object.

3. Ditch and Canal Maintenance

- A. Vegetation on slopes should be routinely mowed. All woody stem plants and cattails (*Typha sp.*) must be removed, including their associated root systems.
- B. Submerged species of vegetation (e.g. Hydrilla (*Hydrilla verticillata*), East Indian Hygrophila (*Hydgrophila polysperma*), etc.) must be removed or may be treated, with approval from City inspector, when growth becomes excessive.
- C. Eroded or unstabilized areas must be redressed and secured with sod. Depending on slope, sod may need to be secured to banks using pins or staples.
- D. Stormwater runoff should not be impeded or reduced by any natural or manmade object.

4. Underdrain Maintenance

- A. Systems must function to properly discharge designed runoff or to return pond to designed ponding elevation within 72 hours of rain events.
- B. Cleanouts and concrete pads, if applicable, must be visible and accessible. Caps must be secured onto cleanout pipes.
- C. Aquatic vegetation growing along underdrain system must be carefully removed, including their root systems.
- D. Failure of system is determined when discharge from underdrain pipe is not sufficient enough to allow pond to drawdown to designed elevation within 72 hours or prolonged wetness is evident.
- E. If failure occurs, a City Stormwater Code Inspector must be present during installation of underdrain system. Prior to installation of underdrain system, pond must be excavated to proper dimensions and elevations. Trench dimensions are to be excavated to designed and approved length, width and depth, according to plans. Old underdrain pipes, filter material, filter media and excavated pond sediments must be removed from site before new material arrives to prevent cross-contamination.
- F. FDOT-approved filter fabric is to be placed in the trench, lining the floor and walls of the trench with enough excess to overlap over the top of the trench after all pipe and filter media are installed.
- G. Install new underdrain pipes with new fabric socks at designed elevation, surrounding it with fresh filter media, as dictated in plans. Filter fabric must overlap to encase the underdrain package.

5. Exfiltration Maintenance

- A. Systems must function to properly contain and discharge designed runoff.
- B. All inspection ports and manholes must be visible and accessible.
- C. System should be jetted and vactored to remove sediment, trash and debris as recommended by the manufacturer, but not less frequently than every two years, to extend functionality of the system. Manifest of work must be documented and retained for verification by City inspector.
- D. All dewatering activity must be approved by City inspector prior to maintenance activities. Discharge water must not violate any Federal, State or local water quality standards, including turbidity. Manifest documentation may be required for disposal of water, depending on site conditions. Decanting from vactor trucks will not be allowed.

6. Control Structure Maintenance

- A. Sediment, vegetation, trash and debris should be removed periodically.
- B. Bleed down device must be positioned and operating as designed and free of debris at all times.
- C. Weir structures must be undamaged, unobstructed by debris or sediment and must function at designed elevations.
- D. Weir plates over grates must be present at all times.
- E. Broken or missing grates must be replaced, as specified on plans, or to current edition of FDOT Specifications for Roads and Bridge Construction.
- F. Skimmer plates must be undamaged and properly fastened to inlet structures.
- G. Cracks must be sealed, if leaking, and damage repaired promptly.
- H. Connections, to-and-from structures, must be mortared to eliminate the infiltration of bedding materials, sand and earth and exfiltration of stormwater runoff.
- I. Erosion around structures must be filled and repaired by careful compaction and stabilized with sod.

7. Stormwater Pipe, Grate and Flume Maintenance

- A. Sediment, vegetation, trash and debris should be removed periodically.
- B. Leaking joints between stormwater pipes and/or between pipes and structures must be repaired promptly. A collar may be poured to FDOT standards to repair one joint in a run of

sections, however, if more than one joint is leaking, new gaskets are to be used for repair along with the possibility of replacing or lining the pipes.

- C. Deteriorated stormwater pipes must be lined or replaced.
- D. Broken or missing grates must be replaced, as specified on plans.
- E. Erosion around pipes, flumes, headwalls and mitered-end sections must be filled and repaired by careful compaction and stabilized with sod.
- F. Broken flumes must be repaired or replaced, depending on severity.
- G. Accumulated sediment at end of pipes and flumes should be removed periodically.

8. Maintenance on Miscellaneous Stormwater Structures and Devices

Maintenance of the various structures, not listed above, should be scheduled per manufacturer specifications or at a frequency that allows systems to remain at their designed pollution abatement. Maintenance frequencies should be adjusted based on sediment loading, volumes of trash and debris between regular cleaning cycles and overall system performance. All efforts should be made to minimize flooding potential and negative water quality impacts.

CHAPTER 8 - TRANSPORTATION

Section 8.01 Pavement Markings

The work specified in this section shall consist of the design and installation of pavement markings as shown on the plans and in accordance with this Manual. Temporary markings shall be used as required by the City. The City Transportation Engineer has approval jurisdiction over any requests for modifications from these standards.

A. Materials

1. Paint

All paint used for pavement markings shall conform to the latest edition of the FDOT Standard Specifications for Road and Bridge Construction (SSRBC).

2. Thermoplastic Compounds

All Thermoplastic Compounds used for pavement markings shall conform to Section 711-2 of the latest edition of the FDOT SSRBC. Only alkyd based materials shall be used.

2. Reflective Pavement Markers

All reflective pavement markers shall conform to Section 706 of the FDOT SSRBC and on the FDOT's Qualified Products List (QPL).

3. Glass Spheres

All glass spheres shall conform to Section 971 of the FDOT SSRBC, latest edition.

B. Installation

1. General

All surfaces shall be cleaned prior to the start of installation.

2. Painted Markings

Painted traffic markings shall be installed in accordance with Section 710 of the FDOT SSRBC and the Manual of Uniform Traffic Control Devices (MUTCD). Paint may be used only on private development improvements or as temporary markings.

3. Thermoplastic Traffic Markings

Thermoplastic traffic markings shall be installed in accordance with Section 711 of the FDOT SSRBC and the MUTCD. Pre-formed plastic markings may be substituted as permitted by the City Transportation Engineer. Alkyd materials may be applied immediately after final compaction of asphaltic concrete.

4. Reflective Pavement Markers

All reflective pavements markers shall be installed in conformance with Section 706 of the FDOT SSRBC.

Section 8.02 Urban Streets and Intersections

The design and locations of urban streets and intersections shall be consistent with the requirements of the City of Orlando Land Development Code (LDC), Downtown Streetscape Guidelines (as appropriate), and Section III, Paragraph 9, and “Intersection Design” of the Manual of Uniform Minimum Standards for Design, Construction and Maintenance for Street and Highways (also referred to as the Florida Greenbook), as prepared by the Florida Department of Transportation. Streets are defined based on the traffic load, travel speed, medians and other criteria. Street type definitions can be found in Chapter 61 of the Orlando City Code. The City Engineer and City Transportation Engineer have approval jurisdiction over any requests for modifications from these standards. Unless stated otherwise, all separation references are centerline to centerline.

A. Design and Placement

The design and placement of streets, intersections and driveways shall encourage the appropriate use of ALL Limited Access Roadways, Arterial Streets, Collector Streets, Local Collector Streets, Local Non-residential Streets and Local Residential Streets (including Local Single-family Residential Streets).

B. Single-family Residential Neighborhood Protection

Streets, intersections and driveways shall be located and designed to discourage and where possible prohibit non single-family residential traffic from cutting through any single-family residential neighborhood.

1. Single Family Local Street Traffic Control and Informational Signage

The following shall be used individually or in combination in individual single-family residential developments or neighborhoods:

- a. One-way and two-way street combinations,
- b. Intersection turn restrictions,
- c. Neighborhood entry identification signs.

C. Special Considerations

1. A Traffic Operation and Safety Study may be required from the Owner/Developer by the City Transportation Engineer prior to approval. All traffic control devices at intersections being signal control, stop control, all-way stop control, or yield control shall be studied in accordance to the appropriate warrants per the current MUTCD edition. If the roadway has yet to be established and no existing traffic volumes can be measured, trip generation volumes, based on values from ITE’s Trip Generation Manual current edition, shall be used along with an appropriate trip distribution projection. All traffic studies required shall be signed and sealed by a Professional Engineer registered within the State of Florida.
2. The minimum requirements of this chapter may be reduced upon a finding by the City Transportation Engineer that given the particular conditions of the proposed

development, the minimums cannot be met and such reductions will not compromise operational and safety standards.

3. At preliminary review, the minimum requirements of this chapter may be increased upon a finding by the City Transportation Engineer that given the particular conditions of the proposed development, the minimums are not adequate to meet operational and safety standards.

Section 8.03 Non-Signalized Urban Intersections

A. Arterial Streets

1. Arterial Street intersection/interchanges with Limited Access Roadways are reviewed on a case by case basis. Intersection/interchange locations are determined based upon the requirements and standards of the Limited Access Roadway not the intersecting Arterial Street.
2. An Arterial Street (A) may intersect with another Arterial Street (B) if Arterial Street (A) is aligned with and is an extension (opposite approach) of an existing street or if the new Arterial Street (A) intersection is located at a desirable distance, typically one mile, from any adjacent intersection of two Arterials.

B. Collector Streets

1. Collector Street intersections/interchanges with Limited Access Roadways are reviewed on a case by case basis. Intersection/interchange locations are determined based upon the requirements and standards of the Limited Access Roadway not the intersecting Collector Street.
2. A Collector Street may intersect with an Arterial Street if the Collector Street is aligned with and is an extension (opposite approach) of an existing Collector Street that intersects with the Arterial Street or if the Collector Street is located at a desirable distance, typically at least one-quarter mile, from any adjacent existing Collector (or Arterial) Street that intersects with the Arterial Street.
3. A Collector Street (A) may intersect with another Collector Street (B) if Collector Street (A) is aligned with and is an extension (opposite approach) of an existing Collector Street or if the new Collector Street (A) intersection is located at a desirable distance, typically at least 660 feet, from any other intersection.

C. Local Collector Streets

1. Local Collector Streets intersections/interchanges with Limited Access Roadways should be avoided. If allowed, intersection/interchange locations are determined based upon the requirements and standards of the Limited Access Roadway not the intersecting Local Collector Street.
2. A Residential Collector Street may intersect with an Arterial Street if the Residential Collector Street is aligned with and is an extension (opposite approach) of an existing Residential Collector Street or if the Residential Collector Street is

located at a desirable distance, typically at least one quarter mile, from any adjacent existing Collector (or Arterial) Street that intersects with the Arterial Street.

3. A Residential Collector Street (A) may intersect with either a Collector Street or another Residential Collector Street (B) if it is aligned with and is an extension (opposite approach) of an existing Residential Collector Street intersection or if the new Residential Collector Street intersection is located at a desirable distance, typically at least 660 feet, from any other intersection. Non-residential traffic shall be discouraged and prohibited where possible from using Residential Collector Streets.

D. Local Streets

1. Intersections of Local Streets with Limited Access Roadways should be avoided. If allowed, intersection/interchange locations are determined based upon the requirements and standards of the Limited Access Roadway not the intersecting Local Street.
2. Intersections of Local Streets with Arterial Streets should be avoided. In cases where a Local Street must intersect with an Arterial Street the intersection shall be located/spaced at a minimum distance of 660 feet from any other intersection and will comply with the following:
 - a. Local Residential Streets shall be aligned only with an existing Local Residential street which intersects with the Arterial Street or be designed as a "T" intersection with right turn-in and right turn-out only.
 - b. Local Non-residential Streets shall be aligned with an existing Local Non-residential Street which intersects with the Arterial Street or be designed as a "T" intersection with right turn-in and right turn-out only.
3. Local Streets may intersect with a Collector Street if the Local Street is aligned with an existing Local Street of the same type which intersects with the Collector Street or if the Local Street is located at a minimum distance of 660 feet from any other intersection. The location of the Local Street shall also comply with the following:
 - a. Local Residential Streets shall be aligned only with an existing Local Residential Street which intersects with the Collector Street or be designed as a "T" intersection.
 - b. Local Non-residential Streets shall be aligned with an existing Local Non-residential street which intersects with the Collector Street or be designed as a "T" intersection.
4. Local Streets may intersect with a Residential Collector Street if the Local Street is aligned with an existing Local Street that intersects with the Residential Collector Street or if the Local Street is located at a minimum distance of 660 feet from any other intersection. The spacing between two or more Local Street intersections with a Residential Collector Street may be less than the required 660 feet if

combinations of full access, One-way access and/or right turn only access are used or if the Residential Collector is part of a planned/coordinated development or if the design involves a Low Volume Residential Collector Street. In any case the spacing may not be less than 330 feet.

5. A Local Street (A) may intersect with another Local Street (B) if Local Street (A) is aligned with and is an extension (opposite approach) of an existing Local Street or if the new Local Street (A) is spaced at a minimum distance of 150 feet from any other adjacent street intersection. The location of the Local Street shall also comply with the following:
 - a. A Local Residential Street (A) shall be aligned only with an existing Local Residential Street that intersects with Local Street (B) or be designed as a “T” Intersection.
 - b. A Local Single-family Residential Street (A) shall be aligned only with an existing Local Single-family Residential Street that intersects with local Street (B) or be designed as a “T” intersection. With approval of the City Engineer and City Transportation Engineer the spacing between two or more Local Single-family Residential Street intersections, including “S” or off-set intersections, may be less than the required 150 feet but not less than two lot depths (when placed back to back).
 - c. A Local Non-residential Street (A) shall be aligned only with an existing Local Non-residential Street that intersects with Local Street (B) or be designed as a “T” intersection.

Section 8.04 Spacing of Signalized Urban Intersections

In order that distances between intersections with traffic signal control are capable of providing reasonable cycle lengths and levels of service; intersections that are planned to be signalized should be spaced a minimum of one quarter mile from any adjacent intersection with existing or planned traffic signal control. Approval by the City Transportation Engineer is required.

All new traffic signals shall be warranted based upon latest MUTCD criteria. Field traffic data and/or ITE trip generation data will be required and submitted in a report for the City Transportation Engineer to review for approval.

Section 8.05 Sight Distance Requirements

A driver’s ability to see ahead is the utmost importance in the safe and efficient operation of a vehicle on any roadway. Sight distance is the distance to the driver of a passenger vehicle measured along the normal travel path of a street from a designated vehicle location and to a specified height above the street when the view is unobstructed by traffic. Four aspects of sight distance are: (1) the sight distances needed for stopping, which is applicable on all roadways, (2) the sight distances needed for passing of overtaken vehicles, applicable only on two-lane roadways, (3) the sight distances needed for decisions at complex locations, and (4) the sight distances needed at intersections.

In addition to the above, all drivers shall have a clear line of sight in order to also view pedestrians

(especially small children) on the sidewalks/parkway areas, bicyclists within the travel-way, and other potential types of non-motorized roadway users. Pedestrians and bicyclists should also have a clear line of sight when crossing at an intersection where the opposing approaches have no traffic control. This also applies to mid-block pedestrian and bicycle path crossings. Mid-block crossings should be offset whenever possible, and include a refuge area. Extra care must be taken where elevation/vertical alignment, horizontal alignment, and on-street parking could potentially interfere with any and all types of sight line distances.

Refer to AASHTO, Geometric Design of Highways and Streets (Current Edition) and FDOT Greenbook (Current Edition), for applications to specific design needs such as stopping sight distances and all other sight distance requirements. The minimum sight distances are specified in these manuals, but depending on the specific conditions greater sight distances may be required by the City Transportation Engineer. All public and private streets and the intersection of driveways shall be required to maintain clear sight distances. All regulatory traffic control devices shall have clear lines of sight to appropriately maintain their function in accordance to the above referenced manuals and in accordance the current edition of the MUTCD.

Section 8.06 Angles of Intersection

All streets shall be laid out to intersect as nearly as possible at (90 degree) right angles or radial, but in no case shall the angle of the intersection be less than 60 degrees.

Section 8.07 Multiple Approach Intersections

Multiple approach intersections involving the juncture of more than two streets and/or four intersection approaches shall be prohibited unless:

- A. The streets are joined within an interchange or
- B. The streets are joined within a large one-way traffic circle that provides adequate approach and turning movement separation.

Approval of the use of these options by the City Transportation Engineer is required.

Section 8.08 Intersection Pedestrian and Americans with Disabilities Act (ADA)

When planning, designing or constructing transportation facilities, the following ADA standards shall be complied with:

- 2006 Standards for Transportation Facilities (or the most current)
- Public Rights of Way Accessibility Guidelines (PROWAG)
- Florida DOT Design Standards
- Florida Green Book

Sidewalks and ADA ramps are required on both sides of all approaches of new intersections. Sidewalks and ADA ramps are required on both sides of all new intersection approaches to an existing street and all reconstructions of existing approaches unless specifically exempted by the City Transportation Engineer.

All ramps, including detectable warning surfaces, must be in compliance with ADA Criteria regarding number of ramps and detectable warning surface. Additionally, if these ramps are within the ROW, they shall be an approved type found in the FDOT Design Standards Index 300.

All marked pedestrian crosswalks on typical asphalt or concrete surfaces shall be marked with the latest FDOT special high emphasis crosswalk marking design (FDOT Standard Index 17346). Any pedestrian crossing within a signalized intersection shall be marked. At stop and yield control intersection approach crosswalk markings should be installed if an engineering analysis requires this and/or if the City Transportation Engineer requires it. At non-controlled intersection approaches and mid-block locations, crosswalks with appropriate warning signage and markings should be installed if recommended through an engineering analysis and/or the City Transportation Engineer requires it. The City strongly recommends utilizing the National Cooperative Highway Research Program (NCHRP) Study No. 562 Pedestrian Crossing at Un-Signalized Intersections as an engineering analysis if these types of pedestrian crossings are desired to be implemented.

Decorative crossings are permitted at locations where engineering analysis does not prohibit it. The details of the decorative crosswalk shall be approved by the City Transportation Engineer. Any proposed decorative crosswalk design shall incorporate the current FDOT standard crosswalk marking (2 parallel 12-inch thermoplastic markings and/or perpendicular 24-inch pavement markings).

Section 8.09 Medians

A. Median Separation Requirements

Median separation is required on all divided streets with four or more travel lanes and as may be required by the City. The City Transportation Engineer has approval jurisdiction over any request for modifications from these standards.

B. Minimum Width

1. The minimum width of a median containing a left turn lane shall be 16 feet when curbed and including a 4-foot-wide traffic separator (suicide lane). If there is a bi-directional turn lane, the minimum width shall be 12 feet unless otherwise approved by the City Transportation Engineer.
2. The minimum width of a median intended to protect a vehicle crossing or turning left from a side street or driveway shall be 19.5 feet when curbed.

C. Openings

1. Median openings on all streets shall be spaced at 660 feet intervals or per the standards of the City of Orlando Land Development Code.
2. Correct signal spacing and dedicated public streets are given priority consideration for median opening approvals.
3. All median designs and provisions shall be consistent with standards provided by the Manual of Minimum Standards for Design, Construction and Maintenance for Streets and Highways.

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4. All median openings shall include a 12 foot wide left turn storage lane and taper. The minimum lengths for the storage lanes and taper are included in Section "Turn Lanes and Tapers".
 5. The preferred end treatment for median opening is the bullet-nose design rather than the circular design.
 6. The width of full access median openings, measured from the end of one nose to the end of the other nose, shall be a minimum of 40 feet. The design shall be based upon the required turning radii and lane alignment of the intersection.
 7. No median opening shall be allowed where the median is intended to protect a vehicle crossing or turning left vehicle from a side street or driveway and is of insufficient width to do so.

D. Special Considerations

The minimum spacing requirements of this Section may be modified upon a finding by the City Transportation Engineer or his Designee that, given the particular conditions of the proposed development, the minimums cannot be met and such reduction will not compromise operational and safety standards of the adjacent roadway.

Section 8.10 Turn Lanes and Tapers

A. General Requirements

Turn lanes and tapers, when designed by the Manual of Uniform Minimum Standards for Design, Construction and Maintenance for Streets and Highways (FDOT), 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. Turn lanes and tapers are required for the following conditions.

1. The Design Speed of the accessed street is 35 MPH or greater;
2. 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;
3. The parcel of property accessing the street is residential and has 50 or more dwelling units;
4. 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;
5. At any development as a Traffic Impact Analysis may warrant;
6. At any parcel of property where a use changes to one that meets one of the above conditions;
7. The main street has an Average Daily Traffic Count of 500 or more vehicles per day or

50 or more vehicles in any hour;

8. 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.
9. The street is classified as a thoroughfare.

