



PUBLIC WORKS MANUAL

Revised 5/2014

Table of Contents

SECTION 1: AUTHORITY AND JURISDICTION	4
A. AUTHORITY	4
B. PENALTIES	4
C. INTENT	4
SECTION 2: STREETS AND HIGHWAYS.....	5
A. GENERAL	5
B. ARRANGEMENT.....	5
C. STREET NAMES, STREET MARKERS AND OTHER MARKING REQUIREMENTS	6
1. STREET NAMES.....	6
2. STREET NAME SIGNS.....	6
3. OTHER STREET MARKING REQUIREMENTS.....	7
D. GEOMETRIC DESIGN.....	8
1. CROSS SECTION ELEMENTS.....	8
2. DESIGN SPEED	9
3. SIGHT DISTANCE.....	9
4. HORIZONTAL ALIGNMENT	9
5. VERTICAL ALIGNMENT	9
6. ALIGNMENT COORDINATION.....	9
7. ACCESS CONTROL.....	9
8. INTERSECTION DESIGN.....	10
E. BASE AND PAVEMENT DESIGN AND CONSTRUCTION	10
1. SUB-GRADE/BASE COURSE	10
2. PRIMING AND PROTECTION OF THE BASE.....	11
3. PAVED/SURFACE COURSE	11
F. OTHER DESIGN AND CONSTRUCTION ITEMS.....	11
1. CONCRETE WORK.....	11
2. CURB AND GUTTERS	13
3. SIDEWALKS.....	13
4. DRIVEWAYS	14
5. STREET LIGHTS	14

6. UTILITIES.....	15
SECTION 3 – EARTHWORK	15
A. ROADS AND STREETS	15
B. UTILITIES.....	16
1. GENERAL	16
2. EXISTING FACILITIES	16
3. MAINTENANCE OF TRAFFIC	16
4. CONSTRUCTION WITHIN STREETS, RIGHT-OF-WAYS AND EASEMENTS	16
5. EXISTING PAVEMENT REMOVAL AND REPLACEMENT.....	17
6. EXISTING SIDEWALK, DRIVEWAY AND CURB REPLACEMENT	17
7. EXCAVATIONS FOR PIPE WORK.....	17
8. DEWATERING FOR PIPE WORK	17
9. BACKFILLING OF TRENCHES	18
SECTION 4 – UTILITIES – SEWER/WATER/NATURAL GAS	18
A. SANITARY SEWER – WASTEWATER COLLECTION AND TRANSMISSION	18
1. GENERAL	18
2. DESIGN FLOW.....	18
3. GRAVITY SYSTEM CONSIDERATIONS.....	18
4. SANITARY SEWER LIFT STATIONS – GENERAL DESIGN.....	23
B. POTABLE WATER DISTRIBUTION.....	27
1. GENERAL	27
2. DESIGN FLOW.....	27
3. DISTRIBUTION SYSTEM CONNECTIONS TO SUBDIVISIONS.....	28
4. DISTRIBUTION MAIN LAYOUT AND SIZING	28
5. POTABLE WATER PIPE AND FITTINGS	29
C. NATURAL GAS PIPE LINES	33
1. GENERAL	33
2. PRODUCT.....	33
3. EXECUTION.....	34
D. INSTALLATION OF SANITARY SEWER AND POTABLE WATER.....	35
1. GENERAL	35
2. PIPE LAYING PROCEDURES.....	36

E.	TESTING AND INSPECTION OF SANITARY SEWER AND POTABLE WATER.....	37
1.	GENERAL	37
2.	TESTING OF GRAVITY PIPEWORK	38
3.	HYDROSTATIC TESTING OF PRESSURE PIPE	38
4.	CHLORINATION OF POTABLE WATER PIPING	38
5.	ACCEPTANCE	39
	SECTION 5 – DRAINAGE	39
A.	GENERAL	39
B.	DRAINAGE PIPE AND STRUCTURES	40
1.	MATERIALS.....	40
2.	LAYING OF STORM DRAIN PIPING.....	41
	SECTION 6 – TABLES AND FIGURES	

SECTION 1: AUTHORITY AND JURISDICTION

A. AUTHORITY

The City Council of the City of Milton (City) has authorized the use of the Public Works Manual as its standard for construction. These standards shall govern all related construction within the corporate limits of the City as now and hereafter established and any construction or connections to City owned utility systems in unincorporated areas.

Any owner of land within the limits stated above wishing to develop or improve his property in such a way as to require any construction improvements regulated herein, shall submit plans and specifications to the Planning and Development Department for review and approval as required in Article II of the City of Milton Land Development Regulations. No such improvements shall be accepted for public maintenance unless constructed to these standards and accepted and approved by the City Manager or his designee.

These regulations are to be considered as the standards required by the City for construction. It should be understood that this manual is only a guide and not intended to dictate good engineering practices. In addition, the City retains the right to place more stringent requirements upon construction where actual field conditions mat warrant.

B. PENALTIES

As provided for in Article II, Section II-1.2 of the Land Development Regulations, no building permits (as therein defined) may be authorized by the City of Milton Planning and Development Department, unless such plans and specifications for the development activity conform to the technical and construction standards contained in this manual and other Land Development Regulations, Life Safety Codes, etc. Failure to comply with these standards will result in the denial of acceptance for maintenance by the City until such improvements comply with the requirements contained herein. Further, no utilities shall be connected until such time as the improvements have been approved by the City Manager and accepted by the City.

C. INTENT

It is the intent of this manual to be used as a guide for design as well as establish minimum standards for construction. It should be noted that the standards contained in the manual may be increased by the City Manager or his designee, dependent upon circumstances related to a specific site. Additionally, the City may place more stringent requirements on a particular project based upon actual or anticipated field conditions.

While this manual does provide for the use of specific materials and design criteria, it is also understood that materials and methods of construction constantly change. It is the intent of the City to be able to keep current with new technology as it relates to new materials and methods. Therefore, the City will review alternative materials and construction methods presented by developers and contractors from time to time. The review will be made by the Technical Review Committee (TRC) and minor modifications may be approved by the City Manager or his designee. Major deviations will be reviewed by the TRC who will forward their recommendations to various committees and then to the City Council for final approval. Unless specifically stated, any deviations allowed will be on a case by case basis until such time as this manual may be revised.

SECTION 2: STREETS AND HIGHWAYS

A. GENERAL

New roadways proposed for construction within the City shall be classified as *arterial, collector, local roads and streets or alleys*. The functional classification of each proposed roadway within a new development shall be confirmed during the Application for Development approval process. A schematic illustration of the functional classification concept is provided in Figure II-1.

For the purpose of design for all new roadways and developments, the following publications shall act as guides. While these publications are intended for large highways systems, the design criteria contained within them can be applied to most projects within the City of Milton. Throughout the remainder of this section, more specific data will be presented that may supersede the publications:

- 1. *FDOT - Plans Preparation Manual, latest edition.***
- 2. *FDOT - Manual of Uniform Minimum Standards for Design, Construction & Maintenance for Streets and Highways, latest edition. (also commonly known as the "Florida Green-book")***
- 3. *FDOT - Design Standards for Design, Construction, Maintenance & Utility Operations on the State Highway System, latest edition.***

B. ARRANGEMENT

The arrangement, character, extent and location of all streets shall conform to the current Comprehensive Plan. The relation of proposed streets to existing and planned streets, to topographical conditions and to the proposed land uses to be served by such streets, shall be considered in the development of the proposed street arrangements. The arrangement of all proposed streets shall promote public safety, public convenience and should allow the most advantageous development of the surrounding neighborhood.

1. Where such is not shown in the Comprehensive Plan, the arrangement of the streets in a subdivision shall either:
 - a. Provide the continuation or appropriate projection of existing principal streets in the surrounding areas, or,
 - b. Conform to a plan for the neighborhood adopted by the Planning Board.
2. Where a subdivision abuts or contains an existing or proposed arterial street, the development approval authority, as provide for in Article II, Administration, of the Milton Land Development Regulations, may require marginal access streets, reverse frontage with screen planting contained in a non-access reservation along the rear property line, deep lots with rear service alleys or such other treatment as may be necessary for adequate protection of residential properties and to afford separation of through and local traffic.
3. Reserve strips controlling access to streets shall be prohibited except where their control is definitely placed in the City under conditions approved by the development approval authority.
4. Half streets shall be prohibited, except where essential to the reasonable development of a subdivision in conformity with the other requirements of the regulations and where the development approval authority finds it will be practicable to require the dedication of the other half when the adjoining property is subdivided. Whenever a half street is adjacent to a tract to be subdivided, the other half street shall be platted within such tract.
5. Permanent dead-end streets (cul-de-sacs) which are not to be extended by either the sub divider or the adjoining property owner shall be provided at the closed end with a turnaround having a minimum paved outside diameter of one hundred feet (100') and a minimum right-of-way diameter of one hundred twenty feet (120'). The maximum length of a dead-end street shall be 1000' as depicted in Figure II-2.
6. Street jogs with center line offset of less than one hundred twenty five feet (125') shall be avoided.

C. STREET NAMES, STREET MARKERS AND OTHER MARKING REQUIREMENTS

1. STREET NAMES – A proposed new street, which is in alignment with a continuation of an existing street, shall have the same name as the existing street. In no case (including numbered or lettered streets) shall a new street have the names or numbers which duplicate or are phonetically similar to existing street names regardless of the prefix or suffix used such as Avenue, Boulevard, Court, Crescent, Drive, Place, Street and Terrace. All street names shall be subject to the approval of the Coty Council.
2. STREET NAME SIGNS - Street name signs shall be installed by the developer at street intersections, designating the names of the streets. Street name signs shall be erected in urban areas at all street intersections regardless of other route marking that may be present and should be erected in rural districts to identify important roads not otherwise marked.

Supplementary lettering to indicate the type of street (Street, Road, etc.) or section of the City (N.W., S.E. etc.) may be in similar lettering, at least 2½” high. Conventional abbreviations are acceptable except for the street name itself.

Street sign blades on streets located at city, county or state road intersections shall be nine (9”) inches in height aluminum with a green background. Lettering on these signs shall be white, six (6”) inch high letters. The background shall be a high intensity grade green reflective material or illuminated. The downtown historic district shall be white letters on a brown background. Some districts may use a different color scheme. In these districts the City Council shall have final approval for variations to the color scheme.

Any circular street shall be required to notate the address ranges on each sign for emergency response purpose.

In business districts and on principle arterials, street name signs should be placed at least on diagonally opposite corners so that they will be on the far right-hand side of the intersection for traffic on the major street. Signs naming both streets should be erected at each location. All faces shall be parallel to the streets they name.

In residential districts, at least one street name sign should be mounted at each intersection. In locations where same name street loops or has 90 degree curves, additional street name sign will be required.

The sign supports shall be constructed as shown in [Figure II-3](#).

All sign supports shall be galvanized and installed with vandal proof hardware consisting of stainless steel brackets and bolts.

The developer is responsible for purchasing and installing speed limit, STOP and other warning or information signs as deemed necessary by the City. All signage shall comply with the latest edition of the MUTCD or FDOT Standards. All STOP signs shall be thirty (30”) inch.

3. OTHER STREET MARKING REQUIREMENTS - STOP bars shall be installed at all intersections. The STOP bar shall be 18” wide solid white in subdivisions developments and 24” wide at all other intersections of the city, county or state roads.

A solid double yellow six inch (6”) line shall be installed at each STOP intersection. The yellow lines shall extend from the STOP bar a minimum of seventy-five (75’) feet in order to divide the traffic lanes.

The word “STOP” shall be painted on the pavement twenty-five (25”) prior to the STOP bar. The letters shall be ninety-six (96”) inches high.

All pavement markings shall be thermoplastic.

At each fire hydrant location a blue raised pavement marker shall be installed on the centerline of the street. If the fire hydrant is located on a street corner, two (2) markers shall be installed, one on each street.

D. GEOMETRIC DESIGN

See Publications

1. CROSS SECTION ELEMENTS

- a. RIGHT-OF-WAY – The acquisition of sufficient right-of-way is necessary in order to provide space for a safe street or highway. The width of the right-of-way required depends upon the design of the roadway, the arrangement of bridges, underpasses, other structures, utility installations and the need for cuts or fills. The minimum right-of-way shall be as specified in **Table II-1**. For preexisting conditions when the right-of-way is less than 60 feet, efforts should be made to obtain the necessary right-of-way.
- b. PAVEMENT – ***See Publications***
The paved surface of all travel lanes shall be designed and constructed in accordance with the requirements set forth in Section II-E; BASE AND PAVEMENT DESIGN AND CONSTRUCTION. All pavement widths shall be a minimum of 12 ft. from centerline of street to pavement edge at curb (24 ft. total, edge of pavement to edge of pavement).
- c. ROADSIDE CLEAR ZONE – ***See Publications***
The width of the clear zone should be as wide as practicable. For design speeds of 25 mph or less, the minimum width is six (6') feet. For design speeds greater than 25 mph, the minimum width shall be six (6') feet for local roads, ten (10') feet for collector roads and fourteen (14') feet for arterials roads. These are minimum values only and should be increased wherever possible.
- d. CLEARING, GRUBBING AND GRADING – ***See Publications***
Clearing and grubbing shall be for the full width of the right-of-way except as may be approved by the City Manager or his designee. Grading shall be in accordance with the approved plans. All cleared areas shall be seeded and mulched per FDOT standards or a City approved equal, to insure stabilization on a permanent basis. The developer/property owner/permit holder shall be responsible for maintaining and stabilizing the grassing the site through the warranty period or as may be approved by the City. This includes right-of-ways, easements, stormwater ponds and other areas as may be identified during the construction process.

- e. PARKING – Parking on street right-of-ways shall be prohibited on all twenty-four (24') foot wide streets.

2. DESIGN SPEED

See Publications

Recommended minimum values for design speeds are given in [Table II-4](#).

3. SIGHT DISTANCE

See Publications

The stopping sight distance shall be no less than the values shown in [Table II-5](#).

4. HORIZONTAL ALIGNMENT

See Publications

Design speed maximum degrees of curve relationships are given in [Table II-6](#). The use of sharper curvature for the design speeds shown in [Table II-6](#) would call for super elevation beyond the limit considered practical or for operation with tire friction beyond the limit considered practical, safe or comfortable.

5. VERTICAL ALIGNMENT

See Publications

The grades selected should be as flat as possible and should not be greater than the value given in [Table II-7](#).

Vertical curves are required when the algebraic difference of the intersecting grades exceeds the value given in [Table II-8](#). The length of the vertical curve on a crest as governed by stopping sight distance is obtained from [Figure II-5](#). The minimum length of a sag vertical curve as governed by vehicle headlight capabilities is obtained from [Figure II-6](#).

6. ALIGNMENT COORDINATION

See Publications

7. ACCESS CONTROL

See Publications

Spacing and location of access points shall be established consistent with Section V-3 Access Management of the Land Development Regulations.

“T” intersections in branching networks are recommended, particularly for local and collector streets. Street jogs with centerline offsets of less than 125 feet shall be avoided.

8. INTERSECTION DESIGN

See Publications

The location and spacing of intersections should follow the requirements presented in Section II.D.7 – ACCESS CONTROL.

Approach to STOP signs, YIELD signs or traffic signs should be provided with a sight distance no less than the values given in **Figure II-7**.

Where the approach roadway is on grade or vertical curve, the sight distance should be no less than the values shown in **Figure II-7**.

The distance required for acceleration on level roadways for passenger cars are given in **Table II-10**. Where acceleration occurs on a grade, the required distance is obtained by using **Tables II-10** and **Table II-11**.

The distance required for deceleration of passenger cars is given in **Table II-10**.

Where deceleration occurs on a grade, the required distance is obtained by using **Table II-10** and **Table II-11** and should be increased whenever feasible.

E. BASE AND PAVEMENT DESIGN AND CONSTRUCTION

1. SUB-GRADE/BASE COURSE – ***See Publications***

The constructed base course shall be a minimum of six (6”) inches thick and shall be placed on a stabilized, compacted subgrade having a minimum Limerock Bearing Ratio (LBR) of 40. The sub-grade shall be compacted to 95% of the maximum dry density as obtained by the standard proctor method (ASTM D-698). Compaction test of the sub-grade shall be completed at one (1) per every 300’ of roadway, with no less than a total of 3 tests being made. All compaction testing shall be completed prior to the placement of the base material or concrete curbing.

The types of base courses approved for use are shown below, along with the testing requirements.

- a. Sand – Clay
- b. Limerock
- c. Graded Stone Aggregate

All materials specified and construction methods shall be in accordance with the FDOT – Standard Specification for Road and Bridge Construction, latest edition. Any alternate base course proposed shall have written approval by the City Manager or his designee.

The City Planning and Development Department shall be notified at least 48 hours in advance of any testing so that a City representative may be present.

The City shall be provided the results of all compaction tests as construction progresses or as requested. Compaction test of the base shall be completed at one (1) per every 300’ of roadway, with no less than a total of 3 tests being made. The test shall not fall in the same locations of the sub-grade compaction tests. In

areas of questionable soils, more stringent requirements may apply. Location of the testing sites shall be coordinated with the City staff. Copies of all tests results shall also be submitted with the “as-built” drawings or prior to the acceptance by the City.

2. PRIMING AND PROTECTION OF THE BASE – *See Publications*

Priming of all base courses will be required and shall be in accordance with FDOT Standards. Until paving occurs, all primed bases shall be protected with an approved sand coating or other type of armor coating.

3. PAVED/SURFACE COURSE – *See Publications*

All roadways shall be paved. Minimum thicknesses are shown in **Figure II-9**. All surface courses shall be FDOT Type S-1 or equivalent based on the latest edition of the FDOT Standards.

F. OTHER DESIGN AND CONSTRUCTION ITEMS.

1. CONCRETE WORK

All cast or poured-in-place concrete work shall comply with the following requirements.

a. Quality Assurance

- (1) Comply with the latest published edition of the American Concrete Institute (ACI) and American Society of Testing and Materials (ASTM) standards and codes:
 - (a.) ACI 301-Specifications for Structural Concrete for Buildings
 - (b.) ACI 305-Placing Concrete in Hot Weather
 - (c.) ACI 306-Placing Concrete in Cold Weather
 - (d.) ACI 318-Building Code Requirements for Reinforced Concrete
- (2) The City of Milton reserves the right to require submitted or proposed job mixes, slump test and compressive strength tests for all concrete used.
- (3) Unless otherwise indicated, all concrete shall be 3000 p.s.i. design strength.

b. Products

- (1) Portland Cement: ASTM C150
- (2) Fly Ash: ASTM C618, Type C or F. Limit use of fly ash to not to exceed 25% of cement content by weight.
- (3) Aggregates: ASTM C33, except local aggregates of proven durability may be used when acceptable to the Engineer.
- (4) Water: Potable

c. Admixtures

- (1) Air-Entraining Admixture: ASTM C260
- (2) Water Reducing Admixture: ASTM C494, type as required to suit project conditions. Only use admixtures which may have been tested and accepted in mix design.

- d. Related Materials
 - (1) Waterstops: Flat dumbbell or center bulb type, size to suit joints, of either rubber (CRD C513) or PVC (CRD C572).
 - (2) Moisture Barrier: Clear eight (8) mils thick polyethylene.
 - (3) Membrane-Forming Curing Compound: ASTM C309, Type I.
 - (4) Joint Fillers:
 - (a.) Joint Sealer: Hot poured, non-extruding, elastic, ASTM D1190.
 - (b.) Preformed Expansion Joint Filler: Non-extruding, bituminous fiber, ASTM D1751.
 - (c.) Provide form materials with sufficient stability to withstand pressure of placed concrete without bowing or deflecting.
- e. Reinforcing Materials
 - (1) Deformed Reinforcing Bars: ASTM A615, Grade 60, unless otherwise indicated.
 - (2) Welded Wire Fabric: ASTM A185.
- f. Mixing, Forming and Placing Concrete
 - (1) Job-Site Mixing: Use drum type batch machine mixer, mixing not less than 1½ minutes per one (1) cubic yard or smaller capacity. Increasing mixing time at least 15 seconds for each additional cubic yard or fraction thereof. Batch time shall not exceed 1½ hours.
 - (2) Ready-Mix Concrete: ASTM C94
 - (3) Formwork: Construct so that concrete members and structures are of correct size, shape, alignment, elevation and position. Provide openings in formwork to accommodate work of other trades. Accurately place and securely support items built into forms. Clean and adjust forms prior to concrete placement. Apply a form release agent or wet forms as required. Retighten forms during concrete placement if required to eliminate mortar leaks.
 - (4) Placement of Reinforcement: Position, support and secure reinforcement against displacement. Locate and support with metal chairs, runners, bolsters, spacers and hangers as required. Set wire ties so ends are directed into concrete. Install welded wire fabric in as long lengths as practicable, lapping at least one mesh at both ends and sides. Tie or interlace at laps.
 - (5) Joints: Provide construction, isolation and control joints as indicated or required. Locate construction joints so as to not impair strength and appearance of structure. Locate isolation and control joints in slabs-on-grade to accommodate differential settlement and prevent random cracking.
 - (6) Embedded Items: Set or build into work, anchorage devices and other embedded items required for other work that is attached to or supported by the cast-in-place concrete. Use diagrams, templates or instructions provided by others for locating and setting.

(7) Placement: Comply with all ACI requirements when placing concrete. Do not begin placement until the work of other trades affecting the concrete is completed. Consolidate concrete using vibrating equipment, hand rodding and tamping so that the concrete is well placed around reinforcement, embedded items and into forms. Protect concrete from physical damage or reduced strength due to weather conditions.

g. Concrete Finishes

(1) Exposed Surfaces: Unless otherwise called for, provide a smooth surface for all exposed concrete surfaces. Remove all fins and unwanted projections and patch defective areas and rub smooth.

(2) Finishes:

(a) Trowel Finish: slab surfaces exposed to view and to be covered with flooring, painted or other coatings.

(b) Broom Finish: slab surfaces exposed to view and subject to vehicular or pedestrian traffic.

(3) Curing: Provide protection to prevent damage to exposed surfaces for a minimum of 48 hours for pedestrian use and 72 hours for vehicular use.

2. CURB AND GUTTERS – *See Publications*

Concrete curb and gutters shall be installed on all streets utilizing either a layback or FDOT Type 'F' designs as shown in [Figure II-4](#). Other curbs shown may only be used upon request and approval by the City Manager or his designee. The curb will be constructed using a 1/2" expansion joint at the beginning and end of each radius, at any abutments, at any grade change and at every fifty (50') feet thereafter. All stormwater shall be conveyed through curb inlets and into underground piping or as approved in the design.

3. SIDEWALKS – *See Publications*

On projects where sidewalks are included, they shall be constructed of concrete and a minimum of five (5') feet wide and four (4") inches thick.

Sidewalks at all driveways shall be six (6") inches thick. The contractor may use forms or an approved automatic extrusion type paving machine. If a machine is used, it must demonstrate to produce a consolidated concrete section conforming to the required cross section and dimensions.

Sidewalks shall be placed to true line and grade upon a uniformly compacted sub-grade. Control joints providing a groove approximately one-half (1/2") inch in depth with rounded edges shall be provided every five (5') feet.

One-half (1/2") inch expansion joints shall be placed where walks join other concrete units with additional interior expansion joints every sixty (60)' feet and at all radius changes.

All sidewalks shall have a broom finish or as indicated by the City and shall be sloped as to not cause ponding of water and to comply with ADA and handicapped access requirements.

4. DRIVEWAYS – *See Publications*

All driveways shall be constructed using concrete, unless specifically approved to use another material by the City Planning and Development Department.

All concrete driveways shall be constructed using concrete and shall be a minimum of 6” thick. Driveways for non-residential use will require additional reinforcing based on the proposed use.

For all new developments where driveway locations are known, the curb and gutter section should conform to the standard details. At locations within existing developments, the curb and gutter section should be removed and replaced to match the standard details. In some locations and with approval of the City Planning and Development Department, the entire curb and gutter section may only be modified in lieu of total removing and replacement.

The first section of the driveway, at the 1st joint, shall be equal to or higher than the top of the curb nearest the driveway on either side. Should the finished floor elevation of the structure being served, additional grading may be required to address any stormwater flow entering or damaging the structure.

Should the driveway be constructed without removing the entire curb and gutter section, the addition of #4 rebar dowels will be required for structural integrity. The dowels will be drilled into the existing curb 6” deep and secured with epoxy. The dowels shall extend into the new driveway 12” and shall be spaced no greater than 24” apart.

5. STREET LIGHTS

All new subdivision developments within the City, with underground electrical power, will be required to install street lights. As part of the development plan review, a “Street Lighting Plan” will be required. The Plan will show proposed locations and types of lighting and will have been approved by Gulf Power Company. Each pole and fixture shall be spaced no more than 250’ apart and each fixture shall be LED producing a min. of 9200 lumens. The City will, after each light is installed, assume the monthly cost to operate each light. Both the pole and fixture will be the “standard” Gulf Power style, tapered concrete pole and LED cobra head residential streetlight fixture.

Any other type or design will require the approval of the City Manager or his designee.

Because most “build out” of the development is staged, not all of the light poles and fixtures will be required to be installed prior to the final acceptance of the development. Therefore, as each lot is developed, it will be the responsibility of each builder, nearest the locations shown on the approved Street Lighting Plan, to have each pole and light installed. In most cases the pole will split between 2 lots, in this case the first builder to seek City approval for development will be the responsible party to have the pole and fixture installed.

6. UTILITIES

Where it is necessary to locate utilities within the right-of-ways, the placement and location shall not be in contradiction to or fail to meet the intent of the design requirements of this manual. Poles or other above ground utility structures are not generally permitted in the medians or within the roadside clear zones. Underground utilities should not be buried under pavement when other space is available within the right-of-way. Unavoidable crossing of roadways should be designed to allow for repairs and modifications without unnecessary disruption or hazard to traffic, with the exception of local residential streets. The placement of access manholes within the pavement, shoulders or medians should be avoided.

SECTION 3 – EARTHWORK

A. ROADS AND STREETS

See Publications

For all developments within the City, a geotechnical engineer shall be retained in order to prepare a soils report on the various components of the project. The recommendations made in the report shall be no less than those listed below.

Excavation shall be performed in accordance with all applicable Federal, State, County and City Regulations. Blasting will not be permitted.

All streets and roadways shall be cleared of all trees, brush, stumps, roots and other objectionable materials so that the entire right-of-way can be constructed to the required cross section. Any trees or other items noted for preserving shall be protected. All obstructions shall be removed to a minimum of four (4') feet below existing grade and/or twelve (12") inches below the sub-grade. Stump holes or other holes shall be carefully backfilled and compacted. All soft, yielding or otherwise unsuitable materials must be removed and replaced with acceptable fill material.

Suitable materials from roadway cuts may be used in the construction of fills, approaches or at other places needed. The fill shall be spread in layers and compacted in no more than six (6") inch lifts. The top twelve (12") inches of soil in both cut and fill sections shall have a dry weight density of at least equal to ninety-five (95%) percent obtained by the modified proctor method (ASTM D-1557).

Grading must progress so as to insure good drainage and prevent formation of depressions where water may collect. When the natural soil cannot be made stable enough to support construction traffic, sub-grade modifications shall be accomplished. The sub-grade shall have provisions to intercept groundwater from springs and seepage plains to prevent saturation of the sub-grade or other items that would prevent a quality development. The finished sub-grade shall be true to the plan grade and uniformly firm. All disturbed areas outside the paved roadway shall be stabilized with seed and mulch per the standards. In some cases, sod may be required to obtain the stabilization. All slopes greater than 4:1 will require sod.