Special Considerations

The minimum spacing requirements of this Section may be modified upon a finding by the City Transportation Engineer or his Designee that, given the particular conditions of the proposed development, the minimums cannot be met and such reduction will not compromise operational and safety standards of the adjacent roadway.

B. 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 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. A 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 or City Transportation Engineer.

C. Acceleration Lanes and Tapers

The desirable requirements for lengths of acceleration lanes and tapers shall be based on AASHTO's Geometric Design of Highways and Streets (Current Edition) and the FDOT Greenbook (Current Edition) which consider curve design speed, roadway design speed, and curve radius.

D. Right Turn Deceleration and Storage Lanes

The desirable requirements for storage lengths and entrance tapers for right turn lanes shall follow FDOT Design Index. If a lane shift is required to provide room for a right turn lane, the lane shift taper shall use one of the following equations based upon the design speed.

$$\text{For Speeds } \geq 45 \text{ mph: } L = W \times S$$

$$\text{For Speeds } \leq 40 \text{ mph: } L = (W \times S^2)/60$$

Where: W = width of the lane shift

S = design speed

Upon the approval of the City Transportation Engineer, the lane shift taper length may be reduced to achieve the desirable storage length and/or accommodate constrained geometric conditions. However, the taper length should not be below the minimum lengths specified in FDOT Design Index 526.

Storage lengths for left turn lanes may be calculated by an engineering study or one of the following methods and is subject to final approval by the City Transportation Engineer.

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1. 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) = 2×25 ft. (average vehicles length) \times (number of left turning vehicles in peak hour/60).
 2. At signalized intersections, the storage length may be based on the signal cycle length, the signal phasing arrangement and the rate of arrivals and departure of left turning vehicles that would store per cycle to allow for occasional surges. Also, consider the queue lengths of adjacent thru lanes to avoid blocking the entrance to the left turn lane(s).

E. Left Turn Deceleration and Storage Lanes

The desirable requirements for storage lengths and entrance tapers for left turn lanes for un-signalized locations shall follow FDOT Design Index. If a lane shift is required to provide room for a right turn lane, the lane shift taper shall use one of the following equations based upon the design speed.

For Speeds ≥ 45 mph: $L = W \times S$

For Speeds ≤ 40 mph: $L = (W \times S^2)/60$

Where: W = width of the lane shift

S = design speed

Upon the approval of the City Transportation Engineer, the lane shift taper length may be reduced to achieve the desirable storage length and/or to accommodate constrained geometric conditions. However, the taper length should not go below the minimum lengths specified in FDOT Design Index 526.

Storage lengths for left turn lanes may be calculated by an engineering study or one of the following methods and is subject to final approval by the City Transportation Engineer or his Designee.

1. 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) = 2×25 ft. (average vehicle length) \times (number of left turning vehicles in peak hour/60)
2. At signalized intersections, the storage length may be based on the signal cycle length, the signal phasing arrangement and the rate of arrivals and departure of left turning vehicles that would store per cycle to allow for occasional surges.

F. Bypass Lanes

A bypass lane shall be provided for left turns when a median or adequate pavement width does not exist. The lane shift taper shall use one of the following equations based upon the design speed.

For Speeds ≥ 45 mph: $L = W \times S$

For Speeds ≤ 40 mph: $L = (W \times S^2)/60$

Where: W = width of the lane shift

S = design speed

Road sections disturbed by bypass and turn lanes shall be completely overlaid with a minimum of 1 inch of asphaltic concrete.

G. Exceptions

Left and right turn lane provisions may be imposed unless roadway cross section, right-of-way width or deficient frontage prohibits compliance and no other access location can be provided for the site.

H. Reverse Curves

Reverse curves shall not be used. Short straight tangent sections shall be in place between two curves.

Section 8.11 Driveways and Entrances

A. General Requirements

All curb cuts and driveways constructed, altered or removed within the limits of the City of Orlando shall be constructed, altered, or removed as provided for in this Section and the Land Development Code of the City of Orlando. 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 an Engineering Permit from the City of Orlando Permitting Services. Additional permits may be required from the City, Orange County or the Florida Department of Transportation for rights-of-way under their jurisdiction.

The City Transportation Engineer has approval jurisdiction over the design, location and operational portion of any requests for modifications from these standards. The City Engineer has approval jurisdiction over the construction permits, materials and methods portions of any requests for modifications from these standards.

Any developer/owner 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 shall be required to reconstruct or alter such hazardous situation at the time of any modifications/permits to the property including but not limited to use changes, remodeling, reconstruction, enlargement, alterations or paving.

Required Submittals Information required on plans submitted shall include:

1. A complete plot plan showing all proposed and/or existing buildings and parking layouts and shall include a north arrow, date and dimensions.
2. 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.

3. Distances to the nearest public intersection and to the nearest median cut in both directions, if applicable.
4. Street pavement types and widths, lane layout and widths, curb types and right-of-way widths.
5. Proposed and/or existing off-street loading and unloading facilities, interior parking arrangements and interior traffic circulating arrangements. (Non-residential requirement only.)
6. Retaining walls, drainage, utility poles, trees, fences and other physical features which affect the driveway location and sight distance.

C. Design Considerations

1. The choice of the proper location of driveways must involve consideration of the amount of the conflict which can be expected to occur 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.
2. 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.
3. 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.
4. 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.

D. Spacing Between Driveways

The spacing between adjacent driveways accessing public streets shall be regulated as follows:

1. **Functionally Classified Roads**
Driveways on streets classified as Major Thoroughfares by the Orlando Land Development Code shall follow spacing requirements as outlined in Section 61-2B. The City Transportation Engineer (or Designee) has the ability to waive these conditions or classify a road as a Major Thoroughfare that is not currently listed in the Orlando LDC.
2. Street Classifications of Local Driveways shall be located as shown in Table 8.5 below.

Table 8.5
Driveway Separation

Land/Road Use	DESIGN CRITERIA		DRIVEWAY SEPARATION FROM ADJACENT		
			Intersection (Minimum)**	Driveway (Minimum)***	
Single Family (Single Parcel Detached)			=<30 MPH	50 FT.	10 FT.*
			>30 MPH	.	
Multi-Family			=<30 MPH	125 FT.*	100 FT.*
			>30 MPH	150 FT.*	150 FT.*
Non-Residential			=<30 MPH	125 FT.*	100 FT.*
			=35-40 MPH	185 FT.*	150 FT.*
			=>45 MPH	200 FT.*	200 FT.*

* The City Transportation Engineer may restrict directional ingress and egress and/or require joint-use driveways.

**Measured from the throat of the drive to the closest point of curvature at the intersection.

***Measured from driveway throat to driveway throat on adjacent parcel.

1. Distance between adjacent one-way driveways with the inbound driveway upstream from the outbound driveway can be one-half the distance shown above as approved by the City Transportation Engineer.
2. Driveways on opposite sides of any undivided street that is functionally classified shall be aligned or offset a minimum of 200 feet measured from centerline to centerline.
3. For developments that request more than one two-way driveway, based upon parcel size, projected trip generation of the site, amount of roadway frontage and other appropriate design considerations, additional driveways may be permitted with the approval of the City Engineer if all other provisions of this Section are met. A joint-use driveway may be required.
4. Corner lots shall have a maximum of one curb cut per street, however, additional curb cuts may be considered for large lots.
5. Developments projected to generate 1,000 ADT or more, shall provide the City with a Traffic Impact Analysis. The methodology and scope of the TIA shall be determined by Transportation Planning prior to data collection.

E. Design Specifications

1. Location

- a. Single family residential driveways shall not be permitted in the radius return of an intersection.
- b. Driveways shall be no closer than three feet from property line.
- c. The centerline of all other types of driveways shall be no closer to the adjoining property than $\frac{1}{2}$ the width of the driveway plus the return radius dimension and 5 feet.
- d. No driveway shall be permitted which is in conflict with 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 developer/owner's expense. No curb cut shall be made within 3 feet of a drainage inlet. All setbacks shall meet the FDOT requirements for fixed object hazards.
- e. Joint-use driveways shall be used when deemed necessary. The above criteria shall be complied with unless otherwise approved by the City Engineer.
- f. When concrete driveways abut non-concrete surfaces, a 6 inch wide x 12 inch deep flush header curb shall be constructed and separated with expansion joint material from the concrete driveway.

2. Width

- a. All driveway widths shall be measured at the throat.
- b. The minimum width of single family residential driveways shall be 7 feet and the maximum width shall be 18 feet (See Standard Details).
- c. The minimum width of single family ribbon driveways shall be 23 inches per ribbon with a space of 28 inches between ribbons. The maximum width shall be 36 inches per ribbon with a space of 28 inches between ribbons. (See ESM Details).
- d. 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 (See ESM Details).

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:

	Minimum	Maximum
One-Way	16	20
Two-Way	24	36

Non-residential driveways exceeding the maximum width shall only be considered when usage of 40 foot radii cannot be accommodated and must be approved by the City Transportation Engineer.

3. Angle

- a. All driveways shall be constructed as nearly to a right angle (90 degrees) to the street or roadway as possible.

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.

- b. The driveway shall be designed so that approach, ramp and departure angles do not exceed the following maximums.

Single Family Residential Driveway

<u>Angle Type</u>	<u>Maximum Angle</u>
Approach Angle	16.4 degrees
Ramp Angle	11.0 degrees
Departure Angle	10.9 degrees

All Other Driveways

<u>Angle Type</u>	<u>Maximum Angle</u>
Approach Angle	14.14 degrees
Ramp Angle	7.26 degrees
Departure Angle	8.53 degrees

4. 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. The radii will be based on design vehicle requirements with a minimum of 25' radii.
- b. Tractor trailer combination shall be the design vehicle when warranted on all multi-family (3 units and more) residential driveways. AASHTO design standards will apply.
- c. A radius of less than what is required by AASHTO for a particular design vehicle may be approved upon the applicant's demonstration to the City Transportation 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.

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- d. Contraction joints shall be provided on radii at the points of curvature and tangency.
5. Grade
- a. Driveways which intercept sidewalks and bike paths shall not exceed 2% slope to comply with accessibility criteria.
 - 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 downslope or upslope of the driveway begins.
6. Construction Specifications
- a. All driveways shall be constructed in conformance to the plans and specifications approved by the City Engineer. All new driveways fronting a street shall be paved at least 15' within the property or up to an adjacent building. If a driveway with pavers is proposed within the right-of-way, it shall match the standard driveway geometry of a standard City concrete driveway. A City Paver's Memorandum of Understanding shall be required.
 - 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 and with a break and exposed joint at the property line. Concrete for the construction of curbs shall be at least 3,000 psi concrete. Driveway approaches may use brick pavers that meet the installation requirements of Section 6.09. However the sidewalk section through the drive way must be at least 3000 psi concrete at least 6 inches in thickness.

Section 8.12 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 will be subject to the provisions of this Section.
- B. When the use of any driveway is discontinued, the developer/owner(s) of the abutting property shall, at his own expense, remove the driveway and replace all curbs, gutters, sidewalks/bike paths, swales and grass areas. See ESM Details.
- C. When the use, building size or ownership of any property with a driveway(s) is changed, the developer/owner(s) of the subject property shall reconstruct the driveway in conformance with City standards, if the driveway no longer meets 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.

Section 8.13 Temporary Traffic Control

The purpose of this section is to establish uniform standards of traffic control for public and private organizations to follow when temporary disruption of street traffic is required for maintenance and construction projects. These standards are aimed at reducing hazards for motorists, pedestrians and workers, minimizing inconvenience to the public and maintaining public good will.

The provisions set forth in this section shall apply to all contractors, utility and public agencies (except to the State on a State Road and the County on a County Road), whenever such agencies or firms are engaged in work involving the public right-of-way on streets, alleys or sidewalks in the City of Orlando. Those public rights-of-way under the jurisdiction of Orange County or Florida Department of Transportation may require a joint permit.

Responsibility for the installation of adequate safety devices for reducing the hazards to the traveling public, pedestrians and workers, as well as for safeguarding the work in general, shall remain with the contractor, utility company or other public agency. Florida Department of Transportation (FDOT) Maintenance of Traffic (MOT) certification will be required for all involved in the set-up, maintenance, and removal of safety devices. The design of a traffic control plan will require Advanced MOT certification, in certain cases it may also require that the traffic control plan also be designed by a Professional Engineer licensed in the State of Florida that must also hold an Advanced MOT certification. If it appears, at any time, that the contractor has neglected to provide the safeguards which are necessary for the safe and proper maintenance of traffic, the City may provide staff and equipment on the work as may be necessary to provide for safe travel. In this case, the cost of the labor, equipment rental, material and supervision will be charged to the Contractor.

Section 8.13.01 Notification

Prior to the start of construction or maintenance work in the public rights-of-way, it shall be the responsibility of the contractor, utility firm or public agency to obtain street, lane or sidewalk use/closure authorization from the Transportation Engineering Division a minimum of twenty-four hours prior to beginning work for partial and complete lane closures on arterial and collector streets, provided no full directional closure occurs and for partial or complete closures on local streets and alleys. It shall be obtained a minimum of seventy-two hours (excluding weekends) prior to beginning work for a full directional closure or a complete street closure on arterial and collector streets. If necessary, the contractor will arrange for the removal or “bagging” of parking meters that are within the area. The cost of the daily rental of parking meters shall be the responsibility of the party performing the work and shall be coordinated with the City of Orlando Parking Division.

The contractor shall designate a certified Traffic Control Supervisor with FDOT MOT certification that is active and current, who shall supervise traffic control operations. The Traffic Control Supervisor, or his alternate, shall be available to the City Transportation Engineer or his designee and to the Orlando Police Department at all times.

All work in the public right-of-way shall comply with the City Code of Orlando.

Section 8.14 Maintenance of Traffic

The persons involved in designing work zone traffic control (WZTC) plans, supervising field crews installing WZTC devices, and flagging must hold current FDOT Maintenance of Traffic certification at the minimum levels described in the FDOT maintenance of Traffic Training Procedure (Topic No: 625-

010-010-h). Copies of certification shall be provided to the City Transportation Engineering Division prior to implementing any phase of MOT.

The contractor, utility company or public agency shall, at all times, maintain traffic as specified in this section. In addition, nothing in this section shall prohibit the City Transportation Engineer or his designee and/or the Orlando Police Department from requiring cessation of any work and resumption of normal traffic operations when deemed necessary in the interest of public safety.

A. General Land Services Maintenance

Except for street closures, unobstructed access to dwellings and places of business or work shall be provided for emergency vehicles. Access and egress provisions for land service maintenance are desirable under roadway closure or detour circumstances and should be considered at all times.

B. Schedule of Operations

All construction and maintenance operations shall be scheduled to keep traffic delays to a minimum. Included in the operational category are such things as equipment, material delivery, vehicles, workers' autos, loose soil, dust and any other conditions which affect the traveled portion of the roadway or sidewalk shall be brought to and from the site and parked or stored in a planned manner to minimize the interference with traffic. The areas provided for material storage shall not be used for parking of the workers' vehicles.

Street excavations, street closures or single or multiple traffic lane closures are not permitted during weekly business hours in the Central Business District (CBD), except as provided below. Use of utility manhole openings during the hours of 9:30 a.m. to 3 p.m. is permitted. A full street closure in the Central Business District will be permitted only when, in the opinion of the City Transportation Engineer or his designee, no other reasonable course of action is possible.

C. Arterial and Collector Streets

Any work utilizing only an existing parking lane is permitted at any time on these streets after obtaining street, lane or sidewalk use/closure authorization from the Transportation Engineering Division and contacting the Parking Division. Multiple lane closures are also permitted but will be restricted to off-peak traffic (9:30 a.m. to 3 p.m.), nights (after 6:30 p.m.) or weekends. Arterial streets and intersections that have an Average Daily Traffic Volume (A.D.T.) Of 30,000 vehicles or greater, will require that work be performed between the hours of 8:30 p.m. and 6: 00 a.m. Upon submittal of an application for street, lane or sidewalk use/closure authorization by the applicant, the City will advise whether or not this restriction applies to the lane closure of the requested street. Full closures of these streets will be permitted only when no other course of action is possible.

D. Local and Land Service Streets

Local and Land Service Streets shall include all streets not included within the Central Business District or functionally classified Streets. In general, work is permitted without time restrictions.

E. Detours

Nothing in the foregoing paragraphs shall be construed as to permit the contractor, utility company or public agency to close or detour traffic on any public rights-of-way without first obtaining street, lane or sidewalk use/closure authorization from the Transportation Engineering Division. If the contractor, utility company or public agency requests a detour for a specific time and date and fails to notify the Transportation Engineering Division of a change in schedule, said contractor, utility company or public agency shall be responsible for the costs involved in such delay. The contractor, utility company or public agency is obligated to commence operations within a reasonable time after the detour is established to avoid unnecessary inconvenience to the general public. The contractor, utility company or public agency shall furnish, erect, maintain and light all barricades and signs.

F. Street or Lane Closure Exceptions Street, lane or sidewalk authorization is not usually required under the following conditions:

1. When construction or maintenance activities, wherein lane restrictions will occur for a duration of 2 hours or less with two way traffic maintained utilizing proper traffic control devices and techniques (Note: existing traffic conditions and location may result in work hour restrictions as determined by the City Transportation Engineer or his designee.)
2. During emergency conditions where the health, safety and welfare of the Public is in jeopardy.
3. When no street, lane or sidewalk closures are needed for construction or maintenance.

G. Minimum Standards

The following minimum requirements will be adhered to unless otherwise specified and are only for temporary traffic control:

Travel Lane	12' minimum width
Two-Way Traffic	24' minimum width
Walkway	5' minimum width*
Parking lane	7' minimum width
Peak Hour Traffic	6:30 am to 9:30 am and 3:00 pm to 6:30 pm

*Must be ADA compliant with no obstructions in 5 foot area including any temporary fence footing or overhead enclosure footing.

H. Flagging

Nothing in this manual is to be construed as limiting the responsibility of the contractor to utilize workers to direct traffic when temporary or unforeseen conditions arise which indicate the need for such control. All flagging workers shall be supervised by FDOT MOT certified staff, properly dressed and equipped, as specified in the current Manual on Uniform Traffic Control Devices, when directing traffic.

I. Pedestrian Control

Pedestrians must be given adequate warning of hazardous areas in and about the construction project. This is especially true when pedestrians are forced to walk in locations other than normal walk areas. Care shall be taken to discourage children from playing in the work area or near construction equipment.

In residential areas where pedestrian activity is low, it is desirable to direct pedestrians to the opposite side of the street in advance of the work area. Special signs shall be used in conjunction with barricades for this purpose. Requirements of the FDOT Design Standards Index 600 and MUTCD chapter 6 shall be utilized.

In areas where the volumes of pedestrians and vehicles are high and the normal walk area becomes part of the actual work area, the contractor, utility firm or public agency shall provide an alternate or temporary walk area that is ADA compliant, unless otherwise approved by the City Transportation Engineer or his designee.

The contractor must maintain the function of all pedestrian signal and detection for all signalized pedestrian crossings open during construction, provide temporary pedestrian signals and detection when temporary pedestrian paths preclude the use of existing ones, and cover pedestrian signal and detectors when the paths are closed.

J. Steel Plates

Excavations and/or trenches which cannot be properly restored, including the placement of the final surface course of asphalt, prior to opening to traffic by the end of the work period, shall be bridged with steel plates to provide for unobstructed traffic flow. Steel Plates will not be waived unless excavation is properly backfilled and compacted in lifts, and an approved asphalt surface placed at the end of each work period.

Steel Plates used to bridge excavations or trenches shall be subject to the following and subject to the approval of the City Engineer or designee:

1. Contractor shall submit a plan designed, signed and sealed by a Professional Structural Engineer licensed to practice in the State of Florida.
2. Steel plates shall extend a minimum of 16 inches but not more than 30 inches beyond the edges of excavation, or as directed by the Professional Structural Engineer. In all situations, the longitudinal edges of the steel plates shall not be in the wheel path.
3. Steel plates shall be "pinned" to the existing roadway. Pins shall be of a sufficient size to restrict the plate from movement.
4. All edges of the steel plate shall be sloped with asphalt to minimize abrupt changes in grade. Sloping shall be a minimum of 1:4

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5. Steel plates may be installed in a “flush placement” method. Flush placement will require the work area to be milled to a depth and size equal to the thickness and dimensions of the plate.
 6. All steel plates shall be installed with a non-skid surface treatment to the entire surface area.
 7. Steel plates shall be installed with temporary reflective pavement tape for night visibility. Tape shall be 6 inches in width and encompass the entire perimeter of the steel plate.
 8. Trench or excavation walls shall have proper shoring to prevent cave-ins and to adequately support the steel plates and traffic loads and shall be included as part of the Structural Engineers design.
 9. Contractor shall install “Steel Plate Ahead” signs in advance of work area. These signs shall be maintained for the entire duration.
 10. The use of steel plates shall not exceed 14 days maximum duration.
 11. Contractor will notify Permitting Services Division, the Transportation Engineering Division, the Streets and Stormwater Division and The Wastewater Division prior to the placement of a steel plate and provide emergency contacts in the event of a steel plate failure. Once the contractor is notified of such a failure, the contractor must respond within four hours to repair the failure.