All underground utilities crossing paved streets shall be installed prior to final grading and compaction. Electrical, telephone, cable and irrigation systems crossings shall be placed in adequately sized conduits. The conduits shall be no closer to the edge of pavement or curbing than two (2') feet.

B. UTILITIES

1. GENERAL – *See Publications*

All excavation shall be performed in accordance with all Federal, State, County and City regulations. All trench excavations shall conform to the requirements of the Occupational Safety and Health Administration – *Construction Standards for Excavations*.

2. EXISTING FACILITIES – *See Publications*

Adequate measures shall be taken to provide for the protection of all existing structures and utilities, both above and below ground. In **all cases** the City shall be held harmless against damage and claims from damage resulting from construction activity. The contractor performing the work shall be responsible for **all** utility locates and shall have on site, a current Locate Ticket as provided by Florida One Call service, telephone **811** or email www.callsunshine.com.

3. MAINTENANCE OF TRAFFIC – *See Publications*

Effective barricades, danger signals and signs shall be erected and maintained in locations where necessary for the protection of the work and public safety. Barricades or obstructions, which encroach on or are adjacent to public right-of-way, shall be provided with lights. The lights shall always be on during non-day light hours. All work shall conform to all Federal, State, County and City work zone safety requirements and/or FDOT – Maintenance of Traffic Standards. Work shall be arranged to minimize disturbance to normal pedestrian and vehicular traffic.

4. CONSTRUCTION WITHIN STREETS, RIGHT-OF-WAYS AND EASEMENTS

All obstructions along the construction area shall be removed and the area cleared in order to provide adequate space for the layout and construction. Work shall be limited to the street, right-of-way or easement. Any survey reference points

or benchmarks encountered shall not be disturbed. If any points or benchmarks are disturbed, they will be replaced by a registered land surveyor at no cost to the City or the property owner.

5. EXISTING PAVEMENT REMOVAL AND REPLACEMENT

Any removal of existing concrete or asphalt pavement shall be in a straight line and such width only as necessary for the work to be completed. Pavement to be removed shall be saw cut to a width shown in **Figure II – 11, 12 or 13**. Repair after the construction shall also follow that shown in the same details. Until the final repair can be completed, the surface of the trench shall be maintained in smooth riding condition without potholes and depressions. Final repaving will not occur until all heavy equipment is permanently removed and all work has been tested and accepted.

6. EXISTING SIDEWALK, DRIVEWAY AND CURB REPLACEMENT

All existing sidewalks, driveways and curb removed, disturbed or destroyed during construction shall be repaired or replaced. The completed work shall be equal to or better than the original. All edges of the work to be repaired or replaced shall be saw cut in a straight line. All sidewalks and curbs shall be replaced joint to joint. All concrete work shall be in accordance with Section 2.F. All asphalt driveways shall be repaired as detailed in **Figure II – 11, 12 or 13**.

7. EXCAVATIONS FOR PIPE WORK

All excavations for pipe lines shall be along the centerline of the pipe and shall be by open cut method. Bell holes for piping shall be hand excavated to ensure that the pipe rest upon the bottom of the trench. If the bottom of the excavation is found to have unsuitable materials, the material shall be removed at least six (6") inches below the trench bottom and for the length necessary. The bottom of the excavation shall be backfilled using compacted clean sand, gravel or crushed stone.

Suitable excavated materials to be used for backfill or other purposes shall be neatly deposited at the sides of the trenches, where space is available, or at a stockpile location for use at a later time. The stockpile location shall provide for natural drainage and not present an unsightly appearance. The stockpile location shall be owned by the developer or the developer has obtained written permission. The stockpile shall also be protected from erosion by using hay bales or silt fencing or both.

Upon completion, all disturbed areas shall be seeded and mulched per FDOT standards to prevent erosion and to establish a good stand of grass.

8. DEWATERING FOR PIPE WORK

Dewatering, if required during construction, will be to keep the ground water below the work area so that the proposed work to be completed will not be

compromised. Well pointing or other acceptable means of dewatering will be required until such time ground water, either natural or caused by some other means, no longer exist. Well points will not be allowed to be placed in existing pavement unless approved by the City.

9. BACKFILLING OF TRENCHES

Backfilling of trenches will follow the same procedure as detailed in SECTION 3.A for fill sections. Placement of the backfill shall be carefully placed on both sides of the pipe at the same time and compacted until reaching 12” above the pipe. Then the entire trench shall be backfilled and compacted following the guidelines. See Figure II – 14. The trench shall be restored to its original grade or to the proposed grade. Under no condition is construction debris to be included within the backfill. All disturbed areas, unless included within a development, shall be seeded and mulched per FDOT standards or as may be approved by the City.

SECTION 4 – UTILITIES – SEWER/WATER/NATURAL GAS

A. SANITARY SEWER – WASTEWATER COLLECTION AND TRANSMISSION

1. GENERAL

All new wastewater collection and transmission systems shall be designed permitted and constructed in accordance with FAC Chapter 62-604; Ten States Standards or any other rules that may apply. City of Milton Code of Ordinances, Section 48-33, requires that anyone within two-hundred (200’) feet of the City’s wastewater collection system must connect. All persons outside the City Limits may connect, but only with permission of the City. No work shall commence until all permits and approvals are obtained and all fees have been paid.

2. DESIGN FLOW

All new systems shall be designed on the basis of an average daily flow per capita of not less than 100 gallon per day and 3.5 persons per household. The flow shall be adjusted by a “peaking factor” as determined by the Ten States Standards.

In addition to the basis of design provided above, consideration of unusually high commercial, industrial or other flows shall be incorporated into the design.

3. GRAVITY SYSTEM CONSIDERATIONS

a. GENERAL DESIGN

No gravity sewer main conveying raw sewage shall be less than eight (8") inched in diameter. The maximum distance between manholes shall be four hundred (400') feet.

All gravity service laterals shall be no less than four (4") inches in diameter. Each gravity service laterals shall be designed to service only one (1) customer and shall have a clean-out installed at the property line.

All gravity sewers shall be installed with uniform slope between manholes. The sewer shall also be designed and constructed to give minimum velocities of not less than 2.0 feet per second based on Manning's formula using an "n" value of 0.013. (Ten States Standards, Section 33.41)

Sewers shall be laid with straight alignment between manholes. Construction shall be by the use of an internal to the pipe, laser beam system. Prior to final acceptance, ALL sewers shall be cleaned and televised and the videos turned over to the City for review.

When sewers of different size join one another, the invert of the larger sewer should be lowered sufficiently, but not less than 0.10 inches to maintain the same energy gradient.

b. MATERIALS

All materials shall be free from defects impairing strength and durability and be of the best commercial quality for the purpose specified. It shall have structural properties sufficient to safely sustain or withstand strains and stresses to which it is normally subjected and be true to detail.

1) Polyvinyl Chloride Pipe (PVC)

PVC gravity sewer pipe and fittings shall meet or exceed ASTM-D3034. Pipe lengths shall not exceed twenty (20') feet and shall be push-on gasket joints. All pipe shall meet the following minimum wall thickness:

Diameter:	4"	6"	8"	10"	12"	15"
Wall Thickness	.124"	.180"	.240"	.300"	.360"	.437"

All pipes shall have a maximum SDR ratio of 35 and a minimum pipe stiffness (F/Y) of 46 at five (5%) percent deflection when tested in accordance with ASTM. All pipe and fittings shall be joined by means of a bell and spigot joint using a rubber ring gasket. The pipe and fittings shall come to the job site with the gasket securely locked into each bell. The bell shall consist of an integral wall section of the pipe. All joints shall be capable of withstanding the testing requirements described further in this manual.

In every instance where pipe enters or leaves a manhole, a fitting shall be provided which will accommodate expansion and contraction; release strain that may be caused by differential settlement between the pipe and structure; and provide a water tight seal between the pipe and structure.

Each joint of pipe shall be clearly marked with the following information at intervals of no more than five (5') feet:

- Manufacturer's name and trademark
- Normal pipe size
- ASTM specification
- NSF approval stamp

2) Polyvinyl Chloride Pipe (PVC): PVC pressure piping (force mains). PVC pressure pipe shall have a bell-type joint designed for conveying liquid products under pressure. Ring-type neoprene gasket shall be provided in recesses in the bells to make the joints watertight for all slip joint piping. Only where noted on the plans shall solvent weld flanged connections be allowed. All fittings shall be of the same joint design as recommended by the manufacturer. PVC pipe shall meet or exceed the minimum requirements of AWWA C-900, SDR 25. PVC pipe 3" or less shall be Class 200, SDR 21. All sewer force main piping shall be GREEN in color and marked "SEWER".

All fittings for PVC pressure pipe shall be mechanical joint ductile iron as described below.

3) Ductile Iron Pipe (DIP): Ductile iron pipe shall meet the requirements of ANSI A21.51, including Addenda A21.51a. Pipe dimensions shall conform to Federal Specification WW-P-421, Class 150. Each pipe shall be marked on the outside of the barrel to readily identify it from Cast Iron. Metal thickness shall conform to ANSI A21.51, Table 51.1 for 2½-5 feet of cover.

Mechanical Joints: conform to ANSI A21.11, Rubber Gasket Joints for Cast Iron Pressure Pipe and Fittings.

Push-On Joints: conform to ANSI A21.11, Rubber Gasket Joints for Cast Iron Pressure Pipe and Fittings, single gasket push on type.

Flanged Joints: conform to ANSI B16.1, Cast Iron Pipe Flanges and Flanged Fittings, 125 pounds. Screwed on flanges, faced and drilled to ANSI Class 125 pound template. The flanged joints shall be assembled by threading plain end pipe and screwing on long hub flanges. The connection shall then be power tightened and refaced across both face of both ends. Provide 1/16" ring gaskets meeting ASTM D1330-66, Sheet

Rubber Gaskets, Grade 1, Table 1. Connections shall be made with machine bolts and hexagonal nuts.

Fittings: Fittings shall meet ANSI A21.10, Cast Iron Fittings, 2" – 48" for Water and Other Liquids. Minimum pressure rating shall be equivalent to that of the pipe specified.

Coatings: All ductile iron pipe and fittings that will convey wastewater or other non-potable water fluids, shall be lined with *PROTECTO 401 CERAMIC EPOXY LININGS* or *H² SEWER SAFE* and the exterior, below grade, coated with bituminous material in accordance with ANSI A21.6. The exterior above grade shall receive a coating of rust inhibitor primer compatible with the finish paint schedule. All nuts, bolts, studs and other uncoated parts of joints for underground installation shall be coated with asphalt or coal-tar epoxy prior to backfilling.

4) Tracer Wire: A 12 ga. insulated, copper tracer wire shall be installed along the routes of ALL force mains. The wire shall be installed no less than 8" or no more than 12" above the pipe. All joints shall be water tight. Water tight splice kits shall be 3M ID No. 80-6105-9435-2 DBR or approved equal. The wire shall terminate at each end so it may be accessed with a device for future locates.

5) Gate Valves: All valves shall meet the requirements listed in Section B.5.d

6) Air Release and Vacuum Valves: The air release and vacuum valve shall be furnished where indicated on the plans. The valve shall be specifically design for use with sewer force mains and shall be ARI Model D-025P-2. The valve shall have a stainless steel shut off ball valve and a port for back flushing as may be necessary to keep the valve clear of debris and other foreign matter. All valves shall be installed in a fiberglass manhole or suitable and accessible structure appropriate for the location of installation.

7) Manholes: Unless otherwise shown on the drawings, all manholes receiving pipes 12" and less, shall have an inside diameter of four (4') feet. All manholes receiving pipes greater than 12", shall have an inside diameter of five (5') feet. All manholes shall have an eccentric top cone section that narrows to two (2') feet at the cover. Manholes shall be installed at all change in alignment, grade, pipe diameter, the upstream end of sewers and at the junction of 2 or more sewers. Manholes spacing shall not exceed four hundred (400') feet. Sewer sloping in opposite directions shall not use a single manhole as a common terminus.

All manholes shall be precast concrete construction meeting ASTM C478, latest edition, except as modified herein. The concrete used shall be Type II or approved equal with a 28 day strength of 4000 psi. The walls shall have a minimum thickness of five (5") inches.

Flat tops may be used on shorter manholes (5' or less) where a standard cone section will not fit or as may be pre-approved. All flat tops shall be designed for H-20 loading and in no case be reinforced with less than No. 6 bars at six (6") inches, both ways.

The bottom section shall be of monolithic design and a minimum thickness of six (6") inches.

The joints between the sections shall be tongue and groove and shall be sealed with round or other flexible type natural rubber joint rings. In addition to the rubber ring gaskets, the interior and exterior voids at each joint shall be sealed with *RAM-NEK* flexible plastic gasket material as manufactured by K.T. Snyder Company. The material shall be installed in strict accordance with the manufacturer's recommendations.

All manholes greater than four (4') feet in depth will be furnished with steps. The step shall be plastic coated with a non-slip foot surface. Steps shall be placed no more than 18" apart.

All manhole frames and covers shall be *Vulcan Foundry No. VM-37; Neenah Foundry No. R-1600 series; or equivalent*. All covers shall be marked "SEWER".

All manholes shall have approved water tight seals at all pipe openings in order to prevent groundwater from entering.

All manhole invert channels shall be smooth and accurately shaped to a semi circular bottom conforming to the connecting sewer section. Invert channels and manhole bottoms shall be shaped and smoothed with one to two (1:2) cement/sand mortar mix. Side slopes shall be constructed as to not allow water to stand or pool. Changes in size and grade shall be made gradually and evenly.

All manholes interiors and exteriors (including air bubbles and form imperfections) in standard sewer construction conditions shall be coated with a minimum of 15 mils dry film thickness of *Pro Standard (Pro Tech Coatings)* or approved bituminous coating. In the case of precast manholes, the coatings shall be applied at the plant and shall be completely dried and cured prior to delivery.

All new manholes that will receive a force main connection shall be constructed using fiberglass. All existing manholes that will receive a force main connection shall be coated on the interior using *Strong Seal, Sewer Coat or an approved equal*. All new manholes that will receive a force main connection will be five (5') foot interior diameter. The force main drop pipe that is located on the interior of the manhole shall be of stainless steel construction and shall extend outside the manhole no less than three (3') feet. The pipe shall enter the manhole; turn 90° down the wall and 45° towards the flow line of the sewer pipe. The location of the 45° bend shall be positioned close to the flow line to prevent the least amount of splash as possible. The drop pipe shall be strapped or anchored to the wall of the manhole using stainless steel fittings and fasteners.

- 8) Vacuum Sewers: Vacuum sewer collection systems will be evaluated and approved on a case-by-case basis. All vacuum sewers will comply with FDEP and manufactures standards for such systems.

4. SANITARY SEWER LIFT STATIONS – GENERAL DESIGN

Due to the substantial operational and maintenance expense of sanitary sewer lift stations, the use of lift station in the design of sewage collection systems shall be minimized to the greatest extent possible. Lift stations may be used only when the upstream gravity collection system cannot be physically connected to the existing system in a code compliant and practicable manner. A pre-design meeting with the Public Works Director or his designee shall be completed prior to the start of design in order to determine if the project is a candidate for City operation and maintenance.

The installation shall comply with all local, state and federal laws and ordinance applicable to electrical installation and with the regulations of the latest edition of the published National Electrical Code where such regulations do not conflict with those laws and ordinances. The contractor shall obtain all permits, and after the work is completed, shall furnish the City a Certificate of Final Inspection and Approval from the applicable local inspection departments.

Construction drawings submitted to the City for review shall be accompanied by three (3) sets of design calculations. The design shall be in accordance with the Florida Department of Environmental Protection (FDEP), Chapter 62-604 and the Ten States Standards (TSS) and shall specifically incorporate the following features:

- a. The lift Station shall be located in areas not subject to flooding. The lift station top elevation shall be above the 100 year flood elevation as designated by FEMA Flood Maps.
- b. Design shall prevent the introduction of stormwater runoff in accordance with TSS 41.1.

- c. Each lift station site shall have a minimum size of 25' x 25' or of a size to include the location of all equipment and structures, including but not limited to wet well, valve box(s), generator and control panel(s) plus required separation between all components.
- d. Each site shall have a 12' wide, "all-weather" access drive located to allow easy access for future pump removal or maintenance. The drive shall be rated for supporting H-20 loadings. Parcels not fronting a public right-of-way shall include a dedicated access easement of no less than 20' wide with adequate provisions for turnaround equipment. Additionally, a suitable gate for access shall be provided.
- e. The lift station size shall be no less than six (6') feet in diameter and the depth shall be as needed for the project. The minimum liquid level in the wet well shall be in accordance with the pump manufacturer's requirement or a minimum of 2 ft.. This will set the *pump-off* elevation. The minimum control volume shall be set to ensure that minimum cycle time exceeds the pump manufacturer's requirements or a 10 minute minimum. This will set the *lead pump on* elevation. The space between the *lead pump on* and the *lag pump on* shall be a minimum of 12". This will set the *lag pump on* elevation. The *high level alarm* shall be set not less than 12" above the *lag pump on* elevation. The lowest invert elevation shall be set such that a minimum of 30 minute emergency storage volume is provided between the high level alarm and the lowest influent invert.
- f. The wet well shall be fiberglass, manufactured in accordance with ASTM D3753. The discharge piping through the top shall incorporate link seal devices and shall be sized to allow the passage of the pipe flanges. The gate valves and check valves shall meet the requirements detailed in Section B.5.d. The top of the wet well shall be fitted with aluminum hatch cover sized to allow easy access for installation and removal of the pumps. A pump guide rail system shall be included. The rails shall be no less than 2", sch. 40, 316 stainless steel pipes. For wet wells deeper than 20 ft. provide for intermediate guide rail support.
- g. The design shall incorporate a riser and quick coupling device and valves to allow a portable pump to be connected to the force main discharge as shown on the details.
- h. The electrical equipment shall be protected from lightning and transient voltage surges. As a minimum, stations shall be equipped with lightning arresters, surge capacitors, T.V.S.S. or other similar protective devices.
- i. Stations shall be located to minimize adverse effects resulting from odors, noise and lighting. Any station that is thought to produce odors may be required to add such devices that will reduce or eliminate odors.
- j. All stations and support equipment will be enclosed inside a 6' chain link fence as shown in the details.
- k. Stations shall be designed to resist flotation in totally saturated soils.

- l. Lift station and controls shall meet the requirements shown in the following City's Standard Detail Drawings; Dwg. No. C-4 dated 9/24/2007; Dwg No. C-5 dated 9/24/2007 and Dwg. No. C-6 dated 9/24/2007**
- m. All stations will be designed for two (2) submersible pumps operation. Minimum pumping capacity shall be 100 gpm and the minimum force main size shall be four (4") inch. For designs that will require more than two (2) pumps or complex controls, the City shall be consulted prior to start of design.
- n. All stations shall have float switch level controls, stainless steel discharge piping and valves as shown on the standard details.
- o. Lift stations that provide service to more than **20** homes or **20** ERU's shall be designed and constructed with a site mounted stand-by generator. All lift stations serving less than the above shall be fitted with a generator receptacle and manual transfer switch approved by the City.
- p. Stand-by generators shall conform to the following:
- 1) Generators shall be Generac or City approved equal.
 - 2) Where possible, all generators shall be natural gas fueled. Where natural gas is not available and with the City's approval, provide for diesel fuel operations.
 - 3) All diesel fuel tanks shall be sized for 72 hours of continuous, full load operation, unless approved by the City. Tanks shall be double wall, welded painted steel, with fuel gauge, overfill protection, Stage II vapor recovery and meet or exceed all FDEP and EPA requirements. The bottom shall have channel steel construction to prevent the entire bottom from coming in full contact with the foundation. Paint shall be marine grade for wet environments.
 - 4) All units shall be for automatic start-up operation and come with automatic transfer switches (ATS). The ATS shall be NEMA 3R, ASCO or City approved equal.
 - 5) All units shall operate at no more than 1800 rpm. No gear reduction will be allowed unless approved by the City.
 - 6) All units shall be equipped with an engine jacket heater and battery charger.
 - 7) All units shall meet ANSI/NEMA MG 1, three (3) phase, reconnectable brushless synchronous generator with brushless exciter. Insulation shall meet ANSI/NEMA MG 1, Class F standards.
 - 8) All enclosures shall be 14 gauge, painted steel construction and sound attenuated to a maximum level of 72 db. The enclosure shall not allow wind driven rain to enter and cause damage while operating. The enclosure shall be designed to 110 mph wind speed. All silencers shall be mounted inside the enclosure.
 - 9) All units shall be pre-wired to a terminal strip for remote alarm monitoring by SCADA.
 - 10) Provide a full five (5) year warranty for the engine and alternator against wear and defects from date of start-up and acceptance by the City.

- 11) Provide service and maintenance of units for a two (2) year period from date of start-up and acceptance by the City. Items included in this service will include oil, filters or other items that may fall under service.
- q. At the completion of the work, provide to the design engineer or City, three (3) copies of written operation and maintenance manuals, software, copies of any PLC Logic incorporated into the station controls and certified pump curves. The design engineer shall then forward to the Public Works Director, all the data and his certification (including FDEP).
- r. Submersible Pumps:
- 1) Each pump shall be capable of handling raw unscreened sewage or other similar solids-laden fluids without clogging.
 - 2) The impeller shall be made of erosion-resistant cast iron and shall be of the non-clogging, dynamically balanced type capable of passing a minimum of a three (3") inch solid.
 - 3) Each impeller and volute shall have wear rings, minimum of 400bhn hardness, installed, except where vortex impeller design is used.
 - 4) The pump discharge connection shall be a minimum of four (4") inch in diameter. The volute shall be made of Class 35B or higher, gray cast iron, with smooth internal surfaces and all passageways free of any obstructions. The volute shall also have a centerline discharge, unless otherwise approved by the City.
 - 5) Each motor shall be equipped with a tandem, double mechanical seal. Both the lower stationary seals face and rotating seal face shall be made of silicon carbide, while the upper stationary seal shall be sealed with an o-ring. The positively driven faces shall be held in place by individual independent springs. The seals shall require neither routine maintenance nor adjustment and shall not be damaged when the pump is allowed to run dry.
 - 6) Moisture sensing probes shall be used for detecting the presence of water in the lower motor chamber and provide a warning and shut down of the pump, by closing an electrical circuit and energizing a warning light on the face of the control panel. All relays used for this function shall be intrinsically safe.
 - 7) The pump shaft shall be made of AISI 430F stainless steel supported by a heavy duty lower row of ball bearing and upper sealed single row ball bearing and bearings suitable for L10 bearing life of 50,000 hours.
 - 8) Each motor shall be a NEMA design B, suitable for continuous duty with moisture resistant class F insulation rated for 155°F. Each motor shall contain a temperature monitor to provide overheating protection and shall shut the pump down should any of the monitors detect a high temperature. The monitors shall automatically reset once the starter temperature returns to normal.
 - 9) The motors shall be FM Approved for Class 1, Division 1, Group C and D Explosion Proof, Hazardous locations as defined by the National Electric Code.

- 10) Minimum length of power cables shall be sufficient to allow for connection of the pump to the control panel and have at least three (3') feet extra of slack inside the wet well.
- 11) All cable entry designs shall have a potted design to preclude of entry of moisture should the cable be damaged.
- 12) Lifting bail shall be supplied on each pump, sufficient to carry the load of the motor, pump, cable and pull-up attachment.
- 13) Pumps shall be manufactured by one of the following:
 - KSB
 - Fairbanks-Morse
 - Hydromatic
 - EMU
- 14) All pumps shall carry a minimum 5 year, 100% written warranty against defects and failure.

B. POTABLE WATER DISTRIBUTION

1. GENERAL

All new potable water distribution systems shall be designed and constructed in strict accordance with FAC Chapter 62-555; Ten States Standards and any other State and Federal rules that may apply. No construction activity shall commence until all appropriate permits have been received from the Florida Department of Environmental Protection (FDEP).

2. DESIGN FLOW

In sizing the distribution system water mains, the required design flow shall be the sum of the required fire flow, plus two-thirds for the required domestic, industrial, commercial and institutional flow as described below.

a. Required Domestic Flow Residential

The required flow for domestic use in residential areas shall be based on not less than an average daily flow rate of 100 gallons per capita per day assuming 3.5 persons per household. The average daily per capita water flow shall be adjusted by a "peaking factor" of four (4).

b. Required Industrial/Commercial/Institutional Flow

The designer shall include appropriate site specific allowances for large quantity water users such as industries, Laundromats, food processing operations, schools, etc. These design allowances shall be subject to review and approval by the City.

c. Fire Flow

Required fire flow in single-family areas shall be a minimum of 1,000 gpm at 20 psi residual pressure. This may be reduced to 750 gpm if all residential structures are spaced a minimum of 30 ft. apart. Fire Flow requirements may be modified by the Fire Chief in certain single-family

dwelling areas based upon the building areas of structures, fire loading, degree of physical separation between buildings and other factors which contribute to rapid fire spread or excessive fire involvement or as permitted by the Florida Fire prevention Code. Required fire flow for industrial, commercial and institutional areas shall be determined in accordance with the current edition of the Florida Fire Prevention Code.

3. DISTRIBUTION SYSTEM CONNECTIONS TO SUBDIVISIONS

Any proposed subdivision to be supplied by the City water system and having a design flow requirement as determined herein of not more than 1500 gpm, may have a single connection to the distribution system, provided that the design flow requirements can be met with such connection. Any proposed subdivision having a design flow of 1,500 gpm, shall have a minimum of two (2) connections to the distribution system.

4. DISTRIBUTION MAIN LAYOUT AND SIZING

Distribution mains shall be of sufficient size to furnish the required flow at the pressures and velocities provided herein. All mains shall be installed only in dedicated streets, alleys, public rights-of ways or utility easements. All mains locations and sizes shall be as approved by the City of Milton. If the installation of a "dead end" main cannot be avoided, it's dead end length shall not exceed 1,000 ft. unless approved by the City. When a fire hydrant is installed on a dead end main exceeding 300 ft., the hydrant shall be supplied by main of not less than eight (8") inches in diameter. When a hydrant is installed on a dead end main exceeding 600 ft., the hydrant shall be supplied by a main of not less than ten (10") inches in diameter. All dead end mains less than six (6") inches shall be looped. Dead end mains six (6") inches or larger shall be provided with a fire hydrant at the end of the main. See Figure II-18 for general details.

a. Required Pressure

The minimum water pressure in the distribution system shall not be less than 30 psi with no fire hydrants in use. The minimum water pressure in the system with the hydrant in use shall not be less than 20 psi (as measured at ground level). When the water main pressure exceeds 90 psi, an approved individual pressure reducing regulator valve (PRV) shall be installed on the customer side of the meter. If, based on the number of meters to be effected, the City may require an in line PRV to service the development.

b. Minimum Main Size

Assuming that all flows and pressures are met, the minimum distribution water main size shall be three (3") inches and six (6") inches in single family residential areas and eight (8") inches in all other areas. No two (2") inch or four (4") inch mains are allowed. No more than six (6) homes will be allowed on a three (3") inch main. All water service tubing will be one (1") inch. All water service brass will be ¾" and each lot or connection will have no more than one (1) meter per service.

c. Standard Sizes

Standard water main sizes shall be 3", 6", 8", 10", 12", 18" and 24".

d. Velocity

Velocities of water for non-fire flow conditions within the distribution system, shall NOT exceed six (6) feet per second.

e. Cover

1) A minimum cover of thirty (30") inches must be provided unless special conditions exist. The special conditions may be approved by the City on a case-by-case basis.