Section 8.15 General Requirements for Traffic Control Devices

Contractors, utility firms or public agencies shall use signs, warning lights and other traffic control devices which are in conformance with this section and the Manual on Uniform Traffic Control Devices and the FDOT Design Standards for Design, Construction, Maintenance and Utility Operations on the State Highway System (Design Manual). All such devices shall be in place before work begins, be correctly maintained while in use and be removed when work is complete. If, for an intermediate period, they do not apply to existing conditions, they shall be removed or covered. All of the aforementioned devices shall be moved as often as necessary to conform to the limits of the construction in order to convey their intended message clearly and correctly.

All signs and barricades shall comply in location, length, size and color with the latest revision of the Manual on Uniform Traffic Control Devices and the MUTCD’s – Standard Highway Signs Book, most current edition and the FDOT Roadway and Traffic Design Standards Manual. All traffic control devices must be on the latest FDOT’s Qualified Products List (QPL.) In addition, all contractors, utility companies or public agencies shall place their names on all barricades and shall maintain all barricades in good condition and appearance.

For those minor construction or maintenance operations involving slow-moving vehicles or requiring 15 minutes or less, the work vehicle itself shall have at least one rotating beacon or strobe light visible from all directions. No other stationary signs or barricades would normally be required in this case. Additional desirable equipment on the work vehicle would include flashing arrow panel, reflective markings and high visibility body color.

All arterial roadways shall have sign and pole specifications designed to the most current FDOT Design Standards. All collector roadways should have sign and pole specifications designed to the most current FDOT Design Standards. The City Transportation Engineer has the authority to require that a collector roadway's sign and pole specifications be designed to FDOT's Design Standards. Local collector roadways may have sign and pole specifications designed to the most current FDOT Design Standards. This may be required where the local collector roadway intersects with an arterial roadway or a collector roadway. The City Transportation Engineer has the authority to require that a local collector roadway's sign and pole specifications be designed to FDOT's Design Standards.

If a community or neighborhood management agency desires to have decorative poles for traffic control signs, all terms and conditions shall be agreed upon for the proper maintenance of traffic control with the City Transportation Engineer. No traffic sign face shall have a decorative design, and all traffic control signs shall conform with the MUTCD's Standard Highway Signs Book, most current edition. Only traffic sign poles may be allowed to be of a decorative design that functions properly. All traffic control signs with a decorative pole will not be maintained by the City of Orlando. The maintenance agreement should include provisions that a State of Florida Licensed Professional Engineer will be responsible for maintenance of all decorative pole signage, and that the City Transportation Engineer has the final authority to alter or change any and all traffic signage. Also, an appropriate security deposit or escrow should be set aside so that if the City needs to take over sign maintenance, the funds would cover the costs to the City of Orlando to completely replace the existing signage with the City of Orlando's current standard.

All signs installed within the City of Orlando on the sign back, shall have installation date stickers with additional information as to whom initially installed the sign. A double faced street name sign would not have an installation sticker, but records should be kept on its installation and provided to the City Sign Shop upon completion of installation. For example, on a speed limit sign, the back and not the face of the sign shall have the installation date sticker. All traffic signs shall be made of 3M™ Diamond Grade™ DG³ Reflective Sheeting Series 4000. All signs panel sizes and font sizes shall conform to the most current edition of the MUTCD and should at meet all minimum requirements and possibly exceed the minimum as needed. In addition, all street name signs for public streets are required to have the City of Orlando Logo (Lake Eola Fountain) and all street name signs for public or private streets are required to have a block number with arrow specified for the location.

Section 8.16 Traffic Signals and ITS

This section describes the standards for design and installation of traffic signal and intelligent transportation systems equipment. It describes the standard signal configuration, however, all intersections are different, and the designer shall meet with the Transportation Systems Management (TSM) Section before beginning design to discuss project specifics.

A. Design Standards

1. Design traffic signals according to the following documents: MUTCD, FDOT Roadway and Traffic Design Standards (17000 and 18000-series indexes), the FDOT Minimum Specifications for Traffic Control Signal Devices, FDOT Standard Specifications for Road and Bridge Construction, FDOT Plans Preparation Manual, the FDOT District 5 Signal Design Guidelines, and Seminole County Standard Mast Arm Drawings.

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2. Standard signalization general notes are to be included in the plans. The designer can obtain these from the City's Transportation Engineering web site.
 3. Plans for all new and modified traffic signals must be approved by the TSM section.
- B. Materials
1. Use equipment and material listed on the FDOT QPL or APL. The contractor must submit any items not on the APL or QPL first to the engineer of record, who will submit them to TSM for approval. Use FDOT Form 750-010-02, Submittal Data – Traffic Control Equipment to list all items submitted.
 2. The TSM Section must approve mast arm shop drawings and structural calculations before they are ordered unless the mast arms are in the QPL.
- C. Specific traffic and intelligent transportation systems (ITS) signal requirements
1. Download the City's standard general signalization notes from the Transportation Engineering web page.
 2. The City of Orlando uses mast arm assemblies due to their resistance to high winds, reduced maintenance cost, and consistency with other signals. Use them unless another configuration is approved by the Transportation Engineering Department. The assemblies will be the non-fluted Seminole County standard whenever possible. Mount traffic signal heads rigidly to the mast arms.
 3. All mast arm poles will be 32 ft tall topped with a shoe-box style luminaire. The purpose of this luminaire is primarily for pedestrian safety. Provide a 32 ft tall pole with luminaire in corners that do not require signal arms. The City may waive the luminaire requirement if the designer can show adequate illumination from other sources.
 4. Span wire assemblies: when span wire assemblies are used, they may only be perpendicular, box, or dropped box span assemblies. Diagonal spans may only be used for flashing beacon assemblies or when approved by the TSM Section. Use the two-point attachment system.
 5. Relocate any underground or overhead utilities in conflict with traffic signal equipment or ITS facilities. Do not design span wire assemblies with electrical power lines between the catenary and messenger cables. Do not design any traffic signal structure or equipment to come within 10 ft of any power line. Do not design any traffic signal structure or equipment so that overhead communications lines rest directly on the traffic control equipment.
 6. Foundations: provide mast arm foundations according to Index 17743 and 17745 for FDOT standard mast arm assemblies or per the Seminole County Mast Arm Standard Drawings as appropriate. The engineer will provide foundation design for all non-standard mast arm configurations. The design plans must include the geotechnical parameters as used in the Seminole County standards. The City requires all drilled shaft foundations to be tested as described in Section 455 of the FDOT Standard Specifications. Place a round or square pad 2 ft larger than the foundation around any traffic signal foundation located below the surrounding grade or on a slope to prevent shifting soil or turf from overtopping the foundation.

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7. Traffic signals heads for left turns: use either permitted-only, protected-plus-permitted, or protected-only left turn signalization as shown in the traffic study or as directed by the City. Design traffic signal support structures for permitted-only approaches to accommodate future protected-plus-permitted or protected-only phasing. Design traffic support structures for protected-plus-permitted approaches to accommodate both five-section heads and future four-section heads for flashing yellow arrow configurations.
 8. Vehicle signals: 12" LED vehicle signal heads.
 9. Pedestrian signs: LED countdown pedestrian signals.
 10. Pedestrian detectors: equip signals with audible pedestrian detectors, unless waived by TSM. Those not equipped with audible pedestrian detectors must be designed to accommodate them in the future.
 11. Confirmation lights: provide blue LED confirmation lights at all new or significantly modified signalized intersections.
 12. Detection: the City's standard is to use video detection with the ability to stream video over the City's traffic network. The City may accept alternative detection technologies such as inductive loops, micro-loops, and microwave detection. Maintain detection of all traffic lanes throughout construction.
 13. Traffic signal controllers and cabinets: the City's standard controller is a Naztec Series 980 TS-2 Type 2 controller with full Ethernet functionality or Naztec 980 ATC Type 2. Both must be capable of flashing yellow arrow operations. The standard cabinet is a Type VI TS-2 Type 1 cabinet compatible with the Naztec components. The cabinet must include fiber optic patch panes, Ethernet switch, and other components required for the location to communicate with the City's Regional Computerized Signal System (RCSS).
 14. Cabinets at intersections with concrete signal strain poles will be unpainted. Those at locations with steel strain poles or mast arms will be painted black. Any organization wishing to sponsor a cabinet for the purpose of placing art work must enter into a formal agreement with the City.
 15. Traffic monitoring cameras: install a closed circuit television (CCTV) camera at major intersections, intersections serving schools or school crossings, interchanges with limited access highways, or other locations required by the City. The camera must be an NTCIP-type IP-based camera compatible with the City's Cameleon ITS video management system and the FDOT SunGuide system.
 16. Network: connect all new or significantly improved signalized intersections into the RCSS TCP/IP-based Ethernet fiber optic network. The standard fiber optic cable is 72-strand single mode cable placed in underground conduit. TSM may allow overhead placement when construction of new conduit is not practical. Any construction that disturbs existing RCSS communications lines must replace fiber optic cables between major splice points. The City does not allow the introduction of new splices. Place conduit under the sidewalk of newly constructed or reconstructed streets to accommodate future fiber optic cables. Place fiber optic

pull boxes as needed along the runs and at intersections that may be signalized in the future.

17. Traffic signal equipment and network security: the designer must be aware of the City policy is a City traffic signal technician must be present whenever the contractor opens any traffic signal cabinet unless an active monitoring system is present. Contractors must schedule daytime escorts at least two working days in advance and escorts for overnight at least five working days in advance. The City will strive to provide a technician when requested, but may not be able to due to emergencies or staffing limitations.
18. Flashing beacons for pedestrian crossings: designers should not locate an un-signalized pedestrian crossing across a non-stop-controlled location without an active warning device. This device should use a high-emphasis warning light such as a rectangular rapid flash beacon (RRFB) that is operated by an active or passive pedestrian detector. The flasher controller should be capable of remote access to report operational status and usage statistics. This access can be through either the RCSS or wirelessly. Include 10 years of wireless access with the purchase of wireless access.
19. School zone/crossing and other timed beacons: provide solid state controller/timers capable of being interfaced with wireless access systems, controlled by traffic signal controller is near a signalized intersection, or directly into the RCSS via Ethernet if feasible.
20. Emergency vehicle preemption (EVP): the City uses the Opticom GPS EVP. This installation will include all hardware needed to connect the EVP device into the Opticom Central Management Software (CMS) over the Ethernet network. The construction will include system setup including programming the field equipment and updating the CMS.
21. Transit signal priority (TSP): contact TSM to determine if the intersections in question are on a route with TSP. Controllers at those intersections will require the additional TSP firmware.
22. Illuminated street name signs (ISNS): provide ISNS at all signalized intersections. Place one double-sided sign for each approach. Contact TSM for the City's specifications. Signs will be suspended from the arms between the major approach traffic signal heads.
23. Non-traffic control devices at signalized intersections: the City may permit some non-traffic control devices such as red light running (RLR) enforcement cameras on or near traffic signal equipment but only on a non-interference basis. The only devices allowed inside the traffic signal cabinet will be the pick-up coil that must be placed around the red light signal wire. All other equipment must be placed in separate enclosures and operate from independent power sources. The City will allow the other equipment to tie into the signal disconnect but only with an independent circuit breaker

Section 8.17 Parking

Parking space and aisle dimensions in all facilities shall conform to the dimensional requirements provided in Table 8.6. See Figures 17 and 18 for parking layout terms. Parking layout shall comply with the additional standards provided below:

A. Parking Stall Width

Parking stalls shall have a minimum width of 9 feet, except that a width of 8 feet 6 inches may be permitted for low turnover spaces. The module (M) and the associated isle width (A) may be reduced by up to 2 inches for each 1 inch of additional stall width (SW) to a maximum width of 9 feet 6 inches. Where walls, columns, and other vertical obstructions are located immediately adjacent to the sides of parking stalls, the stall width shall be increased by a minimum of 1 foot.

B. Low Turnover Parking Spaces

Up to 20% of the required parking spaces at shopping centers may be designated as low turnover spaces having a minimum stall width of 8 feet 6 inches. The 8 foot 6 inch stall width shall only be permitted in locations intended and suitable for employee parking or in areas likely to be used only on peak shopping days.

C. Aisles

Aisles for 90 degree parking spaces shall be designed to accommodate two-way traffic flow. Aisles for all other angles shall be designed to accommodate one-way traffic flow. For two-way traffic flow, the minimum aisle width (A) shall be 24 feet.

D. Turning Bays

In all parking facilities, turning bays shall comply with the minimum dimension of 16 feet 6 inches, as shown in Figure 18. For two-way traffic flow, the minimum turning bay width shall be 24 feet.

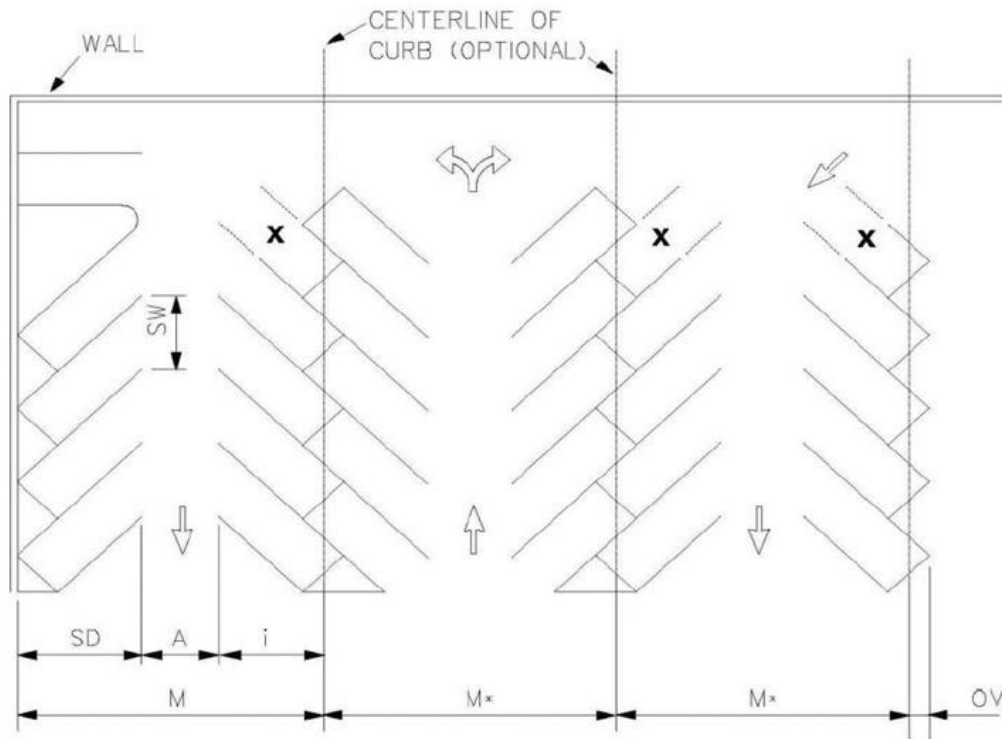
TABLE 8.6. REQUIRED PARKING DIMENSIONS FOR 9' 0" PARKING STALLS.

Angle of Parking	Stall Width (SW)	Stall Depth (SD)	Aisle Width (A)	Interlock (i)	Overhang (OV)	Module (M)	Module (M*)
	9' 0"		9' 0"	9' 0"		9' 0"	9' 0"
45°	12' 7"	19' 6"	13' 0"	16' 0"	2' 0"	48' 6"	45' 0"
60°	10' 4"	20' 6"	15' 0"	18' 0"	2' 0"	53' 6"	51' 0"
75°	9' 3"	20' 0"	19' 6"	18' 6"	2' 0"	58' 0"	56' 6"
90°	9' 0"	18' 6"	23' 0"	18' 6"	2' 0"	60' 0"	60' 0"

Notes:

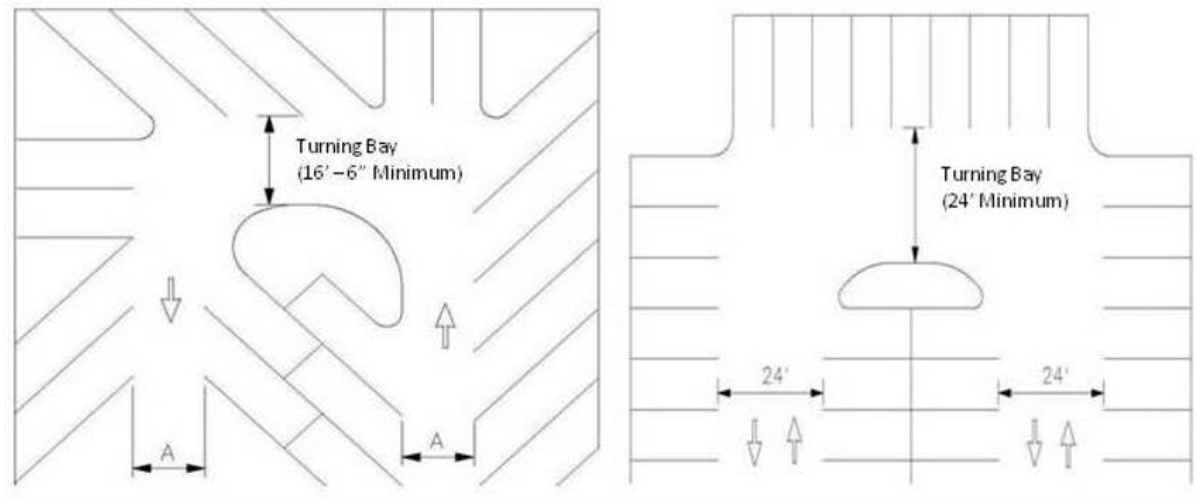
1. 90 degree parking is preferred.
2. Parking angles from 76 to 89 degrees are not permitted.
3. Parallel parking stalls shall have a minimum length of 23 ft. 0 inches and a minimum width of 9 ft. 0 inches for parking within the City ROW.
4. The City Transportation Engineer shall be authorized to allow a maximum 1 foot reduction of the module (M) and the associated aisle width (A).

FIGURE 17 PARKING LAYOUT TERMS



A	MINIMUM AISLE WIDTH	OV	OVERHANG
i	INTERLOCK WIDTH	SD	STALL DEPTH TO WALL
M	INTERLOCK MODULE TO WALL	SW	STALL WIDTH PARALLEL TO AISLE
M*	INTERIOR INTERLOCK MODULE (WITH OPTIONAL CURB)	X	STALL NOT ACCESSIBLE (IN CERTAIN LAYOUTS)

FIGURE 18. MINIMUM TURNING BAY DIMENSION FOR ONE-WAY AND TWO-WAY TRAFFIC FLOW



On-Street Parking

On-street parking stall design shall follow the latest FDOT Design Standards. Parking is restricted 15 feet on either side of a fire hydrant. The curb shall be painted yellow 15 feet on both sides of the hydrant and no parking signs shall be set accordingly. All parking prohibition signs shall be set at a 45 degree angle facing parked vehicles for on-street parking prohibitions. The following table is the City of Orlando's parking restriction warrants. This is provided as a guideline to design especially for residential streets.

Street Width	Peak Hour Volumes		Daily Volumes	
	No Parking One Side	No Parking Both Sides	No Parking One Side	No Parking Both Sides
19' or less	0	0	0	0
20' to 23'	0	90	0	900
24' to 25'	0	150	200	1500
26' to 27'	60	360	600	3600
28' to 29'	90	500	900	5000
30' to 33'	120	600	1200	6000
34' or more	*	*	*	*

* To be determined on basis of individual need and conditions

Parking at the intersection will be based on FDOT Design Standards Index 17346 "Minimum Parking Restrictions for Nonsignalized Intersections". If the City Transportation Engineering evaluation finds that parking is too close to the intersection, yellow curb and/or parking prohibition signs shall be required to be installed. Depending on the location, the City Transportation Engineer may require a larger prohibition distance from the PC.

Where parking is prohibited or parking stalls are designed, the location should favor pedestrians not having to cross the roadway. For example, if parking on an east to west bi-directional roadway is to be prohibited on one side, and there is a park or a pedestrian generator on the north-side of the roadway, the north-side of the roadway shall provide parking and the south-side of the roadway

shall be prohibited. The purpose of this type of design is to reduce pedestrian crossing conflicts on the roadway.

All on-street parking shall not interfere with sight distances and also shall not interfere with the safe and efficient operation of an intersection.

Section 8.18 Roadway Lighting

Street Lighting shall be installed on all City maintained roadways. It is the City's policy to follow the lighting guidelines in the most recent version of the Florida Department of Transportation Plans and Preparation Manual.

A. Standard Street Lighting

For all lighting projects funded entirely by the City, standard street lighting is defined as a 100W high pressure sodium equivalent Light Emitting Diodes (LED) cobrahead light fixture mounted on a 35' concrete pole powered with overhead wiring or underground conduit. All lighting equipment and maintenance is to be furnished by the utility company providing electric service.

B. Decorative Street Lighting

Any decorative lighting installed on right-of-way to be turned over to the City upon completion shall be of a design approved by the City Transportation Engineer. Any decorative street lighting shall require a maintenance and bill payment agreement between the City, the utility company, and the neighborhood management agency before the roadway is turned over to the City.

Section 8.19 Final Acceptance for all Public Roadways

The City's Transportation Engineer has the authority to accept or not accept newly designed and constructed roadways that are for public use. All conditions and standards within this chapter shall be met. All variances shall be agreed upon in writing by the Engineer of Record and the City Transportation Engineer. The purpose of this section is to ensure that public roadways will function safely and efficiently while being designed with all potential users in mind. If the City's Transportation Engineer does not accept the design and the construction of new or redesigned roadways, the City of Orlando will not be responsible for the maintenance of any such roadway.

CHAPTER 9 - WASTEWATER FACILITIES DESIGN

Section 9.01 General Requirements

The following design criteria shall pertain to all gravity sanitary sewer, lift stations and forcemains. 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. Any changes to the requirements listed herein must be requested through the Wastewater Division Manager. All City owned wastewater facilities shall be installed in publicly owned right-of-way or in easements that do not preclude City operation and maintenance of the facilities as determined by the Wastewater Division.

Section 9.02 Design Criteria

A. 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 may be used by the designer in determining the ultimate project flow (ADF) in accordance with those rates currently in effect and available at the Permitting Services.

B. 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 (ADF). The peaking factor is the ratio of the peak flow to the average daily flow, 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 larger than the average daily flows shown in Table 9.1 will be evaluated by the Engineer on an individual basis.

Table 9.1
Peaking Factors

Flow Range (MGD-ADF)	Peaking Factors (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 9.02.01 Gravity Sewer Design Criteria

A. Design Flow

Sewers of 15 inches in diameter and less should be designed to flow no more than ½ full at peak design flow. Sewers greater than 15 inches should be designed to flow no more than ¾ full at peak design flow. All sewers shall be designed to achieve cleansing velocity of 2 feet per second during design flow conditions.

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- B. Minimum Diameter
 - Main Sewer - 8 inches
 - Residential lateral, single unit or one side of duplex – 4 inches;

 - Commercial user lateral – 6 inches, minimum
 - Multi Family user lateral – 6 inches, minimum

 - C. Velocity in Pipes: (At Peak Flow)
 - a) Minimum - 2 feet per second
 - b) Maximum - 8 feet per second

 - D. Roughness (Mannings) Coefficient
 - Lined DIP N=0.012
 - PVC N=0.011

 - E. Minimum Slopes vs. Diameter for PVC pipe

Table 9.3
Diameter vs. Minimum Slope of PVC Pipe

Diameter (inches)	Minimum Design Slopes (feet per 100 feet)	Minimum As-Built Slopes (feet per 100 feet)
8	0.40	0.28
10	0.28	0.22
12	0.22	0.18
15	0.15	0.12
18	0.12	0.09
24	0.08	0.06

For larger diameters, refer to Recommended Standards for Wastewater Facilities, a.k.a. 10 States Standards, latest edition.

- F. Minimum Lateral Slopes
 - Minimum slopes for laterals is one percent (1%)

- G. Maximum Manhole Spacing
 - Maximum manhole spacing is 400 feet for any diameter sewer unless otherwise approved by the Wastewater Division.

- H. Manholes
 1. Shall be placed at ends of all main lines,
 2. Shall be placed at junction of main lines,

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3. Shall be placed at changes of grade and alignment,
 4. Inverts shall be dropped 0.1-foot at all changes in direction exceeding 45 degrees,
 5. When several pipes of different diameters meet at a manhole, the 0.8 depth point shall be equally matched unless otherwise directed,
 6. Drop connections are discouraged except in extreme cases, only with pipe diameters less than 10 inches, and must be approved by the Wastewater Division,
 7. The direction of incoming lines shall not exceed 90 degrees of the established flow direction in the main,
 8. Shall be located, when possible, so that service vehicles block no more than one vehicle travel lane during maintenance operations,
 9. Shall be lined with an approved lining system when receiving force main discharges.
 10. Invert elevations shall not be more than fifteen (15) feet below grade elevation, unless approved by the Wastewater Division.
 11. Concentric cone sections are required.
 12. Hinged manhole covers are not allowed.

I. Main Line Locations

1. Main lines should be installed in the center of paved right-of-way on new construction,
2. Where main lines are to be installed in previously constructed right-of-way, mains may be installed in the unpaved portion of the right-of-way and shall be a minimum of 10 feet from the right-of-way line. Greater distances from the right-of-way line may be required due to pipe depth and other factors,
3. Main lines shall not cross under curbs, sidewalks, bike paths, buildings, or other above ground structures unless approved by the Wastewater Division prior to construction,
4. Main lines shall not be allowed in side or back lot easements unless approved by the Wastewater Division prior to construction,
5. Main lines shall not be installed beneath canals, retention areas or swales without prior approval of the Wastewater Division. Any lines in these areas with less than 3 foot of cover to the bottom of the body being crossed must be installed within a pipe casing that extends the full length of the body being crossed or shall be installed as ductile iron pipe for the same distance.
6. Main lines shall not be placed under trees.

Section 9.02.02 Force main Design Criteria

- A. Design flow shall be the Peak Flow Rate
- B. Size Requirements
 - 1. Adequate diameters shall be selected to convey the peak operational flows being discharged by the lift station pumps to its destination. Design shall endeavor to keep total static and dynamic head to less than 100 feet (43 psi).
 - 2. Force mains within public rights-of-way shall be a minimum 4-inch diameter unless approved by the Division.
- C. Velocity in Pipes
 - 1. minimum 2.5 feet per second
 - 2. maximum 7.0 feet per second
- D. Roughness Coefficient (C)
 - 1. Lined DIP C=120
 - 2. PVC C=140

Combination air and vacuum release valves (ARVs) shall be installed at all high points along the force main route and where the elevation of the top of the pipe changes more than one (1) pipe diameter. Valve vaults shall be constructed to match adjacent finish grade. Force mains shall be designed and installed to minimize ARVs.
- E. Main Line Location
 - 1. Comply with gravity main line requirements.

Section 9.02.03 Sanitary Sewer Pumping Stations

- A. Design Flow

Design flow shall be the Peak Flow Rate including any expected future expansions.
- B. Number of Pumps

Two pumps are required for all stations discharging 2000 gallons per minute or less. Additional pumps as required for larger flows. For submersible stations where the pump size exceeds 25 hp individually, the station shall be equipped with an overhead crane system for removal of the pumps from the wetwell, unless otherwise approved by the Wastewater Division.
- C. Pump Selection

Pumps shall be capable of meeting all system hydraulic conditions without motors overloading. 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:

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1. System operation under peak flow conditions, with one pump or multiple parallel pumping, as designed. Should the receiving force main system be interconnected to additional pumping stations, hydraulic design conditions shall also include said pumping systems operating at rated capacity,
 2. Pumping capability with one pump running, all units operating in parallel and other combinations, if applicable.
 3. All pump systems shall be designed to consider maximum head, minimum head, and run-out conditions. Other criteria may be required for design on a case by case basis.

D. Pump Requirements

1. Minimum five minutes between successive pump starts,
2. Pumps shall alternate operation automatically,
3. Pumps shall be sized to pump the peak design flow rate with one pump out of service,
4. Shall be capable of handling raw sewage and passing a 3 inch diameter solid,
5. Pumps shall be Flygt, Fairbanks Morse, Hydromatic (less than 50 HP) or ABS (less than 50 HP), with no substitutions allowed,
6. All pumps shall be compatible with the Flygt guiderail and pump discharge elbow system.
7. Pumps with motors 50 HP or greater shall have variable frequency drives (VFDs) located in an engineered building,
8. Motors shall be capable of submerged duty,
9. Motors shall be 480/240 volt, 3-phase, 60 Hz, unless required otherwise by the Wastewater Division,
10. Motors greater than 25hp and less than 50 HP, shall have solid state soft starters,
11. VFD manufacturers shall be approved by the Wastewater Division.

E. Wet Well Requirements

1. A minimum 5 foot depth from the lowest incoming gravity sewer invert and the pump top of motor,
2. A minimum 6 foot diameter,
3. The maximum high water level shall be 0.5 feet below the lowest influent gravity pipe invert with the high water alarm no higher than the invert of said pipe,

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4. 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.
 5. Successive pump start requirements shall not be exceeded.
- F. Stand-by Power Generators
1. Stand-by power shall be provided at all stations, unless determined otherwise by the Wastewater Division.
 2. 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 serving lift stations with pump motors 50 hp and greater shall be installed in a concrete masonry building as approved by the Wastewater Division. Generator and controls serving lift stations with pump motors less than 50 HP shall be sheltered and enclosed as approved by the Wastewater Division.
 3. Generator and automatic transfer switch (ATS) shall be approved by the Wastewater Division. Contact the Wastewater Division for Generator Specifications and Standard Lift Station Electrical Drawings.
- G. Telemetry Systems
1. Motorola RTU F75363A MOSCAD ACP PLC Duplex/Triplex RTU (type 3x, 4x, 5x, or 6x with and without VFD's):
ACE3600 with CDM 750n 136-174-MHz Analog Radio
V103Add: 51/0 Slot Frame
V214 Add: 14x14 Metal Chassis ACE3600
V245 Add: ACE3600 Mixed Module 16DI 4DO EE 4AI 20mA (Quantity 2 for VFD)
V118 Add: 4 A/O Module (Quantity 1 VFD Only)
V153 Add: 40 Pin TB Holder Kit (Quantity of 3 for VFD)
V1261 Add: ACE 3600 AC Power Supply 85-264v w/Battery Charger
V114 Add: 6.5 aH Battery
NEMA-4X Stainless Steel Enclosure w/locking handle powder coated white
V224 Tamper Switch
1-Mixed IO Interface Ace-V245-Aux-I_O Din Rail Mountable
 2. Orlando Spec. Antenna Mast
 3. Hunt AC Line Surge Suppressor
 4. Decibel Products DB230-Yago Antenna and 30' RG8/U Cable
 5. Polyphaser Antenna Surge Suppression

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6. PLC Application downloading and programming and PLC Application Modification
 7. Locks: Model # FLN8375A Handle with cylinder Eldon #2920 Key, #21323C

H. Lift Station Layout Drawing:

Drawings of lift stations to be owned by the City shall include a detail showing fencing, gates, landscaping plan and valve pad relative to the lift station, including but not limited to all elevations, such as inverts, floor elevations and finish grades, etc. All the above improvements shall be included inside the fenced-in area. The approach road and driveway shall also be shown. The access driveway shall provide a minimum 25 feet between the nearest travel lane of the public street and the gate and its swing radius. The drawing shall be fully dimensioned.

Section 9.03 Gravity Sanitary Sewers

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

Section 9.03.01 Materials

- A. Polyvinyl Chloride Pipe and Fittings (PVC) green in color
- B. Pipe and fittings shall conform to ASTM D3034, SDR 26 (for pipe diameters 4"-15"), ASTM F679 SDR 26 (for pipe diameters 18" – 48"). PERMA-LOC, SPIROLITE (or approved equal polyethylene pipe in accordance with ASTM F894) and HOBAS (or approved equal fiberglass pipe in accordance with ASTM D3262) may be approved by the Wastewater Division for special purposes as appropriate. Joints shall be made with integrally formed bells and spigots with factory installed rubber sealing ring gaskets. Joints shall conform to ASTM D3212 with push-on type elastomeric compression gaskets. Field solvent weld joints shall not be acceptable. Use ductile iron pipe for invert depths over 15' and when crossing water or stormwater pipes. Invert depths over 15 feet require approval by the Wastewater Division Manager.
- C. Ductile Iron Pipe and Fittings.

The pipe shall be lined ductile iron (DI) with a minimum thickness of Class 350 (4-12 inch), 250 (14-20 inch), 200 (24 inch), and 150 (30-64 inch). Fittings may be ductile iron or cast iron unless otherwise noted.

1. Pipe shall be ANSI A2 1.51 (AWWA C 151).
2. Fittings shall be ANSI/AWWA C110.
3. Mechanical and Push-on Joints shall conform to be ANSI A2 1.11 (AWWA C111).
4. Flange Joints shall conform to ANSI A2 1.10 and A2 1.15 (AWWA C 110 and C115), Class 125 with 1/8-inch full faced rubber gaskets.

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5. Restrained Joints shall be ductile iron mechanical joint retainer glands manufactured by American Cast Iron Pipe Co. or an approved equal.
 6. Flexible Joints shall be boltless with 15 degrees joint deflection per applicable portions of ANSI A2 1-10 (AWWA C 110) as manufactured by "Flex-Lok" by American Cast Iron Pipe Co., or an approved equal.
 7. Bolts shall conform to ANSI B 18.21 and nuts shall conform to B 18.2.1. of low carbon steel per ASTM A307, Grade B.

D. Coatings and Linings for Ductile Iron Pipe

All ductile iron pipe and fittings shall have a protective interior lining. The lining shall be a ceramic epoxy material such as SP2000 or Protecto 401. All linings shall be applied to a nominal thickness of 40 mils. Polyethylene encasement, where required, shall be per ANSI A2 1.5 (AWWA C 105). If polyethylene encasement is not required, the pipe exterior shall be bituminous coated. Color Coded green per Section 9.04.

E. Pipe-Manhole Connector

Connection to pipes less than 12-inch diameter shall be with Kor-N-Seal or Link Seal, for pipes 12-inch diameter and larger, where invert depth exceeds 10 feet for all pipe type and diameters, and for all DIP use Link Seal. Other proposed connectors must be approved by the Wastewater Division.

F. Non-Shrink Mortar

All holes in manholes and wetwells shall be thoroughly plugged with an approved 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 wetwell wall surfaces. When mortar is set, coat with Koppers 300 M, or approved equal coal tar epoxy 16 mils dry thickness.

G. Precast Manholes

Precast manholes shall have a minimum wall thickness of six inches. Manholes shall be manufactured with 4,000 P.S.I. concrete, Type II cement. Wall reinforcement shall meet ASTM-478 and also have a No. 4 rebar hoop around each pipe opening. Bottom slabs will be 8 inches thick and be reinforced with No. 4 @ 9 inches O.C.E.W. All items will be wet cast. Dry casting or low slump concrete will not be allowed. All bases will have proper lifting hooks in the bottom slabs (min. of 3) and there will be no penetrating lifting holes on any structures. No holes will be allowed within 6 inches of any joint on structures. Manhole cone sections shall be concentric. Eccentric cone sections shall not be allowed unless approved by the Wastewater Division.

H. Brick

No brick manholes unless approved by the Wastewater Division for special circumstances. Bricks may be used for adjustment of manhole frames without approval. Brick shall conform to ASTM C32, grade MC (hard brick). Maximum number of courses of brick shall be

per the City standard detail drawings.

I. Mortar

For brick sections of manholes, mix one part Portland Cement Type II and three parts of sand per FDOT 902-2. For mortar plaster, use one part cement and two parts sand.

J. Manhole 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 Ramnek and placement of each manhole section to form a water-tight joint. Manhole joints and ring and cover chimney shall be wrapped with adhesive polyolefin sheeting that is heat applied to the exterior of the structure. Upon cooling, the adhesive shall form a tough, elastomeric protective layer that shall effectively prevent the infiltration of groundwater through these areas. The overall thickness of the applied sleeve shall nominally be 2.5 mm. Wrap material shall be Wrapid Seal or approved equal.

K. Manhole Frame and Covers “City and Private”

Manhole frame and covers shall be manufactured by U.S. Foundry or approved equal. Manhole frames and covers shall be standard 2-piece heavy duty with machine bearing surfaces, no hinged covers (see standard details). The word “Sanitary Sewer” and the log of the “City of Orlando” shall be cast into the face of the cover in accordance with the standard details. Manholes for privately owned systems shall have the word “Private Sanitary Sewer” cast into the face of the cover, shall not bear the City Seal Logo.

L. Bitumastic Coatings

Shall conform to Carboline 300M, or an approved equal.

M. Manhole lining

The first two (2) manholes upstream of a lift station and manholes that receive force main discharge shall have interior liners or epoxy coating approved by the Wastewater Division. Liners shall be either a solid wall fiberglass liner or an integrally cast fiberglass or polyethylene liner and be provided by GULiner or AGRU Liner. Rings and covers in these manholes shall be coated with a corrosion resistant epoxy.

Section 9.03.02 Installation

A. General Requirements

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 and comply with all local, State and Federal regulations. Call Sunshine State One Call 811 before you dig.

B. Pipeline Trenching

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1. 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. Trenches shall not be left open overnight. Backfill daily.
 2. 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.
 3. All excavations may be made by open cut unless otherwise indicated in this Manual or approved. Sides of trenches shall be kept as nearly vertical as possible from the trench bottom to a level of one foot above the top of the pipe. Trench bottoms shall be excavated true to line and shall be not less than 18 inches wide or more than 24 inches wider than the outside diameter of the pipe so a clear space of 9 to 12 inches is provided on each side of the pipe. Minimum trench width for small diameter pipe shall be 24 inches. Grade of the trench bottom shall be consistent with the method of bedding specified within this Manual.

C. 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. All trenching shall be performed in compliance with the OSHA Trench Safety Act.

D. Dewatering and Drainage

At all times during construction, keep excavations free from standing water. Dewatering operations shall maintain groundwater a minimum of two (2) feet below bottom of trench. Sumps, if required, shall be located outside of load bearing areas so the bearing surfaces will not be disturbed. The Contractor is responsible for all dewatering permits. Before discharge of produced ground water to any surface waters of the State can occur from a non-contaminated site, analytical tests on samples of the proposed untreated discharge water shall be performed to determine if contamination exists. Minimum requirements as set forth by FDEP Document 62-621.300(2) "Generic Permit for the Discharge of Produced Groundwater from any Non-Contaminated Site Activity" must be followed and test results must be below screening values for discharge in Table 1 of the FDEP document. All reporting and record retention requirements of this document shall be adhered to. 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. The sanitary sewer system shall not be used to dispose of dewatering drainage unless approved by the Wastewater Division. Following completion of dewatering activities, contractor shall fill all wellpoint holes with flowable fill or pea gravel for the entire depth.

E. 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 3/4" stone or smaller with a minimum of 6inch thick base or approved coarse granular stabilization material. Depth of stabilization shall be as directed by the City Engineer or his designee.

F. Bedding of Piping

1. General

- a. Haunching is defined as the shaped and tamped granular material which extends from the pipe bedding to the springline 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 one 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.
- b. All buried piping shall be continuously bedded and covered, except where concrete or flowable fill encasement, concrete cradles or boring and jacking are indicated.

2. 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 27.03(G). Bedding materials shall be limited to Class I or Class II materials.

3. Pipe Cover

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

G. 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.

Unless otherwise indicated or approved by the City Engineer or his Designee, fills shall be placed in the loose lift thickness 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 D1557 unless otherwise noted.