2) At all road crossing, except FDOT, the minimum separation between the bottom of the base and the top of the casing shall be twenty-four (24") inches.

3) All stream crossings shall have the minimum cover listed in e.1 above or as may be required to prevent "fracking out" in the stream bed.

f. Crossings

Major road crossings shall be encased in a steel casing. All casings shall extend a minimum of four (4') feet beyond the pavement edge. Additional requirements of the responsible regulatory agency shall also be met.

5. POTABLE WATER PIPE AND FITTINGS

All materials shall be free from defects impairing strength and durability and be of the best commercial quality for the purpose specified. It shall have the structural properties sufficient to safety sustain or withstand strains and stresses to which it is normally subjected and be true to detail.

a. Polyvinyl Chloride (PVC) Pressure Pipe

PVC pressure piping (water mains) shall be a bell-type joint designed for conveying water under pressure. Ring-type neoprene gasket shall be provided in recesses in the bells to make the joints watertight for all slip joint piping. All fittings shall be of the same joint design as recommended by the manufacturer. PVC pipe shall meet or exceed the minimum requirements of AWWA C-900, SDR 25, unless as may be noted on the plans. All pipe must be certified a suitable for potable water by the National Sanitation Foundation (NSF) and be clearly marked as: NSF-PW. Each length of pipe shall also be clearly marked with the following information at intervals of five (5') feet or less:

- Nominal pipe size and OD base
- Material code designation
- Dimension ratio number (SDR or DR)
- AWWA pressure class and standard designation number
- Manufactures name or trademark
- NSF approval seal

All fittings for PVC water mains shall be mechanical joint ductile iron, unless as may be noted on the plans. All mechanical joints shall be restrained using a "Mega-Lug" or similar approved type of device.

b. Ductile Iron Pipe (DIP)

Ductile iron pipe shall meet the requirements of ANSI A21.51, including Addenda A21.51a. Pipe dimensions shall conform to Federal Specification WW-P-421, Class 150. Each pipe shall be marked on the outside of the barrel to readily identify it from Cast Iron. Metal thickness shall conform to ANSI A21.51, Table 51.1 for 2½-5 feet of cover.

- 1) Mechanical Joints: conform to ANSI A21.11, Rubber Gasket Joints for Cast Iron Pressure Pipe and Fittings.
- 2) Push-On Joints: conform to ANSI A21.11, Rubber Gasket Joints for Iron Pressure Pipe and Fittings, single gasket push on type.
- 3) Flanged Joints: conform to ANSI B16.1, Cast Iron Pipe Flanges and Flanged Fittings, 125 pounds. Screwed on flanges, faced and drilled to ANSI Class 125 pound template. The flanged joints shall be assembled by threading plain end pipe and screwing on long hub flanges. The connection shall then be power tightened and refaced across both face of both ends. Provide 1/16" ring gaskets meeting ASTM D1330-66, Sheet Rubber Gaskets, Grade 1, Table 1. Connections shall be made with machine bolts and hexagonal nuts.
- 4) Fittings: Fittings shall meet ANSI A21.11, Cast Iron Fittings, 2"- 48" for Water and Other Liquids. Minimum pressure rating shall be 350 psi.

c. Tracer Wire: A 12 ga. insulated, copper tracer wire shall be install along the routes of ALL water mains. The wire shall be installed no less than 8" or no more than 12" above the pipe. All joints shall be water tight. Water tight splice kits shall be 3M ID No. 80-6105-9435-2 DBR or approved equal. The wire shall terminate at each end so it may be accessed with a device for future locates.

d. Valves:

- 1) Gate Valves: (2" & larger) Valves shall be of the resilient seated wedge type, epoxy coated, meeting AWWA C550 cast-iron body design. They shall comply with the AWWA Gate Valve Standard C509 or latest revision. Valves shall be rated for zero leakage at 200 psi and have a 400 psi hydrostatic test structural soundness. All cast iron shall conform to ASTM A-126 Class B. Castings shall be clean and sound without defects that will impair their service. No plugging or welding of

such defects will be allowed. Stems shall be manganese bronze having a minimum yield of 20,000 psi. Bolts shall be electro-zinc plated steel with hex heads and hex nuts in accordance with ASTM A-307.

- 2) Gate Valves: (under 2") Valves two (2") inches and under shall be bronze body, threaded ends, non-rising stem, solid wedge disc and shall be American Model 3FG or approved equal.
 - 3) Check Valves: (over 3") Valves over three (3") inches shall be iron body, bronze mounted, horizontal swing check with mechanical joints or flanged ends (as may be called for). All working parts shall be spring-loaded to prevent slamming. The check valve shall be M&H Fig. 259-02; American Darling 50 Line or approved equal.
 - 4) Check Valve: (under 3") Valves under three (3") inches shall screwed-end, bronze body, silent type as manufactured by Crane Co., No. 34 or approved equal.
 - 5) Air Release & Vacuum Valves: The combination air release and vacuum valve shall be furnished with both a large and small orifice. The valve shall automatically function to release to atmosphere both large and small amounts of air that accumulate in the pipeline. Once air has been exhausted, both the large and small valve shall seat tightly to prevent water leakage. The valve shall also function to admit air into the line under emergency conditions, when the line is being drained. The valve body and cover shall be of semi-steel, floats of stainless steel, levers of bronze and resilient seats. The Valve shall be G-A Industries Inc., Type I-AV or approved equal.
 - 6) Valve Boxes: All valves shall be provided with cast iron valve boxes. The top section shall be adjustable for finish grade. Each box shall be fitted with a precast concrete "donut" style ring for protection. All boxes shall have the type of utility serviced (ie; WATER; SEWER; GAS) provided in each cover.
- e. Fire Hydrants:
- 1) All fire hydrants shall be standard 3-way, 5¼" barrel and two 2 - 2¼" hose connections. The hydrant shall be designed for 250 psi working pressure. Hydrants shall conform to the requirements of AWWA C-502. Hydrants shall have mechanical joint inlets and designed for three (3') foot bury. Additionally, all hydrants shall be traffic or breakaway style, dry barrel type. Hydrants shall be Mueller, Centurion 250; M&H Style 129; or approved equal. The hydrant shall be painted RED in color.

- 2) Maximum separation between fire hydrants shall be 1,000 feet. In no case shall the farthest point of corner of any new structure be permitted to be located more than 500 feet from the nearest fire hydrant capable of delivering the required fire flow. The distance shall be measured as the hose is laid.
 - 3) All fire hydrants shall have a six (6") inch gate valve installed no more than two (2') feet in front of the hydrant. The hydrant shall also be set on one (1') foot of pea gravel under, around and up the side of each unit. The supply line and all fittings, including the main line tee, shall be fully restrained using "Mega-Lug" style mechanical joints. No rods or cables may be used.
 - 4) All fire hydrants, unless otherwise agreed to, will be owned and maintained by the City of Milton. If no public right-of-way is available, a ten (10') foot wide utility easement will be required.
- f. Steel Casing: All casing used for borings or similar crossings, shall be wrought steel, schedule 40, with minimum yield strength of 35,000 psi. The casing shall be installed by either jack/bore or directional drill method. Casing spacers and end seals shall be used in all installations. Additionally, as may be shown on the plans, casing vents may be required.
- g. Pipeline/Valve Markers: Where indicated pipeline/valve markers may be required. All markers shall be Rhino Tri-View as manufactured by Rhino Marking & Protection System. Markers shall be one of the following colors. WATER – Blue; SEWER – Green; GAS – Yellow. Consult with the City for actual placement prior to installation. Prior to ordering, the contractor shall request from the City, the current data to print on each marker label.
- h. Water Service Materials: When required, the following materials will be used for the item listed.
- 1) Service Clamps: Ford Model FS202.
 - 2) Corporation Stop: Ford Model F-1000, w/compression connection.
 - 3) Service Tubing: Polybutylene meeting AWWA C-902, SDR 11, NSF approved. All service tubing under paved surfaces shall be encased in PVC or PE tubing.
 - 4) Curb Stop: Ford Model BH 41-233, w/ compression connection.
 - 5) Meter Boxes: Unless otherwise directed, will be supplied by the City
 - 6) Meter:
 - Up to two (2") inch: supplied by the City.
 - Above 2": supplied by the contractor. Meter shall be
 Commercial- Sensus OMNI Compound (C2)
 Industrial- Sensus OMNI Turbo (T2)

7) Backflow Preventer:

- Up to two (2") inch: supplied by the City.
- Above two (2") inch: supplied by the contractor. Backflow Preventer (BFP) shall meet all State and local requirements for either low or high hazard as defined by the Cross-Connection Control Program.
- All BFP's will be the responsibility of the customer to maintain and test on an annual basis.

C. NATURAL GAS PIPE LINES

1. GENERAL

- a. The work covered by this section shall consist of furnishing and installing natural gas pipe lines, including fittings, casings, testing and appurtenant items as called for on the plans and as specified herein.
- b. The contractor or sub-contractor must have a minimum of five (5) years experience installing gas pipe lines of similar size, length and complexity. Further, they must be OQ certified to perform each task in accordance with Federal and State laws, rules and regulations.
- c. All work shall be performed in accordance with Federal Title 49 CRF, Part 192.
- d. All gas lines installed will be considered to be in a Class 3 location, as defined by the Federal Safety Standards. Further, all work shall be in conformity with the applicable provisions of the Minimum Federal Safety Standards for this Class location.
- e. All gas lines installed shall have 36" minimum cover or that shown on the plans. All gas lines installed under ditches, streams or road crossings shall have 48" minimum cover or that shown on the plans.
- f. Where the gas line crosses other pipelines, drains, sewers, conduits, utilities or other underground structures, the trench at such points shall be excavated a sufficient depth to permit the proposed gas pipeline to be laid underneath such structures with a minimum clearance of twelve (12") inches or at a depth required by the City if greater than twelve (12") inches.
- g. PRIOR TO CONSTRUCTION, the Contractor or sub-contractor, must submit for the City's files two (2) copies of the following. 1) Their current drug and alcohol testing program which satisfies the appropriate Federal, State or other regulations for such procedures. 2) Their certificates for making heat fusion joints. Additionally, the Contractor will demonstrate to the City making heat fusion joints.

2. PRODUCT

- a. Polyethylene Pipe and Fittings

- 1) Polyethylene pipe (PE) and fittings shall conform to the applicable requirements of ASTM D2513, Thermoplastic Gas Pressure Pipe, Tubing and Fittings, latest edition. The polyethylene resin shall be in accordance with ASTM D1248, Standard Specification for Polyethylene Plastic Molding and Extrusion Materials, Class B, Grade P24, SDR 11. Cell Classification shall be in accordance with ASTM D3350, PE 234363E. Pipe shall be Poly Pipe 3810, PE 2406, MDPE as manufactured by CSR PolyPipe.
- 2) Storage, handling, installation and fusion shall be in accordance with the manufactures recommendations.
- 3) A 12 ga., insulated solid copper wire (locator wire) shall be installed along the entire length of the pipe line and service lines. The wire shall be installed at a depth of no less than 8" and no more than 12" above the pipe. The wire shall extend to the ground level at all valves, services or other locations designated by the City. Water tight splice kits shall be 3M ID No. 80-6105-9435-2 DBR or approve equal.
- 4) A 3' wide locator tape shall also be installed at a depth of no greater than 12" below the finished grade. The tape shall be YELLOW with the words "CAUTION – GAS LINE BURIED BELOW". The tape shall be Magnatec 31141 (3" X 1000' roll) or approved equal.

b. Valves

- 1) Valves shall be installed where shown on the plans. The location is only approximate and shall be confirmed by the City prior to installation.
- 2) All polyethylene vales shall be Polytec ball valves (PE 2406) as manufactured by Kerotest Corp. or approved equal. All in ground valves shall have cast iron valve boxes as shown in section B.5.d.e above.

3. EXECUTION

a. Stringing, Bending and Welding

Pipe shall be handled, welded and lowered in a workmanlike manner in accordance with best pipeline construction methods. Pipe shall be handled and strung to prevent damage to the pipe. Immediately prior to lining-up the pipe, each length of pipe shall be carefully examined for defects and swabbed clean with a steel brush pulled through the pipe. Bends shall be made of the same materials as the pipe. For steel pipe lines, the pipe shall be aligned and welded in strict conformance to the applicable provisions of Title 49 CRF, Part 192.283 using approved procedures by qualified welders. In accordance with Title 49 CFR, Part 192.285, all persons making heat fusion joints must be qualified to make the joints in accordance with Approved Qualified Fusion Procedures. Records of qualified personnel shall be maintained.

b. Laying of Pipe

After stringing and welding of the pipe, open ends will be left at intervals as directed by the City. All open ends, as well as all other exposed ends where work has been discontinued for any reason, shall be temporarily capped to prevent entry of dirt, water and other foreign debris. Prior to lowering any pipe into the trench, the bottom of the ditch shall be cleared of all debris or other items that could prevent from providing a firm continuous support for the pipe. Backfilling of trenches shall be in accordance with the applicable provisions of these specifications.

c. Blowing, Purging and Testing

After all open ends have been connected, but prior to testing, a standard cleaning "pig" shall be blown through the line using compressed air until the line has been cleaned to the satisfaction of the City of all rust scale, dirt or any other foreign matter. After cleaning, the Contractor shall air test all pipelines to 100 PSIG for polyethylene pipes and XXX PSIG for all steel pipeline. All tests shall be for a minimum of eight (8) hours with NO pressure drop. An approved pressure recording device shall be used. The testing shall be in the presence of City personnel and copies will be given to the City for their records. Any leak(s) detected shall be repaired at the Contractors expense and the tests repeated until all leaks are eliminated and a passing test is produced.

d. Record Drawings

Upon completion of the work, the Contractor will furnish to the City a complete and accurate record drawing of the work. The drawing shall show additions and revisions using red pencil or ink. The drawings shall also show locations to all valves, casings, service lines, regulator stations, pressure recorders, mains and any other pertinent information. Where possible, all gas lines shall be dimensioned to the centerline of any street. If the street centerline is not available, the Contractor shall ask the City on the method to be used. All valves shall be referenced by a 3-point method using street centerlines, power poles or fire hydrants as the basis points.