Table 9.4
Backfill Requirements

Type of Fill	Usage	Thickness	%	ASTM
Trenched Pipe Foundation, Bedding and Haunching	Beneath piping	6"	95	D1557
Trenched Pipe Cover	Over and/or around piping	6"	95	D1557
Utilities Trench Backfill	"Influence area" beneath other piping or utility lines	8	95	D1557
	"Influence area" beneath rigid paving and railroad tracks	6"	98	D1557
	"Influence area" beneath non-rigid paving	9"	98	D1557
	Adjacent to or under Structures	9"	98	D1557
	Cropland, plant site, lawns	12"	85	D1557
Structural Fill	All locations under minor structures (manhole, etc.)	12"	98	D1557
Granular Fill	Below concrete slab bedding, foundations, rigid paving and excavated areas adjacent to structures	8"	98	D1557
Granular Bedding	Beneath concrete slabs	12"	85	D1557
Structural Backfill	See Trench Backfill			
General Site Grading Not Covered Herein	Fill in other locations	12"	85	D1557
	Topsoil placement	12"	85	D1557

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

H. Pipe Laying and Jointing

Gravity sewers will be laid in the dry to the elevations and slopes shown on the approved construction drawings. Laser equipment shall be used to provide proper line and grade. Surveying equipment will be used to set the laser. The laser equipment will have a slope indicator to facilitate checking by both the pipe laying foreman and the City Engineer/inspector. Since most gravity sewers are laid with extremely flat slopes, the tolerance shall be within 10% of the design slope as long as the minimum slope criteria are met. Upon completion of the work, the lines will be cleaned, with all debris removed from the sewer at downstream manhole and each section of pipe will be TV- inspected to

indicate any pipe defects. Any defects, bellies or other deformities will be taken up and relaid to provide the correct line and grade. Special attention will be given to the requirement that the pipe be laid in a dry trench with properly compacted bedding and with properly compacted 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 pipe manufacturer. The minimum allowable cover for gravity sewers shall be 3 feet from the top of the pipe to the finish 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 30 inches, unless special design considerations have been approved by the Wastewater Division. Pipes shall be installed to the alignment and grade as shown on the approved plans.

I. Tee Branches for Service Laterals

Tee branches are to be installed in conjunction with the laying of sewer pipe. Tees 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.

J. Laterals

All laterals shall be installed 90 degrees off the sewer main at minimum grade of 1 percent and located between 3 and 4 feet below the right-of-way line finished grade with a two-way cleanout assembly between the sidewalk and curb line. A tee branch fitting for each service line shall be provided. Double or single wyes are not acceptable. All lateral ends not connected shall be plugged with a PVC plug at the right-of-way line. All laterals shall be 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' plastic stake shall be painted green and installed at the end of the connection. Cleanout caps shall be PVC and of the inverted hex-nut type. If required by the City Engineer in writing, the terminal ends of laterals shall be marked by electronic location devices that are compatible with City owned equipment and shall mark the terminal ends of laterals. Cleanouts in driveways and sidewalks are not allowed unless approved by the Wastewater Division. All approved cleanouts in driveways and other paved areas shall be adjustable traffic bearing cast iron valve box with cover stamped with the word "Sewer".

K. Protection of Water System Crossings

Where the horizontal separation between sanitary sewer and potable water lines are less than 6 feet, the sewer pipe shall be constructed of lined ductile iron pipe with high pressure joints. Where the sewer pipes cross any potable water lines with a vertical clearance of less than 12 inches, a minimum of 10 feet each side of the crossing shall be high pressure joint lined ductile iron pipe. If required by the City Engineer, cathodic protection shall be provided.

L. Stormwater Crossings

Where sanitary sewer crosses under stormwater pipe with a vertical clearance of less than

12" or over with a vertical clearance of less than 6", a minimum of 10 feet each side of the crossing shall be lined ductile iron pipe with high pressure joints. Nearest joint shall be 10 feet each side of crossing.

M. Downstream Protection

Dirt and debris collected in the pipe during construction shall not be flushed downstream into the existing sewer system. The open end of pipe shall be closed daily to prevent foreign matter from entering. Contractor is responsible for any cleaning that is necessary, to include the hiring of a vacuum truck.

Section 9.03.03 Connections

A. Transition Connections

Where pipes of differing materials (PVC to DIP, etc.) are to be connected together between manholes, suitable approved transition couplings shall be "Eastern Standard Mission Couplings" manufactured by Mission, or an approved equal. Special designed units may be submitted for approval. Concrete collars are not acceptable and changes in pipe size or slope are not allowed between manholes.

B. Connections to Existing Lines and Stubs

Connections into PVC, Clay or concrete sewers shall be accomplished with a PVC Tee fitting sized to match existing main and lateral. The tee fitting must have 2' pieces of SDR 26 installed on each end of the fitting with Eastern Mission Couplings with adapters depending on the pipe material to close the installation. The sewer main shall be protected and cleaned of debris resulting from the connection. When connecting to an existing stub, contractor shall verify that the stub is on line and grade prior to making the connection. Any stub which has become off grade shall be relayed until proper slope has been achieved.

C. Tall Riser Connections (Lateral Connections)

Connections shall be provided, as shown in the standard detail drawings, 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. Lateral connections shall be made by individual Tee fittings only. Double wye connections are not permitted.

D. Connections to Manholes

Connections shall be in accordance with the Standard Detail Drawings as specified herein. All openings for pipes into existing structures shall be made by cutting with a power driven circular coring machine.

E. Connections to Wet Wells

One joint (18-20 feet) of epoxy lined ductile iron pipe shall extend outward from the structure. Perform connections as for manholes using Link Seal connectors, or approved equal.

F. Conflicting Structures and Protection of Sanitary Sewer at Utility Crossings

Where it becomes necessary to extend sewers through structures, such as conflicting manholes, junction boxes, etc., the pipe shall be ductile iron with no joints inside the conflicting structure and approved by the Wastewater Division.

Section 9.03.04 Manholes

A. General Requirements

Manholes shall be in accordance with the Standard Detail Drawings as specified herein. Manholes shall be precast concrete with integral bottom slab and lower ring or poured in place concrete slab with precast ring wall. Cone Sections shall be concentric. Eccentric cone sections shall not be allowed without Wastewater Division approval.

Brick manhole construction shall only be allowed with special approval from the Wastewater Division and the City Engineer. Brick manholes shall be true and symmetric with all courses level. Bricks shall be placed by shoving into a full bed of mortar with 1/4 to 1/2 inch joints completely filled. Courses shall be laid continuously with alternating joint and whole headers every sixth course. Excess mortar shall be carefully struck off. Portland cement plaster (1/2 inch minimum) shall be applied to the interior and exterior brick surfaces. Brick manholes shall be protected and kept moist for at least 48 hours following completion during hot or dry weather. Brick manholes may only be used up to depths of five feet. A maximum inside chimney height of eighteen inches shall be allowed, as measured from the top of the ring to the bottom of the vertical portion of circular chimney walls.

B. Manhole Foundation

The soil beneath the manhole shall be compacted to 98% of maximum modified Proctor AASHTO T-180 density for twelve inches and then stabilized using a minimum of 12" of 57 stone. .

C. Manhole Base

Bases shall be poured in place with Type II portland cement concrete or cast as an integral part of the precast section. The Wastewater Division may request to use GU Liners.

D. Manhole Invert

On precast structures, the manhole base shall be trowel finish concrete benching and invert channels provided in accordance with the City standard detail drawings. The Wastewater Division may require the manhole base be cast with an integral base liner system which shall also form the invert channel(s). The base liner shall be of polyethylene or fiber reinforced plastic (FRP) and shall be a non-load bearing component of the structure. The liner shall be anchored into the base during the casting process at the precast manufacturer's facility. The liner shall include full flow channels, an anti-skid pattern on the bench surface and a means of making a leak-free pipe connection.

E. Manhole Coating

Two coats of bitumastic shall be applied to all interior and exterior surfaces by the precast manufacturer at a rate necessary to achieve a 16 mil dry film thickness. All disturbed and uncoated surfaces shall be coated in the field. This work shall be accomplished prior to CCTV inspection.

F. Manhole Lining

All manholes receiving force main discharge shall have an FRP/Poly liner or epoxy coating approved by the Wastewater Division.

G. Top Elevation

Precast manhole top shall be adjustable between six inches and 12 inches by means of bricks laid in mortar or precast riser rings. Vertical walls of manhole entrances shall be a maximum of 18 inches in length, including the ring and cover.

H. Manhole Frames and Covers

Manhole frames and covers shall be set to conform to the finish 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 should be set approximately 0.2 foot above the existing ground unless otherwise noted.

I. 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.

J. Bulkheading Stub-out Channels

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

K. Drop Connections

A drop connection shall be required for invert elevation differences greater than 18 inches. Benches shall be built up to the 0.8D point of all incoming pipes for invert elevation differences greater than 12 inches. Outside drop connections are not allowed. Minimum inside manhole diameter shall be 5 feet for drop manholes. Drop connections should be avoided and must receive prior approval of the Wastewater Division.

Section 9.03.05 Testing

A. Closed Circuit TV Inspection

Note: The City of Orlando Wastewater Division crews will conduct internal inspections only if systems are dedicated to the City. If the system is private, the contractor shall have the

system internally inspected at their own cost. Wastewater Division must review all video recordings for approval of construction acceptability. CCTV inspection shall be performed and approved prior to asphalt construction. CCTV inspection shall be performed when roadway base course is stabilized, pipes cleaned of dirt and debris, and rings and covers set but asphalt paving course shall not be constructed.

1. To insure the proper documentation and the integrity of newly installed sanitary sewer, all main pipelines, laterals and manholes shall be cleaned and all debris removed using high-velocity jet equipment (Hydrocleaning). All high-velocity sewer cleaning equipment shall be constructed for ease and safety of operation. The equipment shall have a selection of two or more high-velocity nozzles. The nozzles shall be capable of producing a scouring action from 15 to 45 degrees in all size lines designated to be cleaned. Equipment shall also include a high-velocity gun for washing and scouring manhole walls and floor. The gun shall be capable of producing flows from a fine spray to a solid stream. The equipment shall carry its own water tank, auxiliary engines, pumps and hydraulically driven hose reel.
2. After cleaning, the line section shall be visually inspected by means of closed-circuit television. The inspection will be performed one line section at a time. Prior to inspection, water will be introduced continuously into the upstream manhole until it appears in the downstream manhole. At the time, the water source will be terminated and the closed-circuit television inspection will commence.
3. The television camera used for the inspection shall be one specifically designed and constructed for such inspection. A pan and tilt camera shall be used in pipes with a diameter of eight inches (8") and larger. Pipes with a diameter less than eight inches (8") shall be able to be inspected with a rear view camera. Lighting for the camera shall be suitable to allow a clear picture of the entire periphery of the pipe. The camera shall be operative in one hundred percent (100%) humidity conditions. The camera shall also be equipped with depth gauge with one-quarter inch (1/4") increments and shall be two inches (2") in height. The camera, television, monitor and other components of the video system shall be capable of producing a high quality DVD format. The video image shall be clear, focused and relatively free from roll, static or other image distorting qualities which would prevent the reviewer from evaluating the condition of the sewer system.
4. The camera shall be moved through the line in either direction at a moderate rate, stopping when necessary to permit proper documentation of the sewer's condition, panning and tilting as necessary with a speed slower than thirty feet (30') per minute. When a lateral is located, panning to look up the lateral for a minimum of ten (10) seconds for proper documentation of the connection and lateral will be required. In addition, all laterals shall be internally inspected, with a closed-circuit television camera designed for the smaller diameter pipe, from the clean-out assembly located at the property line to the sewer main. Manual winches, power winches, TV cable and powered rewinds or other devices that do not obstruct the camera's view or interfere with the proper documentation of the condition of the sewer, shall be used to move the camera through the sewer line.
5. When manually operated winches are used to pull the television camera through the line, a suitable means of communication shall be set up between the two

manholes of the section being inspected to insure good communications between members of the crew.

6. The importance of accurate distance and manhole designation measurements is emphasized. Measurements for location of defects shall be above ground by means of a meter device, marking on the cable, or the like, which would require interpolation of depth of manhole, will not be allowed. Accuracy of the distance meter shall be checked by use of a walking meter, roll-a-tape or other suitable device and the accuracy shall be satisfactory to the City of Orlando's representative. Manhole identity will correspond to the set of plans which have been approved by the City of Orlando prior to construction.

7. Documentation of the television shall be as follows:

a. Television Inspection Logs

Printed location records shall be kept by the contractor and will clearly show the location in relation to an adjacent manhole of each infiltration point observed during inspection. In addition, other points of significance such as location of building sewers, unusual conditions, roots, storm sewer connections, broken pipe, presence of scale and corrosion, gapped joints, rolled gaskets, deflections and other discernible features shall be recorded and documented in written logs. A copy of such records shall be supplied to the City of Orlando.

b. Video Recordings

The purpose of the video recording shall be to supply a clear visual and audio record of problem areas in the lines televised. Video playback shall be at the same speed that it was recorded. Video recording speed shall be standard DVD format. Prior to submission to the City, the TV inspection company will review the video to ensure that they meet the quality criteria set forth in the previous sections of this specification. A copy of such video, along with the television logs, will be supplied to the City within three (3) business days of completion of the job. In the event the video or television logs are deemed of poor quality or substandard by the City of Orlando, the videos and/or logs shall be returned and a reinspection will be provided by the contractor, at no additional cost to the City.

B. PVC Ring Deflection

Maximum diameter ring deflection shall not exceed five (5) percent 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 nine and a maximum distance between the runners of two inches. A gauging ring certified for each size of pipe inside diameter and the mandrel size shall be as follows:

Table 9.5
Mandrel Sizing

Pipe Size	Mandrel Diameter
8"	7.28
10"	9.08
12"	10.79
15"	13.20
18"	16.13
21"	19.00
24"	21.36
27"	24.06

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 at no additional cost to the City.

C. 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 pipeline, laterals and manholes. All dewatering systems shall be off prior to inspection.

D. Testing Prior to Resurfacing

All tests shall be completed and accepted by the City Engineer prior to the placement of asphalt over sewer lines. Sanitary sewer systems to be dedicated to the City shall be televised by City staff to determine if any defects are present in the system. Prior to requesting an inspection, the contractor shall be responsible for removing all dirt and debris from the sewer system and installing a stabilized driving surface which allows access to all manholes. Inspection requests shall be made 48 hours in advance.

The City shall prepare a written punch list of all discovered defects during the TV inspection. The contractor shall repair all defects noted and successfully pass reinspection prior to acceptance by the City. All costs associated with reinspection shall be borne by the contractor.

E. Final Inspection

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

F. Grease Interceptors

1. All grease interceptors shall be approved by the Wastewater Division and the Plumbing

Inspection Section of Permitting Services Division in accordance with the Standard Plumbing Code Section 801.2.

2. All grease interceptors shall be sized in accordance with Section 801.2 of the Standard Plumbing Code and Sections 10 D-6.054 and 9.027 of the Florida Administrative Code.

Section 9.04 Sanitary Sewer Force mains

This section shall govern the construction of force mains including valves, fittings and other appurtenances.

A. Materials

1. Ductile Iron Pipe and Fittings

The pipe shall be of ductile iron (DI) Class 350 (4-12 inch), Class 250 (14-20 inch), Class 200 (24 inch), and Class 150 (30-64 inch). Fittings shall be ANSI/AWWA C110/A21.10 ductile iron unless otherwise noted. Pipe and fittings shall be manufactured by American Pipe, U.S. Pipe, or approved equal.

2. Coatings and Linings (Iron Pipe)

All pipes and fittings shall have a protective interior lining in accordance with the materials section of Chapter 9.

3. Polyvinyl Chloride Pipe (PVC)

PVC pipe shall conform to AWWA C900, DR 18, Pressure Class 150 or approved equal with an integral bell and spigot joint conforming to ASTM D3 139. For pipe diameters less than 4", provide pressure rated PVC schedule 80 pipe and fittings. PVC pipe shall use ductile iron or PVC fittings for less than 4-inch diameter and ductile iron fittings for larger pipe.

B. Valves

1. 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. Valves shall be lined with a factory applied ceramic epoxy material such as SP2000 Protecto 401, or an approved equal. Exposed valves shall have flanged connections. Buried valves shall have mechanical joint connections. Buried valves shall have stem extensions which shall bring the operating nut within two feet of finished grade. Stem extension shall be contained within an appropriately sized valve box. Gear actuators for valves 8 inches or larger shall be provided. Valves and appurtenances shall be Series 100 as manufactured by DeZurik Corp., Milliken, Val-Matic, or approved equal.

2. Check Valves

Check valves shall have a iron body, bronze-mounted, stainless steel hinge pin,

replaceable rubber faced clapper, outside spring or lever operated, swing non-slam type and 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. Valves shall be manufactured by Mueller Company or an approved equal.

3. Air Release Valves

Air Release Valves, below grade, shall be Crispin, Val-Matic, H-Tec, or ARI Pressure Sewer Valves and above grade shall be only H-Tec. The valve(s) shall be of the long body design and orifice with an adjustable BUNA-N rubber valve and a sealing face of PVC. Three-inch and smaller shall be threaded N.P.T. connection. Four-inch and larger shall be ASNSI Class (125,250) flanged connection. All piping shall be 316 Stainless Steel. Isolation valves for the air release shall be cast iron body plug valves with 316 Stainless Steel Trim and buried service actuator as manufactured by Dezurik, or approved equal as shown on the Wastewater Division standard details. All offset air release valve vaults shall have isolation plug valves located outside and adjacent to the valve vault.

4. Tapping Sleeves and Valves

Tapping sleeves and valves shall be a joint type with flanged outlet per ANSI B 16.1, Class 125 equal to M and H Fig. 74-M (Tapping Sleeve) manufactured by Dresser Industries, Inc., Anniston, Alabama or as approved by the Wastewater Division. Sleeve shall be epoxy coated or stainless steel with stainless steel hardware. Tapping valve shall be installed horizontally. An isolation valve (plug valve) shall be installed adjacent to the tapping Valve. Tapping Valves shall be gate valves specially designed for wet tapping and compatible with the connecting sleeve and with a sanitary sewer application.

5. 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 and equal to Clow, M and H, or U. S. Foundry. Valve boxes shall be labeled to identify type of valve, depth and number of turns required on a brass marker permanently affixed to the valve box cover.

C. Installation

1. General Requirements

Excavation and backfill including sheeting and bracing, dewatering, bedding and foundation and furnishing and disposal of materials shall be as required in Section 9.03.

2. Pipe Laying

All pipe shall be laid "in the dry" along straight lines and grades between

fittings, manholes or other defined points. The standard minimum cover for sewage force main systems shall be 3 feet from the top of the pipe to finish grade. Where waterways, canals, ditches or other cuts are crossed, a protective casing should 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, all open ends must be plugged off to prevent debris from entering pipe. 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.

3. 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. Damaged bells or spigot ends will not be accepted.

4. 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. Gaskets damaged during installation, shall be replaced at no cost to the City.

5. 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.

6. 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.

7. 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, use a solvent to clean the affected area, abrade the surface, then field apply Protecto 401 or SP2000 repair kit to the original film thickness specified.

8. Pipe Restraint

All plugs, caps, tees and bends, unless otherwise specified, shall be restrained by mechanically restrained joints. Fittings shall be restrained with Meg-A-Lug or equal pipe restraint with collars, tie rods and retainer glands shall be only if specifically approved by the Wastewater Division. 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 metal components shall be stainless steel 316. Backfilling over pipe restraints shall not proceed until inspected by the City Engineer or designee.

9. Polyethylene Encasement

Extra protection shall be provided for underground ductile iron pipe and fittings within areas of severe corrosive conditions. This shall be accomplished by the installation of polyethylene encasement through the area of concern. The soil-test evaluation to determine the necessity for extra protection in suspect areas shall be as set forth in ANSI Standard A2 1.5.

10. Above Ground Pipe Support

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

11. Connections

Where dry connections are feasible and allowed by the Wastewater Division where a new branch is to be connected at an existing force main, a wye fitting shall be used. Wet tapping shall be by tapping sleeve and valve installed with a tapping device designed for the pipe material. Tapping sleeves are recommended for receiving mains of 24-inches or larger. Size on size wet taps shall not be allowed. Tapping of force mains shall be only where approved by the Wastewater Division. Tapping of force mains shall be only where approved by the Wastewater Division.

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 and approved by the Wastewater Division, lay valves on side such that the plug rotates to the top of the pipe when in the open position. Where extension stems are required within valve boxes, insert stems shall be provided.

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. 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 which identifies the valve shall be provided as shown in the ESM Details.

14. Air and Vacuum Valves

Where the force main profile is such that air pockets or entrapment could occur, air release/vacuum valves 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 suitably housed in a properly vented underground valve vault as shown in Standard Detail Drawings.

15. Terminal Discharge

Force mains shall enter the terminal facility, gravity sewer manhole, pumping station wet well or other, at a point equal to the operational water level of said receiving unit. Force mains entering manholes shall enter so that flow is in the same direction as the outlet pipe and at an elevation no greater than the top of outlet pipe. Should an elevation drop be required to obtain the outlet connection, the prior down-slope of the force main shall not exceed 45 degrees unless prior approval is obtained from the Wastewater Division. Adequate air venting shall be provided at the profile break-point. Manholes which receive discharge from a force main shall be lined in accordance with the requirements of this Chapter.

D. Identification

1. In order to preclude possible domestic water tapping, all installed underground sanitary sewage force mains shall be green in color or shall be marked with continuous stripes painted at the 12 o'clock, 3 o'clock

and 9 o'clock positions of the pipe. Each stripe shall be a minimum 2 inches in width and shall be light 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. 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, as manufactured by Terra Tape Detectable or approved equal.

2. Green sewer locate balls shall be buried with a depth of 3-4 feet below finished grade.
3. In addition, 8 gauge solid copper locate wire attached to the entire length of non-metallic sewer force main shall be installed in accordance with the City standard detail drawings.

E. Hydrostatic Testing

This test shall be performed by the contractor with his labor and equipment in the presence of the City Engineer (or designee), and the engineer of record (EOR). No testing shall proceed until all restraining devices installed. Clean and flush all piping thoroughly prior to testing. The amount of water to be used for cleaning shall be twice the volume of the pipe being tested and the velocity of flow should be a minimum of 3 feet per second (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 150 pounds square inch (psi) for a period of two hours. Following stabilization of the pressure reading, there shall be no allowable leakage.

During the 2 hour period of the test, the contractor shall maintain a continuous pressure of 150 psi by means of a pump taking supply from a container suitable for the measurement of water loss. Should the test fail, the leak(s) will be located and repaired and the test performed again until it meets the above specified limits. The test results shall be documented in a report signed and sealed by the EOR submitted to the Division.

Section 9.05 Sanitary Sewer Pump Stations

This section shall govern the construction of a 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, telemetry system, electrical service and wiring and testing for a complete installation ready to operate.

A. Materials

1. General Requirements

Ductile iron pipe and fittings, plug valves, and check valves shall be per Section 9.04.

2. Pre-cast Wet Well Sections

Pre-cast wet well sections shall conform to ASTM C478 as modified in Section 9.03.

3. Pumps and Motors

Pumps and motors shall be as specified in 9.02.

4. Discharge Elbow

Discharge elbows shall be compatible with Flygt standard connection.

5. Guiderails, Upper Holders, Cable Holders, Anchor Bolts and Lifting Chains

Guiderails, upper holders, cable holders, anchor bolts and lifting chains shall be Stainless Steel. Guiderails shall have 2 inch minimum diameters.

6. Access Frames and Covers

Access frames and covers shall be structural aluminum with 316 Stainless Steel hardware, sized to provide access clearance as required by the pump manufacturer and as required to adequately service and/or remove check valves from the check valve vault. Cover shall have lifting handles safety latches and locking hasp. Depending upon location, frames and covers shall be traffic bearing type suitable for use with delivery class vehicles as determined by the Wastewater Division. Non-traffic areas shall use non-traffic frames and covers. Flygt Safe-Hatch design or approved equal shall be installed on a wet well access cover.

7. Control Equipment Control equipment shall be as listed below or an approved equal:

- a. Enclosure shall be 316 stainless steel, minimum 14 gauge, weatherproof, NEMA-3R with dead front panel, separate removable inside panel and handle and extra large padlock provision, drip shield, powder coated white or sun shields.
- b. Main disconnect shall have two manual interlocked Schneider Electric Square D or Siemens I-T-E circuit breakers.
- c. Telemetry shall be Motorola, radio controlled, to match City of Orlando existing equipment and include NEMA-4X steel enclosure antenna and mounting pole or tower. Antenna height shall be 20 feet from finished grade of station.
- d. Controls shall be 120 volts, 60 HZ.
- e. Starters shall be manufactured by Allen Bradley.
- f. Bubbler Level Control shall be Siemens HydroRanger 200 Part No.

7ML5034-1 AD01 (4-20mA) with Echomax XPS-15 Transducer (6 degree) Part No. 7ML 1118-0BA30 5m cable, Part No. 7ML 1118-0CA30 10m cable, or Part No. 7ML 1118-0EA30 30m cable, Hand-Held Programmer Part No. 7ML 1830-2AK. The transducer shall be mounted using either a FMS-210 Wall-Mount (5-10" Part No. 7MI1830-1BL or a FMS-220 Extended Wall-Mount (13-39" High-level Sensor shall be normally open and have a mercury-free Anchor scientific Eco-Float or Siemens Water Technologies USF Model 9G-EF direct-acting float switch for telemetry alarm.

- g. Local high level alarm shall have a 115 Volt AC light in weatherproof bracket fixture for 100 watt lamp with red enclosing vapor tight globe with flasher and bell or buzzer. Local high level alarm shall be activated by a high set point programmed into the level control.
- h. Relays shall be manufactured by Diversified Electronics, Inc., Potter Brumfield or approved equal. Relays shall have an 8-pin plug-in type base.
- i. Elapsed Time Meters shall be manufactured by General Electric or approved equal.
- j. HOA Switches shall be manufactured by Allen Bradley, Bulletin 800t-J2B.
- k. Lightning Arrester shall be manufactured by General Electric and 3 phase.
- l. Phase Voltage Monitor Relay shall have Phase loss, phase reversal and low voltage sensor and relay to alarm system and shall be manufactured by Diversified Electronics or approved equal.
- m. Pump run indicator lights shall be Allen Bradley 800T-Q 1 OR.
- n. Emergency Generator Plugs for 230 volt service shall be Russell and Stoll JRS 1044F for up to 10 HP and JRS 2044F for greater than 10 HP. Plugs for 480 volt service shall be Crouse-Hinds AR 1047 for up to 10 HP and AR204126 for greater than 10 HP.
- o. Pump Disagree Sensor shall be a normally closed mercury tube switch mounted in an E condolet with rubber insulated cable mounted on the check valve lever arm. Provide ¾ inch PVC conduit from control panel to valve pit for connection of pump disagree wiring.
- p. Convenience Outlet shall be a duplex GFCI 120 Volt, 60 HZ 20 amps.

8. Vent Cap

Vent cap shall be vandal-proof, hooded, and galvanized iron as manufactured by Josam 26700 Series or approved equal.

9. Backflow Preventer

A hose bib and backflow prevention device conforming with Orlando Utilities Commission (O.U.C.) requirements shall be provided.

10. Pressure Gauge for Discharge Lines

Pressure Gauge for Discharge Lines shall be Red Valve Series 40 wafer thin in-line pressure sensor. Wafer shall have carbon steel body and a Buna-N Elastomer.

11. Station yard

Station yard shall be covered with a minimum 4 inch thickness of FDOT No. 57 white stone with a weed-blocking fabric which allows for water drainage installed underneath unless approved otherwise by the Wastewater Division.

12. Fencing

Fencing fabric posts, gates, barbed wire and appurtenances shall be in accordance with the FDOT Roadway and Traffic Design Standards, latest edition, and the City of Orlando Details and include lightning protection and proper grounding.

B. Installation

1. General Requirements

Excavation and backfill including sheeting and bracing, dewatering, bedding and foundation, and furnishing and disposal of materials shall be as required in Chapter 4.

2. Wet Wells

Wet wells shall be constructed to the same requirements as sanitary sewer manholes with the following additional requirements, unless approved otherwise by the Wastewater Division:

- a. The base shall be monolithic with lower ring.
- b. The base slab and top slab shall be constructed to the dimensions shown in the Standard Detail Drawings. 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.
- c. Brick construction shall not be acceptable.
- d. Wet wells shall be free from all detectable leaks. Any leaks detected shall be corrected prior to acceptance by the City.
- e. All hardware and metals inside the wet well shall be 316 stainless steel, unless specified otherwise.
- f. All interior concrete surfaces shall be coated with Epoxy Tech or approved equal, or lined with AGRU liner or approved equal. Coating shall be applied and spark tested by the manufacturers approved application and in accordance with the manufacturers written instructions

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- g. Minimum vertical distance from lowest invert into the wetwell to the top of motor shall be 5 feet.

3. Pipe, Valves and Fittings

All exposed pipe shall have flanged joints. All buried pipes shall have mechanical joints. All exposed piping shall be coated with a minimum of 16 mils epoxy paint, color selection by the Wastewater Division.

4. Pump 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 Wastewater Division for review prior to installation of equipment. Upper guide rail holders shall be located exactly as required.

5. Control Panel

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, pump circuit breakers, minimum of two (2), 20 amp panel circuit breaker, Digital bubbler level control starters, minimum of two (2), an elapsed time meter for each pump, run indicator lights, minimum of two (2), HOA switches, minimum of two (2), and phase voltage monitor relay. All switches, main circuit wiring, breakers and other devices shall be clearly and neatly labeled inside the control panel. A single line wiring diagram shall be included within the panel with a copy provided for the Wastewater Division's records. Pump data for the station (HP, amps, volts, impeller size, model, etc.) shall be on a label and shall be affixed to the inside of the panel door.

6. High Level Alarm

A mercury-free float ball switch shall be provided as high level alarm to the telemetry system. Red alarm signal light shall be mounted on top of control panel enclosure. Bell or buzzer shall be mounted on outside of panel with weatherproof alarm silence button.

7. Accessory Equipment

Lightning arrester, pump disagree sensors, emergency disconnect switch, telemetry system, including antenna with mounting pole, emergency generator plug, red alarm light, bell or buzzer, level transducer mounting and convenience outlet shall be provided.

8. Emergency Power Generation

Stand-by power emergency generators are required at all stations unless otherwise determined by the Wastewater Division on a case by case review. Generators

must conform to Section 9.02.

9. Flow Meter

Unless otherwise approved by the Wastewater Division, a magnetic flow meter with by-pass piping and valves shall be provided. Flow meter shall be approved by the Wastewater Division.

10. Fencing

Construct a 6-foot, vinyl coated, chain link fence meeting FDOT Roadway and Traffic Design Standards with 1 foot of 3 stranded barbed wire. In residential areas an 8-foot high fence, without barbed wire, may be used with the approval of the Wastewater Division. A cantilever slide gate with a minimum 15-foot wide opening shall be installed. Where a cantilever slide gate would not be feasible, One 16-foot double swing drive gate (two 8-foot leaves) with center drop rod assembly latch (no post) and gate hold backs for both leaves shall be installed. Gate shall open outward from station. Gate drop rod receiver in driveway shall be sleeved with galvanized pipe. Fence shall be meshed with vinyl stick weave.

11. Grading

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

C. Testing

1. Factory Performance Tests

Manufacturer's factory performance tests and certified performance curves shall be provided for capacity power requirements and efficiency at specified minimum operating head, rated head, shut-off head and at as many other points as necessary. A copy of the certified pump curve shall be mounted on the inside of the control panel door. Two additional copies shall be provided to the Wastewater Division during start-up testing.

2. Field Testing

Field testing shall be provided by the contractor with the pump manufacturer's representative present and witnessed by the City Engineer or his designee and the Wastewater Division representative to provide a three point pump performance test by measuring the amp draw and voltage, the discharge pressure, and the rate of flow. The rate of flow and head must be within 10 percent and 5 percent, respectively, above the approved curve for acceptance.

3. Start-up and Final Inspection

The contractor shall schedule with the Wastewater Division and the City Engineer (or his designee) for start-up and final inspection at the completion of the work. After final inspection is complete, the contractor shall provide the Wastewater Division with two copies of the station O&M manual.

Chapter 10 – Reclaimed Water Facilities Design

Section 10.1 General

These specifications cover the design, plans, specifications, installation, inspection, testing and acceptance of reclaimed water distribution systems, reclaimed water transmission main extensions, and all appurtenant items which are to be owned and maintained by the City of Orlando. This includes developer-built on-site reclaimed water distribution systems in residential subdivisions and commercial developments, off-site transmission main extensions to development sites, and on-site requirements for large reclaimed water users. All City owned reclaimed facilities shall be installed in publicly owned rights-of-way or in easements that do not preclude City operation and maintenance of the facilities as determined by the Wastewater Division.

- A. Reclaimed water shall be used, when available, to accomplish irrigation needs and other approved uses that do not require potable water. Use of reclaimed water shall be in accordance with the most current edition of Chapter 62-610, Reuse of Reclaimed Water and Land Application, Part III, F.A.C., City of Orlando Engineering Standards Manual and Engineering Standard Details, and Chapter 32 of the Orlando City Code. Reclaimed water facilities shall be completely independent of all potable water, raw water supply, wastewater, and storm water systems.
- B. Please refer to the General Notes in the ESM Details.

Section 10.2 Evaluation Of Need For Use Of Reclaimed Water

Based on Chapter 32 of the City Code, property location, surrounding utilities, available capacity, future reclaimed water system expansion plans, and the criteria contained herein, the City of Orlando will evaluate all new developments to determine if the use of reclaimed water is appropriate. The City of Orlando will review the existing and the proposed reclaimed water system characteristics to determine if the new connection to the reclaimed water system represents a benefit to the community as a whole.

Section 10.3 Mandatory Connection

Upon completion of the evaluation, the City of Orlando shall have the authority to require the development, including all individual lots and tracts therein, to connect to the reclaimed water system for all landscaped and sodded areas of the development that are planned to be irrigated by the Developer. The Developer shall be responsible for all costs necessary to provide onsite distribution and offsite transmission required to serve the irrigation needs of the development.

- A. For residential properties, in cases of conflict, Chapter 32 of the City Code shall prevail. Reclaimed water use shall be a condition of all development approvals granted as of the effective date of the Chapter 32 of the City Code, provided that service is available, and adequate capacity (flow and pressure) will exist in the City's reclaimed water facilities to service the development, as determined by the Director of Public Works and as set forth by the following criteria:

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1. Reclaimed water shall be considered available if the City's reclaimed water facilities are located at a distance of 100 feet or less from the property line.
 2. For non-residential properties, reclaimed water service shall be considered available if the City's reclaimed water facilities are located at a distance of 1000 feet or less from the property line.
 3. For all new construction or development, reclaimed water shall be considered available if the proposed development / projects are in an area designated by the Public Works Director to have reclaimed water available within 2 years following the completion of construction. Such properties shall install complete and separate potable and reclaimed water systems, with a single above ground connection between the potable water source and the future reclaimed water distribution system. This connection shall provide a temporary means to provide potable water supply to the irrigation systems until the reclaimed water system is constructed in that area. The connection shall be protected by a reduced pressure zone type backflow prevention device and pressure control valve which shall be designed to sustain an 80 psig upstream pressure and to reduce the downstream pressure on the reclaimed water distribution system to 50 psig. When the reclaimed water main construction is completed in that area, the potable water main connection to the reclaimed water system shall be completely removed, entirely disconnecting the reclaimed water system from the potable water source, and then the reclaimed water source shall be connected to the reclaimed water distribution system. The master flow meter and pressure control valve shall remain in place. There shall not, under any circumstance be a simultaneous physical connection of a potable water source and a reclaimed water source to a common piping system, and in no case shall a reclaimed water source be connected to a potable water piping system.

Section 10.4 Plans Preparation

- A. Three (3) complete sets of accurately scaled plans shall be submitted for review. Plans shall include the following minimum information requirements in addition to the building permit requirements:
 1. Reclaimed water supply source main size, material, location, depth, point of connection, and pressure.
 2. All easements, property lines, rights-of-way, and structures.
 3. All reclaimed water piping, including location, size, restraint type and distance, material, class, and pressure rating.
 4. Area of irrigation per parcel and total project irrigated area.
 5. Estimated weekly reclaimed water usage and rate.
 6. Irrigation zones, demand, and flow rates for all non-residential properties.
 7. Location of irrigation system programmable controller. Note: Controller shall be mounted on outside of building adjacent to electrical power meter.
- B. A Reclaimed Irrigation Application shall be submitted to the City of Orlando Environmental Control Section.

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- C. Any modification to the ESM Details, other than completing required information specific to the project, will require written notification to and prior approval from the City. Any changes to the drawings shall be listed in the text, and noted inside of a revision cloud on the drawing to call specific attention to the changes.
 - D. Following completion of construction and testing, the Developer's Engineer of Record shall submit "Record" drawings on the original design and an as-built survey shall be provided in accordance with Chapter 5. Information required on a "Record" drawing shall include all items listed in section 4 A. above, and State plane coordinates of each valve and bend or branch in the reclaimed piping system including service taps, pressure sustaining valves, strainers, pressure reducing valves, and isolation valves.

Section 10.5 Location of Reclaimed Water System Utilities

- A. Reclaimed water mains shall be located within dedicated rights-of-way or utility easements. When installed in rights-of-way, mains shall maintain a consistent alignment with respect to the centerline of the road. In residential developments, mains shall be installed on the south and east side of the right-of-way. In all cases, mains shall be installed along one side of the road, with crossings kept to a minimum. A minimum 20-foot wide utility easement shall be provided if it is not adjacent to the road right-of-way. However, if a main is located outside and adjacent to an existing road right-of-way, a minimum of a 15-foot utility easement shall be provided. Piping within an easement shall be located within one foot of the centerline of the easement and centerline of the pipe.
- B. Additional easement width, as determined by the City of Orlando, shall be required under the following conditions.
 - 1. Pipe sizes greater than 12 inches.
 - 2. Pipe cover greater than three feet.
 - 3. More than one parallel pipe within the easement.
 - 4. Pipe is not centered in the easement.
- C. Reclaimed water mains shall not be placed under trees, buildings, retention ponds, tennis courts, swimming pools, fountains or other structures. Landscape and privacy walls and foundations shall not be placed parallel over mains. Placement of mains under pavement shall be kept to a minimum. Mains shall not be located along interior side or rear lot lines, unless approved by the City of Orlando. Placement of mains along interior side or rear lot lines or storm water retention pond berms may be allowed on a case-by-case basis if such a configuration results in efficient placement and utilization of the system, as determined by the City of Orlando.
- D. Services, air release valves and other valves shall not be placed along interior side or rear lot lines.
- E. Proposed commercial and residential development offsite mains shall be extended a minimum of 10 feet beyond the furthest entrance to the development.
- F. Modifications to location and dimensional criteria may be granted upon approval of the Wastewater Division.

Section 10.6 Design Basis

- A. The reclaimed water systems shall be designed to promote efficient reclaimed water usage. Reclaimed water mains shall be designed for the estimated ultimate irrigation demand, based on planned development build-out. The developer is responsible for sizing of the mains, only for his development. When a distribution main will serve existing or future developments beyond the borders of the proposed site, the City of Orlando may request over sizing. Individual single-family homes are exempt from providing design calculations for irrigation systems with meters that are two inch or smaller.
- B. Average Daily Flows and Peak Flows for Single-Family Residential and Other Developments:
1. The reclaimed water to be used shall be based on one inch of water per irrigated area per week.
 2. Irrigation zones shall be provided to uniformly distribute flows over a time period acceptable to the City of Orlando. Alternate irrigation system designs will be evaluated on a case-by-case basis.
- C. Minimum Main Sizing for Single-Family Residential Developments:
- The peak hourly demand of reclaimed water shall be based on 50 percent of the lots irrigating simultaneously using a demand of 25 GPM per inch meter diameter, up to 2 inch, per lot. Residential reclaimed water mains shall not be sized larger than adjacent parallel potable water mains on the same side of the roadway.
- D. Irrigation System Design Calculations:
- The Developer's Engineer or Landscape Architect shall submit signed, sealed and dated design calculations with the final construction plans for all reclaimed water distribution projects. Calculations shall show that reclaimed water mains will have sufficient hydraulic capacity to transport peak hourly flows. All head losses and minor losses shall be included in calculations.