D. INSTALLATION OF SANITARY SEWER AND POTABLE WATER

This section covers installation of gravity sewer, force mains and potable water lines.

1. GENERAL

All pipe, fittings and valves shall be carefully handled at all times to prevent damage to the pipe and other items. At times when pipe installation is not in progress, the open ends of the pipe shall be closed by approved means and shall remain closed until construction is resumed. All joints shall be wiped free of all dirt, sand and foreign materials and the pipe shall be examined for defects prior to installation. Deviations from the piping location, line and grade indicated on the approved plans shall not be made without the prior approval of the Public Works Director or his designee.

2. PIPE LAYING PROCEDURES

a. Gravity Flow Piping

Gravity flow piping shall be installed to the line and grade indicated on the approved construction plans. Before installing the pipe, the ditch bottom shall be graded to insure that the pipe will have uniform bearing for its entire length. Bell holes shall be dug for bell placement. Jointing of the pipes shall be in accordance with the recommendations of the pipe manufacturer.

Installation of the pipe shall proceed in an upstream direction, unless otherwise approved, with the bells facing the direction of lying. All piping will be inspected for straightness, both horizontally and vertically. All gravity piping will be cleaned and televised upon completion. Prior to acceptance, all recorded videos will be reviewed before being accepted by the City.

b. Pressure Piping

Pressure piping shall be installed in strict accordance with the manufacturer's instructions. Before installing the pipe, the ditch bottom shall be graded to insure that the pipe will have uniform bearing for its entire length. Bell holes shall be dug for bell placement.

Suitable and approved thrust blocks or joint restrains shall be installed on all lines (except for flanged piping), at all tees, plugs, caps and any bends. All mechanical joint fittings shall use a "mega-lug" style following ring/gland. All fittings that use concrete as the thrust blocking, shall be separated using 30# builders felt or 8 mil plastic sheeting. All concrete shall be a minimum of 2000 psi compression strength.

The degree of joint deflection or bending shall be no greater than as recommended by the manufacturer.

The minimum cover for all piping shall be thirty (30") inches, unless otherwise noted. Minimum cover for all street or ditch bottom crossings shall be thirty-six (36") inches, unless otherwise noted. Minimum cover or separation between existing utilities shall be that required by the permitting agencies.

c. Sub-Surface Explorations

Whenever necessary to determine the location of existing underground utilities and in combination with Sunshine One-Call, the contractor shall examine all available records and shall make additional explorations and excavations for such purpose. All locations are to be considered to be approximate only and the contractor is responsible for locating and protecting all existing utilities whether or not shown on the drawings.

d. Protecting Underground and Surface Structures

The contractor will temporary support, adequately protect and maintain all underground and surface utility structures, drains, sewer and other obstructions encountered in the course of the work.

e. Trench Water and Dewatering

At all times when pipe laying is not in progress, the pipe opening shall be protected as to allow no trench water to enter the pipe. If required, the contractor shall provide all necessary pumps to dewater the site properly. The contractor shall provide all labor and materials including sheeting, boxes, bulkheads, drains etc., required to keep the excavation dewatered during construction so that the construction may be performed under dry conditions. Any discharge from pumps must be led to natural drainage channels or to drains. Pump discharge quality and method shall conform to FDEP Standards. Unless specifically called out, any cost associated with the dewatering shall be included with the line item bid for each item(s).

f. Unsuitable Conditions

No pipe(s) or structure(s) shall be placed in water or unsuitable soils conditions. Unsuitable soils, as to be determined by the Engineer of Record or Public Works Director (whichever appropriate), shall be removed and replaced with an approved material(s).

g. Construction Equipment

Mechanical equipment shall be used for trenching and excavating. However, in places where the operation of the equipment will cause damage to trees, shrubbery, pavement or other structures, either above or below the surface, hand digging methods shall be employed. When a utility is to be installed along paved streets, only rubber-tired equipment will be allowed to be used. The contractor will be responsible for any damage to streets, lawns or other areas when construction has occurred.

E. TESTING AND INSPECTION OF SANITARY SEWER AND POTABLE WATER

1. GENERAL

During construction and at completion of the work, the **City of Milton** shall be present during **ALL** testing as required in these manual.

In general, tests shall conform to usually accepted testing practices for the specific type and class of test. All data, observations and results will be carefully recorded for the City. Project acceptance may be held contingent on receipt of satisfactory test reports. A minimum of 24 hours notice shall be given prior to performance of any tests specified herein. The test shall be scheduled so that the test can be completed prior to 4 p.m. during normal working days.

2. TESTING OF GRAVITY PIPEWORK

a. Testing

It is imperative that all sewers and manholes be built watertight. Upon completion of all sewers and manholes, each will be low pressure air tested. For gravity sewers, including service lines shall be tested in accordance with ASTM F-1417. Manholes shall be tested in accordance with ASTM C-1244. No hydrostatic testing will be allowed. In addition, as specified in Section 4.3.a. above, the pipe shall be flushed, cleaned and televised prior to final acceptance.

3. HYDROSTATIC TESTING OF PRESSURE PIPE

a. Pressure and Duration During Test

After the pipe has been installed and backfilled as specified, each valved section of pipe, unless otherwise noted, shall be subjected to a hydrostatic pressure test. Testing shall be 150 p.s.i.g. for all potable water mains and 100 p.s.i.g. for all sewer force mains. Tests shall be at least 2 hours after the pressure has stabilized. All tests shall use a recording chart recorder with the location, time, dated and contractor making the test neatly printed on the chart. The chart(s) will be turned over to the City for their records.

b. Procedure

Each section of pipe shall be slowly filled with water and the specified test pressure, as measured at the lowest point of elevation, shall be applied by means of a pump connected to the pipe. The pump, pipe connection, gauges, meter and other necessary apparatus shall be furnished by the contractor. All water used for flushing and testing shall be the responsibility of the contractor.

Before applying the specified test pressure, all air shall be expelled from the pipe. In order to accomplish this, additional taps may be made at various points along the main.

c. Permissible Leakage

All installed mains shall be pressure tested and leakage tested in accordance with the latest edition of AWWA Standard C-900.

Pipe Size	Gals/1000'/24hrs.	Gals/1000'/1hr.
3"	5.76	0.24
4"	7.92	0.33
6"	12.00	0.50
8"	15.84	0.66
10"	19.92	0.83
12"	23.76	0.99

4. CHLORINATION OF POTABLE WATER PIPING

a. Disinfection

All potable water mains shall be disinfected in accordance with AWWA C-601, latest edition, and current FDEP requirements. All chlorinated water shall be disposed of in accordance with the current FDEP requirements. In the process of chlorination, all valves and hydrants shall be opened so as to provide the chlorinated water to come in contact with each item. Upon completion of the chlorination process, the contractor will flush all mains of the heavily chlorinated water prior to sampling for bacteriological testing. Upon notification from the contractor, the City will take test samples and supply to an FDEP approved laboratory for testing. Any cost associated with the testing will be borne by the contractor. At least two (2) sets of samples will be required, taken at intervals acceptable to the FDEP. If any test fails, the City will repeat the testing until approval is obtained.

5. ACCEPTANCE

Prior to the City accepting any water or pressure sewer system for use, the contractor and the Engineer of Record shall have the approval of the FDEP. A copy of the Clearance/Acceptance letter shall be provide to the City for their records along with two (2) sets of paper and one (1) electronic set of As-Built drawings.

SECTION 5 – DRAINAGE

A. GENERAL

The techniques utilized for providing drainage should result in proper stormwater conveyance and treatment for developments and for safe vehicle operation on or off the roadway. Proper drainage of pavement, shoulders, medians and roadside clear zones is important to maintain safe streets and highways.

All components of drainage design and construction shall be in strict accordance with the Land Development Regulations (Section V-6, Stormwater management). The City will not accept for maintenance any road or street or will not approve any development for which adequate provision for drainage is not assured. All stormwater collection and treatment systems shall be in accordance with all FDEP and EPA requirements. Runoff from any new road, street or development shall not cause a violation of the rights of any downstream property owners, nor shall the runoff exceed the capacity of existing downstream structures or result in flood conditions at any point. Finally, no additional excavation or work pertaining to runoff shall be left for the City to perform. During construction, the contractor/owner/permit holder shall insure that all proper stormwater controls are in place and properly maintained so that site erosion is contained. Prior to the acceptance of the stormwater system, all components shall be in proper working order (as designed by the Engineer of Record) and free of debris and silt.

B. DRAINAGE PIPE AND STRUCTURES

Drainage pipes shall be reinforced concrete (RCP) meeting the requirements of the FDOT Standard Specifications. RCP shall be used under all roadway surfaces. Other types of pipe may be used in areas outside the roadway surfaces upon approval of the City Manager or his designee.

1. MATERIALS

a. Concrete

Conform to the requirements in SECTION 1, F.1.

b. Forms

Conform to the requirements in SECTION 1, F.1.

c. Reinforcement

Conform to the requirements in SECTION 1, F.1.

d. Placing, Curing and Finishing

Conform to the requirements of SECTION 1, F.1.

e. Masonry

Bricks for accessories shall be hard common clay brick.

Mortar shall be one part Portland Mortar Mix to three (3) parts masonry sand. Special commercial mortar mixes may be used if approved by the Engineer. All masonry materials shall conform to the latest applicable ASTM specification.

1) Set all masonry units in full beds of mortar, with full joints and strike all joints flush.

2) Masonry reinforcements shall be galvanized Dur-O-Wal or approved equal and shall be installed at every other bed joint.

f. Catch Basin, Drop Inlet, Junction Box, Box Culvert and Headwall Construction

All bases shall be precast into each structure. Alternately, separate concrete bases may be poured on undisturbed dry subgrade to the dimensions shown on the plans.

Based on the depth or size of the structures, cast-iron steps may be required. All cast-iron castings shall be heavy duty traffic rated units with the wording STORM cast into the lid.

All piping entering a structure shall terminate at the interior wall. All pipes shall be grouted to the full wall thickness between the pipe and the structure.

g. Reinforced concrete pipe

RCP shall conform to the requirements of ASTM C-76, Class III. Cement used for the manufacturing of the pipe shall be Type II, conforming to ASTM C-150. All RCP shall have a flexible water tight gasket. All pipes placed within dedicated City right-of-ways shall have each joint warped in filter fabric. The filter fabric shall be of the engineered type used for trench drains and retaining walls.

2. LAYING OF STORM DRAIN PIPING

a. General

Before lowering pipe into tranches, the bottom of the ditch shall be graded so that when the pipe rests in the ditch, it will have bearing for its entire length. After placing the pipe in the ditch, the ends shall be wiped free from all dirt, sand and foreign material and the inside of the pipe shall be cleaned. The joints shall then be made in accordance with the recommendations of the pipe manufacturer. The pipe shall be handled and installed in strict accordance with the manufacturers printed instructions.

b. Direction of Laying

The laying of pipe in finished trenches shall be commenced at the lowest point, with the spigot ends pointing in the direction of the flow. All pipe shall be laid with ends abutting and true to line and grade. They shall be carefully centered so that when laid, they will form a uniform invert in a straight line.

c. Protecting Underground Surface Structures

The contractor will temporary support, adequately protect and maintain all underground and surface utility structures, drains, sewers and other obstructions encountered in the progress of the work.

d. Unsuitable Condition

No pipe(s) or structure(s) shall be placed in water, unsuitable soils conditions, when the trench conditions or weather is unsuitable for work. All discharge structures shall incorporate a scupper or oil skimmer using aluminum and stainless steel hardware. No wood products will be allowed.

TABLE II - 4
RECOMMENDED MINIMUM DESIGN SPEED, MPH

TYPE OF ROADWAY	URBAN *SPEED RESTRICTIONS	
	WITH	WITHOUT
Arterial	35	50
Collector	30	40
Local**	20	30

* Speed restrictions are features of the design which would effectively limit the operating speed, such as:

- A short length or roadway (e.g., a dead-end street).
- Closely spaced stop signs, traffic signals or other control devices.
- Locations that would by nature of the surrounding development or land use, indicate to the driver that lower speeds were necessary.

** Design speeds lower than 30 mph may be used for local, subdivision type roads and streets. Streets with a design speed less than 30 mph shall be posted with appropriate legal speed limit signs.

TABLE II - 5
STOPPING SIGHT DISTANCE AND K VALUES

STOPPING SIGHT DISTANCE

(Based on height of eye of 3.50 feet and height of object 6 inches above road surface)

Design Speed, mph	20	30	40	50	60	65	70
Stopping Site Distance, Feet	125	200	275 to 325	400 To 475	525 To 650	550 To 725	625 To 850

**TABLE II - 6
HORIZONTAL CURVATURE**

MAXIMUM CURVATURE, DEGREES			
Rural (Based on max superelevation of 0.10 feet per foot)		Urban (Based on max superelevation of 0.05 feet per foot)	
Design Speed	Max Degree of Curve	Design Speed	Max Degree of Curve
30	24° 45' (230'Radius)	30	14°
40	13° 15'	35	10°
50	8° 15'	40	7° 30'
60	5° 15'	45	6°
65	4° 15'	50	5°
70	3° 30'		

Rural Interstate			3 Deg. Max (2 Deg. Desirable Maximum)
MINIMUM RADIUS, FEET			
Urban - Lower Speed Streets			
Design Speed	Min Radius With .05 feet per foot superelevation	Min Radius Without superelevation	
15	40	50	
20	75	95	
25	140	180	
30	225	300	

TABLE II - 7
RECOMMENDED MAXIMUM GRADES IN PERCENT

TYPE OF ROADWAY	DESIGN SPEED (MPH)						
	20	30	40	50	60	65	70
Arterial			6	5	4	4	4
Collector			9	8	7	6	5
Local	11	10	9	8	6		
Truck Route*		5	5	4	4		

* Local and collector streets with significant (15% or more) truck traffic.

TABLE II - 8
MAXIMUM CHANGE IN GRADE
(Without using Vertical Curve)

Design Speed (mph)	20	30	40	50	60	65	70
Maximum Change in Grade in Percent	1.20	1.00	0.80	0.60	0.40	0.30	0.20

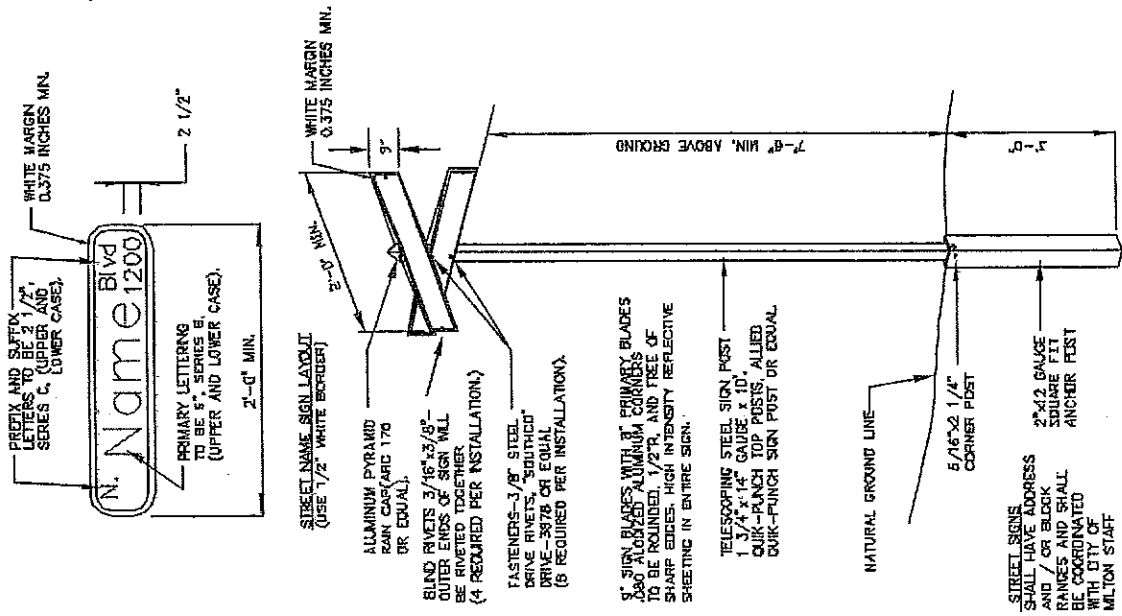
TABLE II - 10
DESIGN LENGTHS OF SPEED CHANGE LANES
FLAT GRADES - 2 PERCENT OR LESS

Design speed of turning roadway curve, mph	Stop Condition	15	20	25	30	35	40	45	50	
		30	90	150	230	310	430	550	690	
Minimum curve radius, feet										
Design speed of highway mph	Length of taper, feet*	Total length of DECELERATION LANE, including taper feet: All main highways								
		325	300	275	250	200	-	-	-	-
		425	400	375	350	325	275	-	-	-
		500	500	475	450	425	400	325	300	-
		530	550	525	500	475	450	375	325	-
		600	575	550	550	525	500	425	400	350
Design speed of highway mph	Length of taper, feet	Total length of ACCELERATION LANE, including taper feet:								
		190	325	250	225	-	-	-	-	-
		230	700	625	600	500	400	-	-	-
		270	1125	1075	1000	900	800	600	400	-
70	300	1530	1500	1400	1325	1225	1000	825	375	

* For urban street auxiliary lanes shorter tapers may be used due to lower operating speeds. Refer to AASHTO Policy on Geometric Design of Highways and Streets for allowable tapers.

**TABLE II - 11
RATIO OF LENGTH OF SPEED CHANGE LANE
ON GRADE TO LENGTH ON LEVEL**

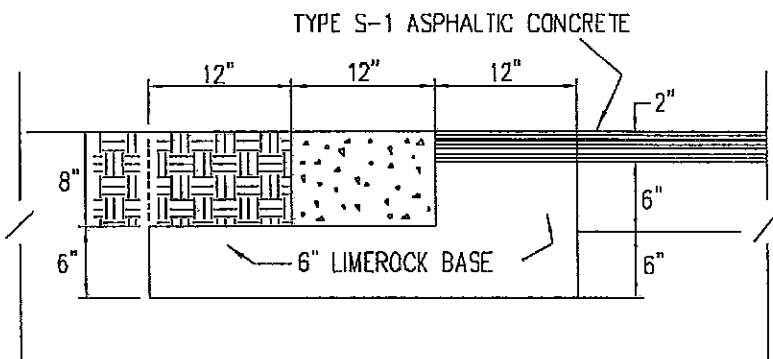
DECELERATION LANE			ACCELERATION LANE						
Design Speed of Highway mph	Ratio		Design Speed of Highway mph	Design Speed of Turning Roadway, mph					
All	3-4% upgrade	3-4% downgrade	20	3-4% upgrade				All speeds	
	0.9	1.2		30	40	50	3-4% downgrade		
5 - 6 % upgrade 0.8	5 - 6 % downgrade 1.35		40	1.3	1.3	-	-	0.7	
				50	1.3	1.4	-	1.65	
				60	1.4	1.5	1.6	0.6	
70			70	1.5	1.6	1.7	1.8	0.6	
				5-6% upgrade					5-6% downgrade
				40	1.5	1.5	-	-	
50	1.5	1.7	1.9	-	0.55				
60			70	1.7	1.9	2.2	2.5	0.5	
				5-6% upgrade					5-6% downgrade
				40	2.0	2.2	2.6	3.0	
Ratios in this table multiplied by the values in table III - 16 give the length of speed change land for the respective grade.									



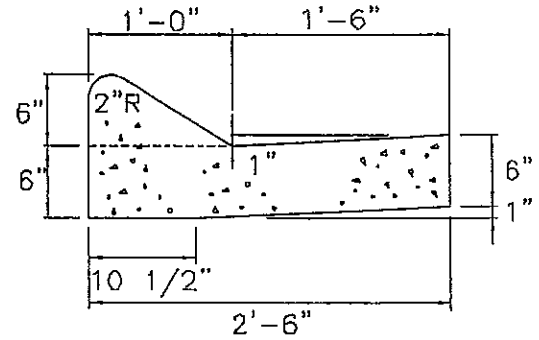
STREET SIGN DETAIL

NOT TO SCALE

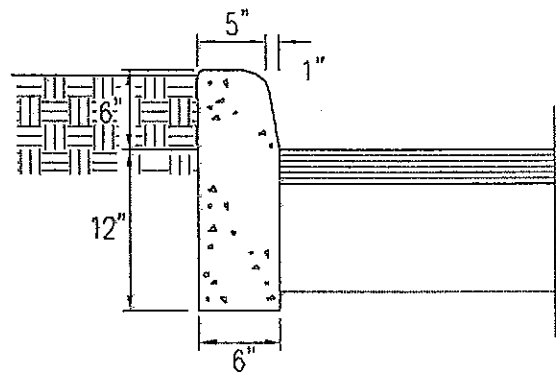
FIGURE 11-3



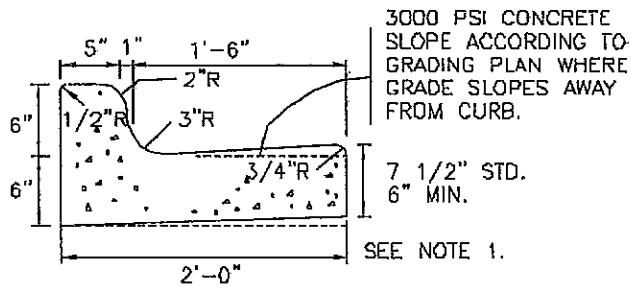
RIBBON CURB DETAIL
SCALE NTS



LAYBACK CURB DETAIL
SCALE NTS

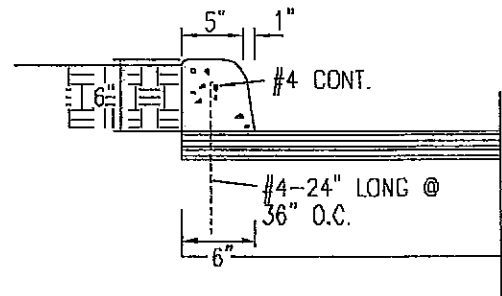


RAISED CURB DETAIL
SCALE NTS



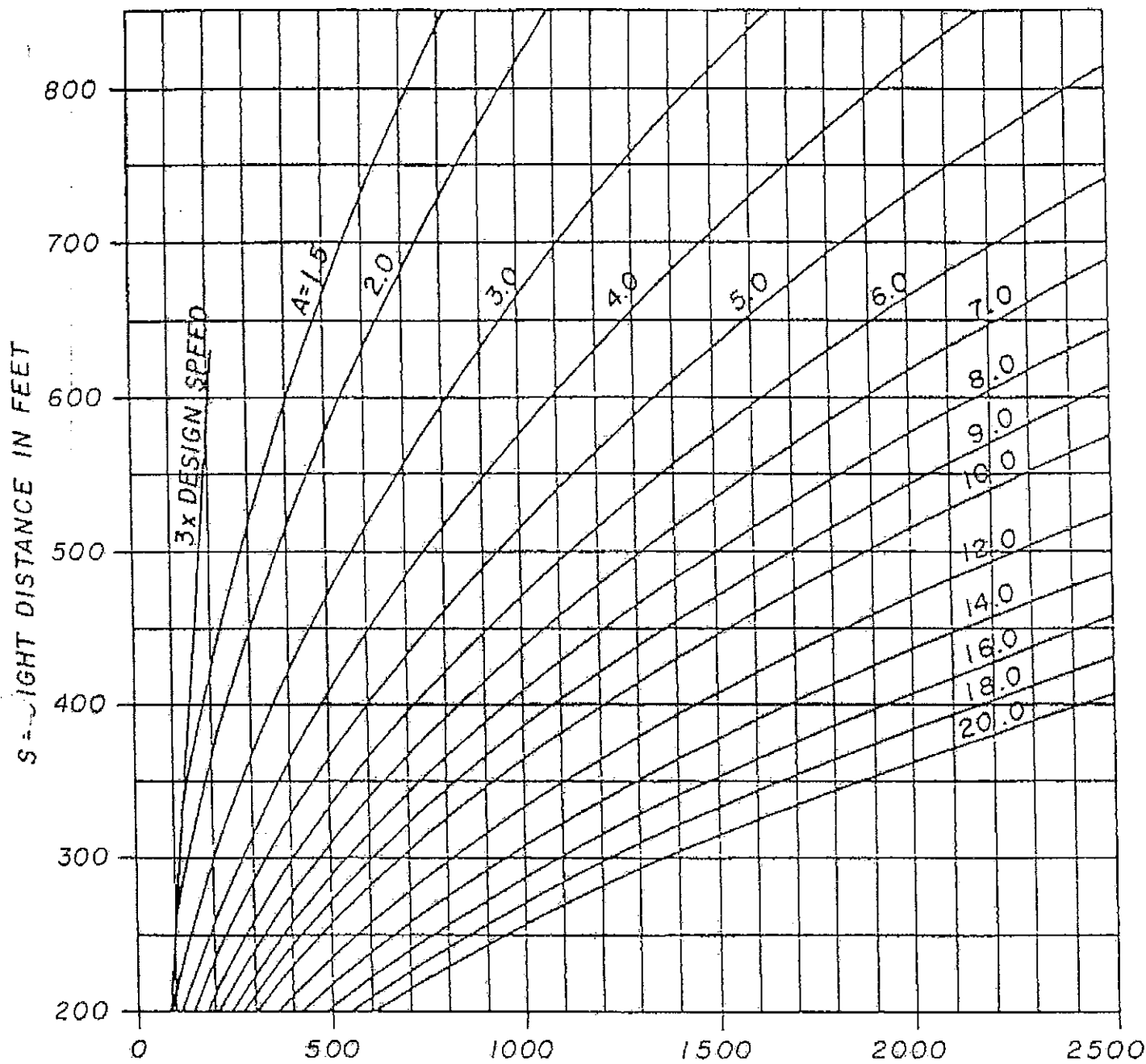
F.D.O.T. TYPE 'F' CURB & GUTTER
SCALE NTS

NOTE 1:
WHEN USED ON HIGH SIDE OF ROADWAYS, THE CROSS SLOPE OF THE GUTTER SHALL MATCH THE ADJACENT PAVEMENT AND THE THICKNESS OF THE LIP SHALL BE 6" UNLESS OTHERWISE SHOWN ON PLANS.