Section 10.7 Design and Construction

- A. Pressure
- All reclaimed water mains shall be designed to maintain a minimum pressure of thirty-five (35) psi at the required meter connection. Pressure reducing devices are required at the connection to the City of Orlando's reclaimed water transmission system as the City of Orlando's system pressures normally operate in the range from 80 psi to 110 psi, with surges up to 200 psi. Pressure reducing valves (PRV) shall be set to a maximum of 50 psi for all distribution systems. Should sufficient pressure not be available after the system is operational, the Division may allow pressure at the PRV to be adjusted upward, but the City will be held harmless from damage to private irrigation components.
- B. Diameter
- Pipe sizing for the distribution system piping is the responsibility of the design engineer. The design engineer shall be responsible for obtaining any additional or updated design criteria from the City of Orlando, Orange County, and FDEP. The City will advise the

design engineer as to whether or not local main pressures are available, or else the design engineer will be responsible to install a pressure tap and pressure recorder to determine the local available reclaimed water pressure. Only AWWA C-900 DR18 PC150 PVC pipe shall be allowed up to 8" diameter. All pipes larger than 8" diameter shall be PC150 ductile iron pipe. Direct tapping of PVC pipe is prohibited. Full width tapping sleeves shall be used on all PVC taps. Ductile iron pipes may be direct tapped up to 1.5" diameter. Four-inch dead end reclaimed water mains shall be permitted with a maximum length of 750 feet of pipe. As a minimum, 6-inch looped systems shall be required. Larger size mains shall be required if necessary to allow the withdrawal of the required flow while maintaining the minimum residual pressure of 35 psi. Four-inch reclaimed water mains may be used in small looped systems having less than 30 houses, as approved by the City of Orlando on a case-by-case basis.

C. Velocity

The maximum velocity at design flow rates should not exceed eight feet per second for DIP and five feet per second for PVC pipe.

D. Design Friction Losses

Friction losses through reclaimed water mains shall be based on the Hazen and Williams formula. In the use of Hazen and Williams' formula, the value for "C" shall be 120 for ductile iron and 140 for polyvinyl chloride pipe. "C" values greater than 140 shall not be allowed.

E. Design Pressure and Restraint

The transmission and distribution mains and fittings, including all restrained joint fittings shall be designed to withstand combined pump operating pressures and pressure surges, of not less than 200 psi. The restrained joint lengths shall be calculated consistent with the table format shown in the ESM Details.

F. Dead Ends

In order to provide increased reliability of service and reduce head loss, dead ends shall be minimized by making appropriate tie-ins whenever practical, as determined by the City of Orlando. Where dead end mains occur, they shall be provided with a 2-inch blow-off valve for flushing purposes.

G. Valves

1. Isolation valves shall be MJ X MJ resilient seat gate valves or eccentric plug valves.
2. Valves shall be placed so that the maximum allowable length of reclaimed water main required to be shut down for repair work shall be no more than 2,000 feet on off-site transmission mains; 1,000 feet in commercial, industrial, or multi-family residential districts; and 1,500 feet on distribution systems in residential subdivisions. Design should consider and incorporate maintenance considerations when placing isolation valves. The City of Orlando reserves the right to require additional isolation valves where necessary for efficient

operation and maintenance. Sufficient valves shall be provided on reclaimed water mains to provide ease of operation, maintenance, and isolation. In-line valves shall be located generally at all branch connections, tees, crosses, etc. Valves shall also be provided at all areas where reclaimed water mains intersect to ensure effective isolation of reclaimed water lines for repair, maintenance or future extension.

3. All branch or service connections larger than 2" to the reclaimed mains shall use flange x MJ resilient gate valves.
4. Valves and roadway boxes shall be provided for all branch connections (i.e., 2 valves on a tee, 3 valves on a cross) and other locations, as required to facilitate operation of the distribution system. Reclaimed water main extensions or mains extending at a project phase line shall include a line size valve and one additional standard length of pipe with a cap and a temporary blow-off assembly. Refer to ESM Details for installation.

H. Air Release Valves

At high points in reclaimed water mains where service connections are limited and where elevation changes exceed five feet, provisions shall be made to remove the air by automatic air release valves.

I Control Valves

Pressure reducing/pressure sustaining valves shall be provided on all master metered reclaimed water main connections for maintaining adequate upstream system pressures, and protection from high downstream system pressures.

1. Single-family residential developments are required to have a pressure-reducing valve at all main connections to the City of Orlando reclaimed water system.
2. Other developments utilizing well backup with or without storage are required to have an approved back flow prevention device at the master meter.

J Booster Pumps

In-line booster pumps are not permitted on reclaimed water mains.

K. Restrained Joints

Pressure piping, fittings, and other items requiring restraint shall be restrained by assemblies or devices designed for a minimum of 200-psi pressure. See ESM Details.

L. Separation of Reclaimed Water Mains and Potable Water and Sewer Systems

1. Separation of reclaimed water mains and potable water and sewer system shall comply with FDEP regulations and City of Orlando standards.
2. A minimum horizontal separation of 3 feet face to face shall be maintained

between reclaimed water mains and potable water mains, sanitary sewers, or sanitary force mains. In cases where it is not practical to maintain this separation, consult FDEP for approved method.

3. Reclaimed water mains shall cross below water mains and above sanitary sewers or sanitary force mains. Where a reclaimed water main crosses a force main, a minimum of 18 inches vertical clearance shall be maintained. The crossing shall be arranged so that the reclaimed water joints will be equidistant and as far as possible from the force main joints. Where 18 inches of vertical clearance cannot be maintained, consult FDEP and the City of Orlando for approved method.
4. Separation criteria are subject to change and the Engineer shall verify this information by contacting the Florida Department of Environmental Protection to review the current criteria. See ESM Details.

M. Signage and Public Notice

1. For all systems, there shall be readily identifiable City of Orlando approved “Reclaimed Water”/“Do Not Drink” notices; and marking or coding on application/distribution facilities and appurtenances. Notification shall be accomplished by the posting of advisory signs designating the nature of the reclaimed project area where reclaimed is practiced; notes on scorecards (if reclaimed water is applied to golf courses); or by other methods. Notification methods used include posting of advisory signs at entrances to residential neighborhoods, medians, rights of way (not greater than 1 mile intervals), at entrances to golf courses, and at the first and tenth tees. Advisory signs shall be posted adjacent to lakes or ponds used to store reclaimed water with a minimum of four signs or as determined by the CITY. Advisory signs shall be color-coded Pantone Purple 522C and include the following text in English and Spanish “RECLAIMED WATER” and “DO NOT DRINK, NO BEBER,” together with the equivalent standard international symbol. Advisory signs shall be posted at decorative water features that use reclaimed water and shall include the following text: “Do Not Drink” and “Do Not Swim”. See ESM Details.
2. Signage shall be placed, as appropriate, at entrances to residential neighborhoods where reclaimed water is used for landscape irrigation and at prominent locations at all commercial sites, including multi-family developments, office parks, schools, churches, condominiums, residential common areas, recreational developments and golf courses.

The developer shall be responsible for all cost incurred and installation of reclaimed water signage in accordance with FDEP regulations and City of Orlando standards. The Owner shall be responsible for operation and maintenance of the private irrigation system and shall also be responsible for maintenance of the signage on private property. The City of Orlando will be responsible for inspection of signage for City of Orlando reclaimed water systems. It shall be the Owner’s responsibility to maintain all signage in an un-

deteriorated condition on private property. The Owner's responsibility to install and maintain signage shall extend to public rights-of-way where the Owner has assumed maintenance responsibility in order to provide an enhanced level of service.

Section 10.8 Services and Connections

- A. All connections to existing reclaimed water mains shall be made by the contractor only in the presence of a City of Orlando inspector, and with the approval of the City of Orlando. The Wastewater Division shall be notified of a request to tap at least two business days in advance.
- B. Services and connections shall conform to the applicable provisions of this specification and the ESM Details. Only 1-inch, 1.5-inch, 2-inch, 3-inch, 4-inch, 6-inch and 8-inch services will be permitted. All services greater than eight inches will be evaluated on a case-by-case basis, as determined by the City of Orlando. Services and connections to new or existing reclaimed water systems shall be installed by the Developer/Owner.
- C. Direct taps 1-1/2" and smaller are permitted in ductile iron pipe. Two-inch tapping saddles with SCH80 stainless steel nipples or bronze 2" corporation stops are required for all threaded 2" taps. Flanged tapping saddles are required for 3" and larger. All 3" and larger taps shall be installed with a "Flange X MJ" resilient seat gate valve. See ESM Details.
- D. Prior to the Tap:
 - 1. The contractor shall assemble all materials, tools, equipment, labor and supervision necessary to make the connection.
 - 2. The contractor shall excavate a dry and safe working area pit of sufficient size to enable the City of Orlando personnel to perform the necessary work.
 - 3. The contractor shall pressure test the tapping sleeve and valve installation under the supervision of the City of Orlando Environmental Control Section personnel. The test pressure shall be 200 psi held for 30 minutes without any loss of pressure.
- E. Reclaimed water mains shall be tapped in such a manner as to avoid disturbance or disruption to the operation of the main in service and to protect the reclaimed water supply from contamination.
- F. Valves on existing mains shall be operated by City personnel or under their direct supervision.
- G. The contractor shall be responsible for properly backfilling the work area pit after the work is completed. See ESM Details..
- H. When service must be interrupted to existing customers during construction of a tap or addition of appurtenances:
 - 1. The contractor shall provide seven days notice to the City of Orlando Reclaimed Water Section.
 - 2. The contractor or developer shall be required to notify existing customers as directed by the City.
 - 3. The contractor shall be ready to proceed with as much material pre-assembled as possible at the site to minimize the length of service interruption. Such connections may be made at night to minimize effects. No customer shall be

without service for more than six (6) hours.

4. If the contractor is not ready to proceed on schedule, the City will postpone a service cut-off.

Section 10.9 Reclaimed Water Metering

A. General

All reclaimed water service connections shall be metered. In general, the method of metering will follow the guidelines listed below. A master metering system is required when reclaimed water flow dictates installation of a 4" or larger meter. However, the Developer's Engineer must obtain approval before finalizing the metering system design. Unless specifically approved by the City, meter boxes shall not be installed in sidewalks, driveways or areas subject to vehicular traffic. All below ground meters subject to vehicular traffic shall be installed in a traffic rated meter box. Based on AWWA Standards, the maximum flow for continuous operation will be 50 percent of rated maximum capacity or as specified in following table:

Reclaimed Water Master Meter Sizing

Turbine Meter Size (in)	Maximum Flow (gpm)
4	300
6	625
8	900
10	1,450
12	2,150

B. Single Family, Duplex, and Multi-Family Subdivisions with Public Rights of Way

Each unit shall be individually metered. Meters shall be installed two feet outside of the right-of-way in individual meter boxes, on the customer's property. See ESM Details.

C. Single Family and Multi-Family Subdivisions with Private Streets

If easements are dedicated over the entire private street common areas, individual meters may be permitted in accordance with the preceding paragraph. If these criteria cannot be met, the subdivision shall be master metered pursuant to the following paragraph. See ESM Details.

D. Commercial, Industrial, Institutional, Shopping Centers, Apartments, Condominium Projects.

In general, all such projects shall require installation of a meter to service the entire development. If the average daily demand is 25,000 GPD or greater, a reclaimed water agreement shall be required, and special provisions as outlined in Section 10.11 may be required. In general shopping centers and associated out parcels shall require installation

of a single meter to service the entire development unless out parcels are adjacent to public right of way or otherwise approved by the City of Orlando. All commercial meter assemblies shall be above ground, not in a meter box unless approved by the Wastewater Division.

E. Meter Installation

Meters shall be installed with assembly in accordance with the ESM Details by the Developer. Installation of residential meters two inches and smaller will be installed by Orlando Utilities Commission. All residential meters two inches or smaller in size will be installed underground in an approved meter box. All commercial meters shall be installed above ground. Meters larger than 2" shall be located in an easement located adjacent to but outside of the public right of way, on the customer's property. See ESM Details.

F. Meter Sizing

The Developer/Owner's Engineer shall determine the size of all meters. The Developer's Engineer shall provide sufficient information on estimated average daily and peak flows to determine meter size.

G. Meter Test Ports

A capped tee with a 2-inch threaded plug shall be installed immediately downstream of the meter for use as a test port.

H. Meter Bypass Loops

Although, bypass loops are typically not required because reclaimed water delivery is not essential to the public health and safety, the City of Orlando reserves the right to request a bypass design on a case-by-case basis.

I. Meter Supports

The pipe supports used in the meter assemblies shall be adjustable.

J. Meter Procurement

1. Residential meters 2" and smaller, shall be coordinated with OUC Development Services Department by calling 407-236-9651, and making arrangements for payment and installation.
2. All commercial meters shall be coordinated with OUC Development Services Department by calling 407-236-9651 and making arrangements for payment. Once this contact has been made, the City of Orlando Environmental Control Section shall be contacted by calling 407-246-2213, and making arrangements for meter delivery. The customer/contractor shall be responsible for installation of all commercial meter assemblies.

K. Placing Meter in Service

1. Inactive (newly installed) distribution lines: Once the distribution line has been flushed and the meter installation is complete, filling the main line and meter

with reclaimed water shall be accomplished by slowly opening the inlet valve and allowing trapped air to be released slowly at the highest point available.

2. Active distribution lines: Once the meter installation is complete, slowly open the inlet valve in order to allow possible trapped air in the distribution system to be released at the highest point available.
3. The contractor should avoid rapid filling of the pipeline in that the expulsion of large volumes of entrained air could cause possible damage to the meter's internal measuring mechanism.

Section 10.10 Irrigation Wells

A. General

Existing or proposed wells may be utilized as a back-up supply of irrigation water in the case of an interruption of service from the City of Orlando's reclaimed water system and shall be approved by the Wastewater Division prior to connection.

B. Ground Water Protection

Existing or proposed wells must be protected from reclaimed water entering the well by either an air-gap or must be outfitted with an approved reduced pressure zone backflow prevention device.

Section 10.11 Golf Courses and Other Major Users

Golf courses and other major water users (over 100,000 gallons per day annual average) may be required to install a pond, meter and equipment to monitor and control the flow entering the property. Prior to connection to the reclaimed water system, the major water user must enter into a service agreement with the City.

The following is a general description of each of the required components.

A. Receiving Pond Level Sensor

1. The golf course owner is responsible for installing and maintaining, in good operating condition, one or more pond level sensors. The type of sensor shall be approved by the City of Orlando. The volume of the on-site storage ponds or tanks shall be equal to or greater than the peak daily demand during a 24-hour period.

B. Control Valve, Operator, and Electronic Controller

1. A control valve shall be installed at the metering station and shall be configured to sustain upstream pressure and shall shut off when commanded from a remote location. In conjunction with an electronic controller, the valve shall maintain a flow rate set point.

C. Pressure Gauges and Pressure Transmitter

1. Pressure gauges shall be installed on the supply side and distribution side of the metered connections.

D. Real-Time Monitoring and Control Panel with PLC

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1. The field panel shall contain all components necessary for both local and remote monitoring and control of the metering stations, including a programmable logic controller (PLC), radio, operator interface unit (OIU), electronic interface controller, flow meter, antenna, open/close/remote hand switch, power supplies to control circuitry, and surge suppression. Provide all programming necessary for operating system.
- E. Radio Survey
1. Conduct a radio survey for each site in which the City of Orlando elects to communicate via a radio link. The objective of the radio survey is to demonstrate that radio signal strength is sufficient to support reliable communications. The radio survey shall consist of two parts -- a radio propagation computer model and a field survey, where actual radios are used. The radio propagation computer model must include a path profile that clearly shows terrain and obstructions between both the remote and central sites.

Section 10.12 Protection of Potable Water System

- A. General
1. Backflow prevention is required in accordance with PL93-623, (Federal Safe Drinking Water Act), and 62-555.360, F.A.C. for the protection of the potable water system.
 2. At all locations where reclaimed water service is provided, the public potable water supply shall be protected by installation of an approved backflow prevention device (directly downstream of the potable water meter).
 3. No cross connection between the reclaimed water system and the potable water system shall be allowed under any circumstances.
- B. Residential Cross Connection Control
1. Prior to receiving reclaimed water service, OUC will install a double check valve (a backflow prevention device) on each residential customer's potable water meter in order to protect the potable water system.
 2. Double check valves shall be capable of being removed in line and shall meet Orlando Utilities Commission standards.
- C. Multi-Family and Commercial Property Cross Connection Control
1. Multi-family complexes and commercial properties with master-metered potable water service and master-metered reclaimed water service shall be required to install a Reduced Pressure Principle type backflow prevention device downstream of the master potable water meter.
 2. The Reduced Pressure Principle type backflow prevention assembly shall include two independently acting check valves; a hydraulically operating, mechanically independent pressure differential relief valve located both between the check valves and below the first check valve, properly located resilient-seated test cocks, and tightly closing resilient-seated shut-off valves attached at each end of the assembly. Shut-off valves 2 inches and smaller shall be ball type; valves larger than 2 inches

shall be gate or plug type.

3. Immediately after the reduced pressure principle device is installed, the contractor shall request an inspection by the City of Orlando Environmental Control Section (407-246-2213). Within thirty (30) days following installation, the contractor shall send a certified "Test and Maintenance Report" to the City of Orlando Environmental Control Section by fax (407-246-2886) or call the above number for e-mail instructions.

Section 10.13 Protection of Reclaimed Water System

General: To protect the City of Orlando reclaimed water system from contamination due to cross-connection with a private system utilizing a chemical injection and/or storm water augmentation systems, the Developer shall install a City of Orlando approved backflow prevention device on the reclaimed water assembly.

- A. Developments that use reclaimed water with chemical injection and/or storm water augmentation systems that add potential contaminants such as fertilizer, pesticides, algacides, etc., shall as a minimum, require installation of an approved double check valve assembly. Projects with a higher degree of hazard, such as saline solutions, etc., may be required to install an approved reduced pressure backflow preventer assembly or other device.
- B. Location and Installation:

All backflow prevention devices are to be located directly following the reclaimed water meter serving the customer's property. All backflow prevention devices shall be installed by a licensed plumbing contractor. It shall be the customer's responsibility to pay for devices, installation, maintenance, and inspection of all backflow prevention devices. It shall be the Owner's responsibility to maintain all backflow prevention devices, including repairs, replacements, and annual inspections.
- C. Any Irrigation system that will be looped with more than one point of connection shall be required to install an approved double check valve prevention device at all points on connection.

Section 10.14 Materials for Pipes, Fittings, Valves and Appurtenances

General: Reclaimed Water distribution mains 8 inches in diameter and smaller shall be either polyvinyl chloride (PVC) or ductile iron. Transmission mains or any main larger than 8 inches in diameter shall be ductile iron. Under unique circumstances as justified by the engineer, the City of Orlando may consider for approval an alternate pipe material. Any changes from the standard pipeline material must be approved by the City of Orlando.

- A. PVC Pressure Pipe and Fittings
 1. Pipe: PVC pressure pipe 4 inches through 8 inches in diameter shall meet the requirements of AWWA C900 and shall have cast-iron pipe equivalent outside diameter.
 2. The pressure class and dimension ratio (DR) of PVC pressure pipe 4- through 8- inches shall be 200 psi per AWWA C-900 rating, and minimum wall thickness of DR18.
 3. Fittings for PVC Pressure Pipe: Fittings shall be ductile iron with mechanical

joints having, at a minimum, the same pressure rating as the pipe and shall be as specified for ductile iron pipe and fittings.

4. Push-on Joints: Joints for PVC pressure pipe shall be of the compression rubber gasket type. The assembly of the joint should be as recommended by the pipe manufacturer.
5. Restrained Joints: Restrained joints for PVC pipe shall be Uni-Flange Series 1350 for PVC-PVC joints and Uni-Flange Series 1300 or EBBA PV2000 fittings for PVC-DIP joints, or approved equal. The length of pipe to be restrained shall be noted on the drawings. Minimum restrained joint spacing shall be in accordance with the ESM Details. Shop drawings from the manufacturer shall be submitted to and approved by the City prior to actual construction.

B. Ductile Iron Pipe and Fittings

1. Pipe: Ductile iron pipe shall meet the requirements of ANSI/AWWA C151/A21.51. The minimum thickness of buried ductile iron pipe shall be Class 50 and shall comply with the requirements of AWWA C 150.
2. Coating: All ductile iron pipes shall have the standard bitumastic outside coating specified in ANSI/AWWA C151/A21.51.
3. Lining: All ductile iron pipe and fittings shall have a cement mortar lining with a bituminous seal coat meeting requirements of ANSI/AWWA C104/A21.4.
4. Fittings: All ductile iron pipe fittings shall be mechanical joint, shall meet the requirements of ANSI/AWWA C1 10/A21 .10, shall have a pressure rating of 250 psi, and shall be full-radius fittings. All fittings shall be coated and lined as specified above for ductile iron pipe.
5. Mechanical Joints: Mechanical joints consisting of bell, socket, gland, gasket, bolt and nuts shall conform to ANSI Standard A2 1.11. Bolts shall be high strength low alloy steel, such as "Corten," or "U.S. Alloy," T-head type having hexagonal nuts. Bolts and nuts shall be machined true and nuts shall be tapped at right angles to a smooth bearing surface.
6. Push-on Joints: Single seal gasket push-on type joints shall conform to the requirements of ANSI A21.1 1 and shall be U.S. Pipe "Tyton," American Cast Iron Pipe Company "Fastite," CLOW Corporation "Super Bell Tite," or approved equal. Restrained Joints shall be installed wherever water main pipe alignment changes direction. Restrained joints shall be of the types fabricated by the various pipe manufacturers and not the type that require field welding or grooves cut into the pipe barrel for restraint. The length of pipe to be restrained shall be noted on the drawings. Shop drawings from the manufacturer shall be submitted to and approved by the Engineer prior to actual construction. The restraining joints for mechanical joint fittings and valves shall be ROMAC Industries "GripRing," EBAA Iron "MEGALUG," or approved equal.
7. Gaskets: Pipe and fitting gaskets, conforming to ANSI A21.1 1, shall be made of viton (fluorocarbon elastomer), EPDM (ethylene propylene diene monomer) or SBR (styrene butadiene rubber).
8. Encasement: All ductile iron pipe and fittings shall be encased in polyethylene in accordance with ANSI/AWWA C105/A21.5 when required by soil conditions.

C. Valves and Appurtenances

All valves shall be the manufacturer's standard design for the service intended and shall bear the maker's name and pressure rating cast on the body, also the valve type, size, and flow direction arrow, if applicable. Valves shall open left (counter clockwise) with an arrow cast in the metal of operating hand wheels or nuts indicating the direction of opening. All underground valves 3 inches and larger, shall have mechanical joints.

1. Gate Valves: Underground gate valves shall be of the resilient seat type meeting the requirements of AWWA C500/C509. These valves shall have non-rising stems, shall be furnished with 2-inch square AWWA operating nuts, and shall open when the nut is turned counterclockwise. Valves shall have mechanical joint ends and shall be furnished complete with joint accessories. Valves shall be "Ken-Seal" as manufactured by Kennedy; "Metroseal" by U.S. Pipe; or approved equal.
2. Tapping Valves: Tapping valves shall be mechanical joint outlet, non-rising, stem, and resilient seat gate valves meeting the applicable requirements of AWWA C509. Tapping valves shall be specifically designed for pressure tapping with sufficient seat opening to allow full diameter taps to be made. Tapping valves shall be manufactured with an integral tapping flange having a raised lip design.
3. Tapping Sleeves: Tapping sleeves for size-on-size connections shall be mechanical joint split cast iron units and rated for 200 psi working pressure. For less than size-on-size connections, tapping sleeves shall be fabricated steel units with a fusion-bonded epoxy coating or 304 stainless steel, and shall be pressure rated as above. The contractor shall determine the pipe material and outside diameter of the existing main before ordering the sleeve. Tapping sleeves shall have an outlet flange per ANSI B16.1, 125 lb. standard. Size on size connections shall not be allowed unless approved by City Engineer or designee.
4. Pressure Reducing Valves: Pressure Reducing Valves shall be manufactured by Bermad Company, or approved equal, and be certified by a Professional Engineer licensed in the State of Florida and will be reviewed by the City of Orlando on a case-by-case basis.
5. Pressure Sustaining Valves: Pressure Sustaining Valves shall be manufactured by Bermad Company, or approved equal, and be certified by a Professional Engineer licensed in the State of Florida and will be reviewed and approved by the City of Orlando on a case-by-case basis.
6. Air Release Valves: Air release valves shall be of the type that will release air from the line when pressurized and keep air from entering the line when not pressurized. Air release valves shall be located at high elevation points on the pipeline and operate automatically. The air release valve shall have a 2-inch inlet, corporation stop, saddle, and stainless steel pipe and fittings. Valves, fittings, and piping shall be rated for a minimum working pressure of 200 psi. The air release valves shall be installed above ground or in traffic bearing pre-cast concrete boxes with gravel and concrete bottoms. Areas prone to high water table or flooding shall require the air release valve to be installed above ground.

Construction plans and record drawings shall include air release valve stationing on both the plan and profile views. See ESM Details.

7. Blow-off Assembly: A permanent blow-off assembly shall be installed on all dead-end mains as shown on ESM Details. Construction plans and record drawings shall include blow-off assembly stationing on both the plan and profile views.
8. Service Saddle: Service saddles shall have a ductile iron body, be equipped with double tie straps, and be suitable for either wet or dry installation. The sealing gasket shall be the O-ring type suitable for the applicable service. Outlet flange shall be ANSI B 16.1, 125 lbs. standard. Tie straps and bolts shall be corrosion resistant alloy steel. Service saddles shall meet ANSI/AWWA C800 Standard.
9. Concrete Valve Pad: Valve boxes located outside of paved areas shall be cast in a 3000 psi concrete slab, 2' x 2' square, and 6-inch (minimum) thick. See ESM Details. Air release valves installed above ground shall be protected from damage as required with a cover and/or bollards.
10. Valve Box: Valve boxes for all valves installed below ground shall be cast iron and shall have square covers so as not to be interchangeable with potable water covers. They shall be adjustable to fit the depth of earth cover over the valve and shall be designed so as to prevent the transmission of surface loads directly to the valve or piping. Valve boxes shall have a minimum interior diameter of 5 inches. Valve box extension shall be installed to reserve a minimum of 50% of the adjustment for a future extension. The operating nut should not exceed 6 inches below finished grade. However, if conditions require that the operating nut exceeds 6 inches, then an extension, mechanically attached to the valve, shall be added, and the top of the extension shall not exceed 6 inches below finished grade. The cover of the valve box shall be marked "Reclaimed Water" and shall be securely installed as to prevent tipping or rattling. See ESM Details.
11. Plug Valves: Valves shall provide drip-tight bi-directional shut off at 200 psi. The plug shall have a cylindrical seating surface eccentrically offset from the center of the plug shaft. The interface between the plug face and the body seat, with the plug in the closed position, shall be externally adjustable with the valve in the line under pressure. Packing and packing gland shall be accessible without disassembly of the valve, and shall be externally adjustable. Stem bearings shall be sintered, oil impregnated permanently lubricated of type 316 stainless steel, or ASTM B30, alloy 95400 aluminum bronze. Valve shall be manufactured by Dezurik, Milliken, or approved equal. See ESM Details.

Section 10.15 Service Connections

Reclaimed water service connections shall be included as part of the distribution system and consist of: the service line, the corporation stop, the curb stop, and (for dual near-side connections) a dual service wye.

A. General Requirements

1. All near-side residential services shall be 1 to 2 inch polyethylene (PE) tubing for single services.
2. All far-side services shall be single 1 to 2 inch PE tubing with individual service connections.

B. Polyethylene (PE) Piping

1. Extrusion compound shall comply with the applicable requirements for the Type III, Grade P34, Class C, PE 3408, very high molecular weight polyethylene plastic material, as specified in ASTM D1248, a cell classification of 345434C or 355434C as specified in ASTM D3350.
2. Tubing shall be SDR 9-200 PSI, type CTSVOD (copper tubing size) or approved equal.
3. Stainless steel inserts shall be provided at all fittings on PE pipe.
4. Standard Dimension Ratio (SDR): The standard dimension ratio (SDR) for Copper Tubing Size (CTS) shall be 9. The average outside diameter, minimum wall thickness and respective tolerances for any cross section shall be as specified in ASTM D2737.
5. Environmental stress cracking resistance testing shall be performed in accordance with ASTM D1693, Condition C, and shall have no failures during 5000 hours of testing.
6. Pipe Identification: Polyethylene reclaimed water service pipe or tubing shall be purple (Pantone Purple 522C).

C. Corporation Stops

1. The corporation stops shall be manufactured from cast bronze with machined fitting surfaces in accordance with AWWA C-800, in sizes 1 inch up to and including 2 inches.
2. The inlet connection shall be Iron Pipe Thread. The outlet connection shall be a packjoint outlet for copper or plastic tubing. Corporation stops with compression joint outlets for copper or plastic tubing shall be Type F-1 100 for sizes up to 1-1/4-inch and FB-1 100 for 1-1/2 inch and 2-inch sizes as manufactured by Ford Meter Box Company or approved equal.
3. All CTS fittings shall use stainless steel inserts.

D. Curb Stops

1. The curb stops shall be ball valve, roundway, with deck, with lock wing cast on stop body and operating tee cap to provide for locking the stop in closed position.
2. Curb stops for use with copper or plastic services shall have an inlet connection with a compression joint and an outlet connection with female iron pipe thread, as manufactured by Ford Meter Box Company B43RW or KV43RW for 1-inch service line with padlock wings or approved equal. Curb stop for a 2-inch service line shall have an inlet and an outlet compression joint connection and shall be Ford B44-777, or equivalent.
3. All CTS fittings shall use stainless steel inserts

E. Service Box Location

In residential subdivisions, the developer is not required to install the individual service box.

OUC will install the service box in response to the residential customer's application for service. However, the developer is required to clearly identify the location of curb stop and future service connection.

1. Temporary identification: During construction, the location shall be temporarily identified with a 2" x 2" x 18" above grade wood stake with the top painted purple and marked with the lot(s) number to be service. See ESM Details.
2. Permanent identification: When the roadway is complete, the Developer shall mark the roadway curb indicating the location of the curb stop and reclaimed water service connection. The marking procedure shall be subject to approval by the City of Orlando.

F. Hose Bibb Connection

Hose bibbs are not permitted in residential installations. Hose bibbs will be permitted in some instances for commercial growers/nurseries and tree farms; where the hose bibb is located in a secure area and is utilized only by commercial employees. Commercial hose bibbs must be individually labeled with signage and must be locked when not in use.

1. Lock Box Assembly: Hose Bibb connections shall be located in a locked below-grade vault clearly labeled "RECLAIMED WATER" and bearing the words in English and Spanish "DO NOT DRINK, NO BEBER" together with the equivalent standard international symbol. The Lock Box Assembly shall be model 10 x 15 HC Series Box and Hinged Cover as manufactured by CDR Systems Corporation, or approved equal.
2. Rubber Hose Unit: This shall consist of a 3/4-inch rubber hose with a NY-Glass cam/groove 3/4-inch coupling Part E and 1-1/4-inch stainless steel center punch clamps, designed specifically for this Hose Bibb connection. On the other end of the hose shall be a 3/4-inch brass male nipple to accommodate a standard spray nozzle or sprinkler attachment.
3. Hose Bibb Location: The lock box and hose bibb assembly shall be located within the owner's property boundary, visible from the street, and shall not be located in the City of Orlando right-of-way.

Section 10.16 System Identification

- A. All reclaimed water piping and appurtenances shall be clearly identified as reclaimed water facilities.
- B. The standard color is Pantone Purple 522C for all reclaimed water system piping and aboveground appurtenances including valves, meter assemblies, and backflow prevention devices.
 1. PVC distribution mains: Color shall be an integral part of the pipe materials.
 2. Ductile iron distribution mains. Buried pipes shall be color coded with a purple tape with adhesive backing. Adhesive tape shall be at least 5 mils in thickness, at least 2 inches in width, and made of an aluminum material sandwiched between two layers of polyethylene or vinyl. See ESM Details. Aboveground piping shall be painted Pantone Purple 522C.
 3. Polyethylene (PE) service pipe or tubing. Service pipe shall be the standard purple

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- or identified with a purple stripe with the words "RECLAIMED WATER" at 8-inch intervals.
4. Locator balls shall be installed 2' below grade directly over the pipe and fittings at every 50' interval along the pipes, and at every branch, bend, deflection, valve, and crossing as per ESM Details.
 5. All nonmetallic reclaimed water mains and service lines shall be installed with a continuous purple insulated 8 gauge solid copper wire installed directly on top of the pipe for future location purposes. The locate wire shall be installed in such a fashion so as to sustain continuity. The contractor must perform a successful continuity test with a City of Orlando representative present.
- C. Valves installed below ground shall be identified with a stainless steel or brass tag to display appropriate valve information per ESM Detail.
 - D. Covers for all valve boxes, meter and service boxes, and other below-ground devices on the reclaimed water system shall be painted Pantone Purple 522C and shall be permanently embossed "RECLAIMED WATER" and bear the words in English and Spanish "DO NOT DRINK, NO BEBER," together with the equivalent standard international symbol.
 - E. Electronically detectable tape shall be installed in trenches above all PVC reclaimed water piping approximately 18 inches above pipe. Tape shall be a minimum of 4.5 mils thick and a minimum of 2 inches wide, with an aluminum core covered by a purple polyethylene coating with the words "CAUTION RECLAIMED WATER LINE BELOW." Tape shall be as manufactured by Reef Industries, Houston, Texas, or approved equal. See ESM details.

Section 10.17 Trench Excavation, Pipe Cutting and Laying, and Backfilling

The provisions set forth herein shall be applicable to all underground-reclaimed water piping installations. It shall be the developer's responsibility to verify all existing conditions and to locate all structures and utilities along the proposed utility alignment in order to avoid conflicts. Where conflicts exist, work shall be coordinated with the facility owner and performed so as to cause minimum interference with the service rendered by the facility disturbed. Facilities or structures damaged shall be repaired and/or replaced immediately at the developer's expense, in conformance with current standard industry practices, according to the direction of the owner of such facility, and approved by the City of Orlando. Horizontal directional drill may be used with Certaloc PVC or, for casing, HDPE.

- A. Trench Excavation
 1. All excavations shall be open cut, with banks of trenches kept as nearly vertical as possible. Trenches shall be wide enough to allow approximately 8 inches clearance on each side of the reclaimed water main, and accurate and uniform on the bottom to provide even bearing. Excavate bell holes after trench has been graded.
 2. Perform all excavations to the depths shown or indicated on plans. In the event unsuitable or unstable soil is encountered, remove it and replace with select sand, gravel, crushed stone, crushed slag, or combination thereof, or other material approved by the Engineer.
 3. Dewatering: Remove all water from excavations to a depth of 2' below trench

bottom, and maintain the zone free of water while construction therein is in progress. Provide dewatering equipment as necessary to conform to this requirement. Dewatering procedure must meet all regulatory requirements.

4. Protection of Trees: Trenching shall not take place within the root zone of trees with a trunk diameter of 6 inches or larger. The root zone shall be defined as the greater of the drip line of the tree or a circular zone extending outward from the base of the tree a distance equivalent to 1/2-foot for every inch of trunk diameter as measured 4-1/2-feet above natural grade (see ESM Details). Exotic nuisance species such as a Brazilian Pepper and Melaleuca are exempt from this protection. When trenching cannot avoid tree roots, contact the City of Orlando - Parks Division, Forestry Section for direction, as per City Code 65.645.
5. All excavations and shoring practices shall be performed in accordance with OSHA safety regulations and City of Orlando requirements.

B. Handling and Cutting Pipe

1. Every care shall be taken in handling and laying pipe and fittings to avoid damaging the pipe, scratching or marring machined surfaces, and abrasion of the pipe coating.
2. Any pipe showing a distinct crack, and in which it is believed there is no incipient fracture beyond the limits of the visible crack, the cracked portion, if so approved, may be cut off prior to laying the pipe. The cut shall be made in the sound barrel a minimum of 12-inches from the visible limits of the crack. All cutting shall be done with a machine adapted to the purpose. All cut ends shall be examined for possible cracks caused by cutting.

C. Pipe Laying

1. Reclaimed water mains shall be constructed of the materials specified and as shown on the construction drawings.
2. Each section of the pipe shall rest upon the pipe bed for the full-length barrel, with recesses (bell holes) excavated to accommodate bells and joints.
3. Any pipe, which has its grade or joint disturbed after laying, shall be taken up and relaid. No pipe shall be laid when the trench conditions or the weather is unsuitable for such work, except by permission of the City of Orlando. Any section of pipe already laid, which is found to be defective or damaged, shall be replaced with new pipe. See ESM Details.

D. Backfill/Compaction

Backfilling and compaction shall be conducted in a manner as to preclude subsequent settlement and provide adequate support for the surface treatment, pavement, pipelines, or structures to be placed thereon.

1. Backfill material shall be common fill material free from organic matter, muck or marl, and rock exceeding 2-1/2-inches in diameter. Common fill shall not contain broken concrete, masonry, rubble or other similar materials.
2. Method of Compaction: The contractor shall adopt compaction methods, which will produce the degree of compaction specified herein without damage to the new or existing facilities. The degree of compaction specified below shall be

considered the minimum allowable.

3. Backfilling Procedures: The backfilling procedures outlined below shall be for reclaimed water mains, and related structures. The backfilling shall be done in three stages as follows:
 - a. In the first stage, the contractor shall provide adequate compacted fill beneath the haunches of the pipe, using mechanical tampers suitable for this purpose. This compaction applies to the material placed beneath the haunches of the pipe and above any bedding material.
 - b. In the second stage, the contractor shall obtain a well-compacted bed and fill along the sides of the pipe and to a point of at least one foot above the top of the pipe. The width of backfill and compaction to be done under this second stage shall be the width of the portion of the trench having vertical sides; or, when no portion of the trench has vertical sides, it shall be to a width at least equal to twice the outside diameter of the pipe. Material to be placed in maximum of six-inch layers (compacted thickness).
 - c. In the third stage, the remainder of the trench shall be backfilled with suitable material in layers not to exceed six inches in thickness and compacted.
4. Compaction Density: Trench backfill density for all stages shall be as provided below:
 - a. For paved and unpaved roadways and traffic areas, from right-of-way line to right-of-way line, including all structures and railroad crossings, shall be 98% of the maximum density, with a minus 3% tolerance, as determined by AASHTO T-180 (ASTM D1557 Modified Proctor).
 - b. For outside of the right-of-way, but within maintenance easements, shall be 95% of the maximum density, with a minus 3% tolerance, as determined by AASHTO T-180 (ASTM D1557 - Modified Proctor).
5. Compaction Test Requirements: Compaction test results shall be submitted for all work in existing or proposed rights-of-way and easements. Results of compaction tests must meet minimum requirements prior to proceeding with the next stage of the work. One complete set of all test reports shall be submitted with the as-built package to the City of Orlando upon project completion. The contractor shall employ an independent testing laboratory, acceptable to the City of Orlando and pay for all required tests. The laboratory shall submit one copy of the certified test reports, after testing in each phase, to the City of Orlando for approval. In the second stage of backfilling, density tests shall be made every one (1) foot vertically, staggered every 500 feet horizontally. There shall be a minimum of one test between structures.

E. Hydrostatic and Leakage Test

1. Reclaimed water mains shall be tested as a whole or in sections between valves. The total length of pipe for any single test shall not exceed 2,000 feet. The mains shall be tested in accordance with Section 4, Hydrostatic Testing, AWWA C600-05, under an average hydrostatic pressure of not less than 200 psi, using a 300 psi gauge, for a minimum of 2 hours. All valves shall be tested for secure closure.
2. All pumps, gauges and measuring devices shall be furnished, installed, and

operated by the Contractor and all such equipment and devices and their installation, shall be approved by the City of Orlando Inspector. All water for testing and flushing shall be potable or reclaimed water provided by the Contractor, at the developer's expense, from a source approved by the City of Orlando.

3. The quantity of water used for testing, which shall be compared to the allowable quantity (per AWWA testing procedures and leakage allowances), shall be measured by pumping from a calibrated container, again approved by the City of Orlando Inspector. All restrained sections of the buried main shall be completely backfilled before such sections are tested. All pressure and leakage testing shall be done in the presence of the City of Orlando Inspector and the Engineer of Record or his designated representative.
4. When leakage occurs, defective pipe, pipe joints or other appurtenances shall be located and repaired at the expense of the contractor. If the defective portions cannot be located, the contractor, at his own expense, shall remove and reconstruct as much of the original work as necessary to obtain a totally leak-free piping system.