ISLAND CURB DETAIL
SCALE NTS

FIGURE II-4



L = MINIMUM LENGTH OF VERTICAL CURVE IN FEET

Lengths of vertical curves are computed from the formula $L = \frac{AS^2}{1329}$

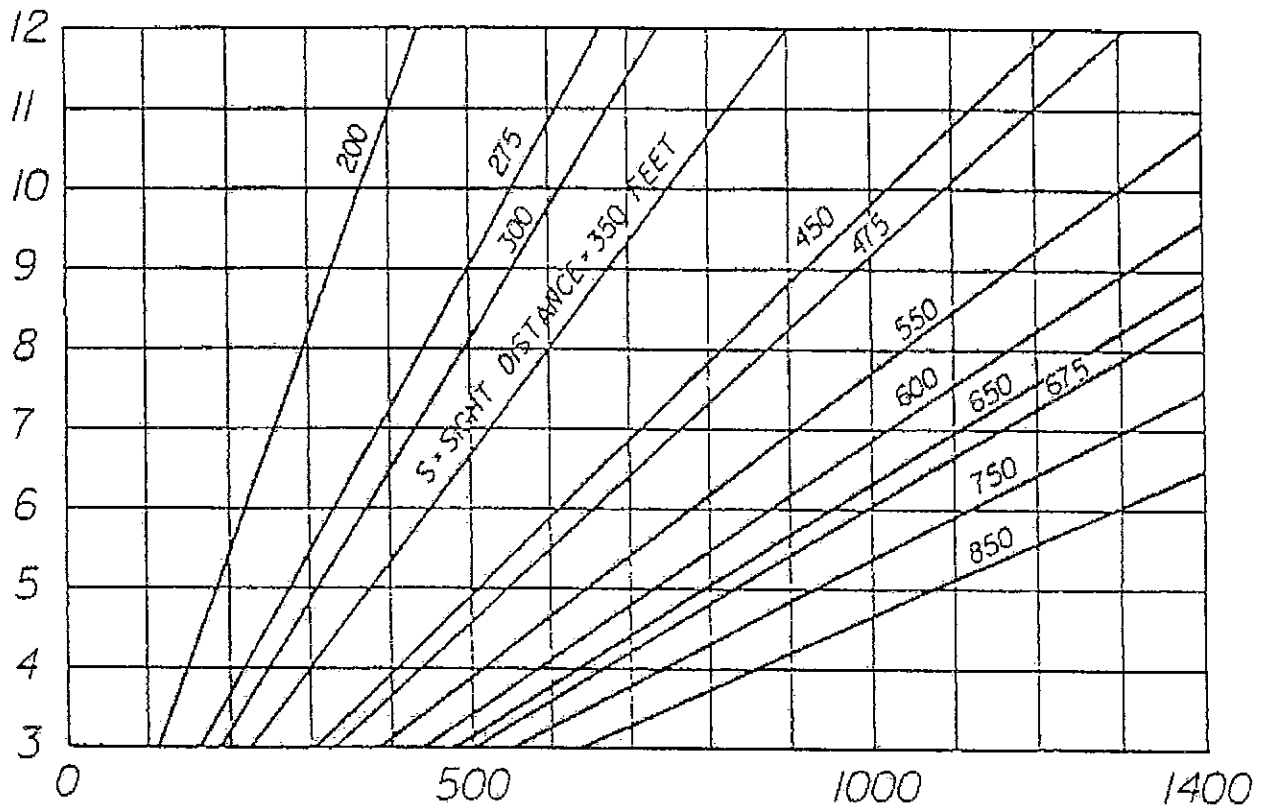
A = Algebraic Difference In Grades In Percent

S = Sight Distance

**LENGTH OF CREST VERTICAL CURVE
(STOPPING SIGHT DISTANCE)**

FIGURE II-5

A = ALGEBRAIC DIFFERENCE IN GRADES



L = MINIMUM LENGTH OF VERTICAL CURVE IN FEET

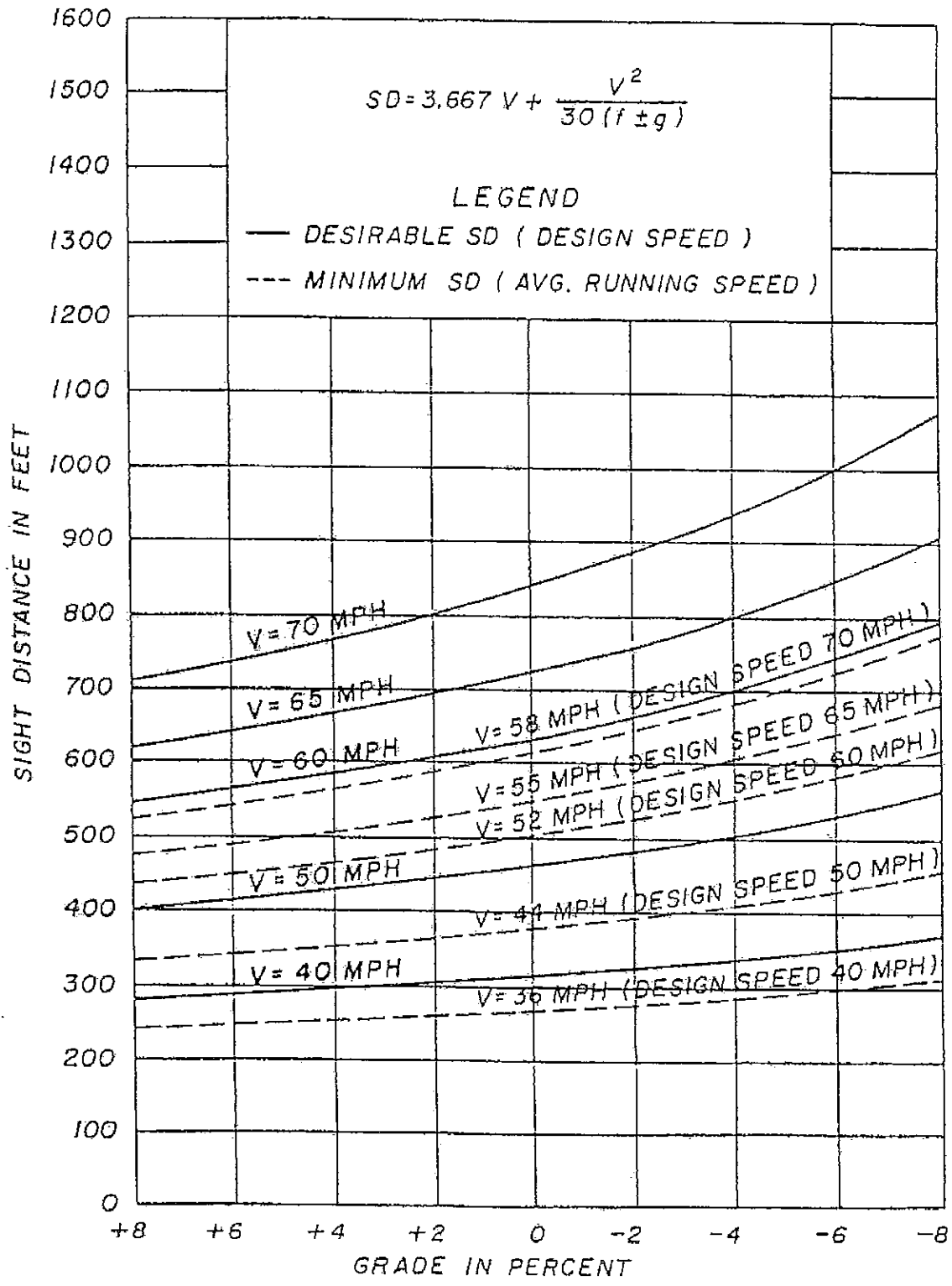
HEADLIGHT SIGHT DISTANCE

Lengths of vertical curves are computed from the formula:

$$L = \frac{AS^2}{400 + 3.5(S)}$$

**LENGTH OF SAG VERTICAL CURVE
(STOPPING SIGHT DISTANCE)**

FIGURE II-6



SIGHT DISTANCES FOR APPROACH TO STOP ON GRADES
FIGURE II-7

1-1/2" D.O.T. TYPE S-1 ASPHALTIC CONCRETE

PRIME AND TACK COATS

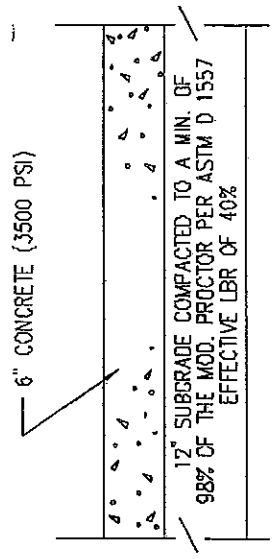
6" SAND-CLAY BASE COMPACTED

12" SUBGRADE COMPACTED

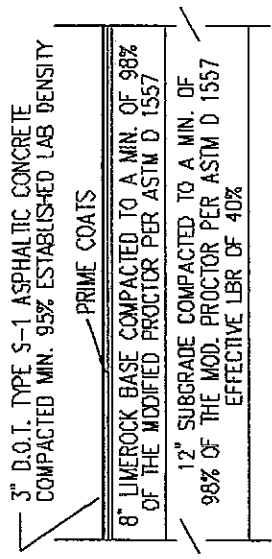
NOTE: PAVEMENT WITHIN MAIN RIGHT-OF-WAYS TO BE 2" ASPHALTIC CONCRETE WITH 8" SAND-CLAY BASE. MATERIALS ARE TO BE OF THE TYPE AND COMPACTED AS SHOWN ABOVE.

TYPICAL PAVEMENT SECTION

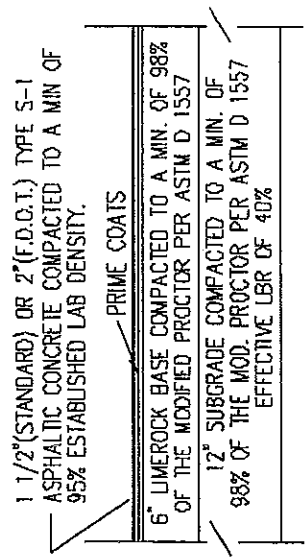
NTS



CONCRETE PAVING SECTION
NOT TO SCALE



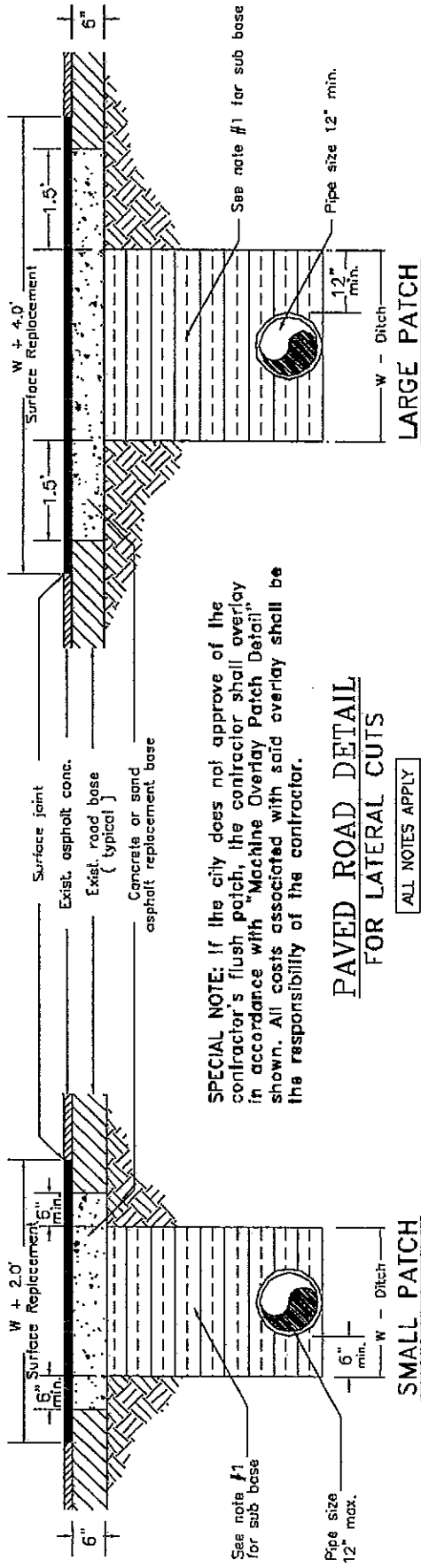
HEAVY DUTY PAVEMENT SECTION
NOT TO SCALE



STANDARD & F.D.O.T.
PAVEMENT SECTION
NOT TO SCALE

NOTE:
1. LIMEROCK BASE SHALL HAVE A MAX. L.L. OF 35. MATERIAL SHALL BE NON PLASTIC AND HAVE A MIN. L.B.R. OF 100% FOR ALL PAVEMENT SECTIONS.

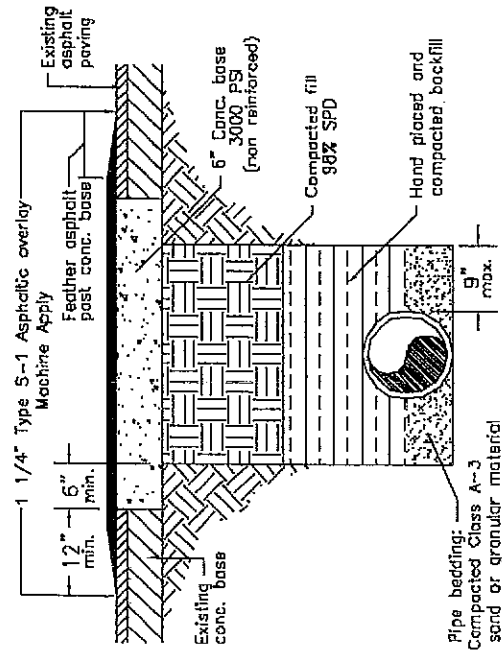
FIGURE 11-9



LARGE PATCH

SPECIAL NOTE: If the city does not approve of the contractor's flush patch, the contractor shall overlay in accordance with "Machine Overlay Patch Detail". All costs associated with said overlay shall be the responsibility of the contractor.

PAVED ROAD DETAIL FOR LATERAL CUTS
ALL NOTES APPLY



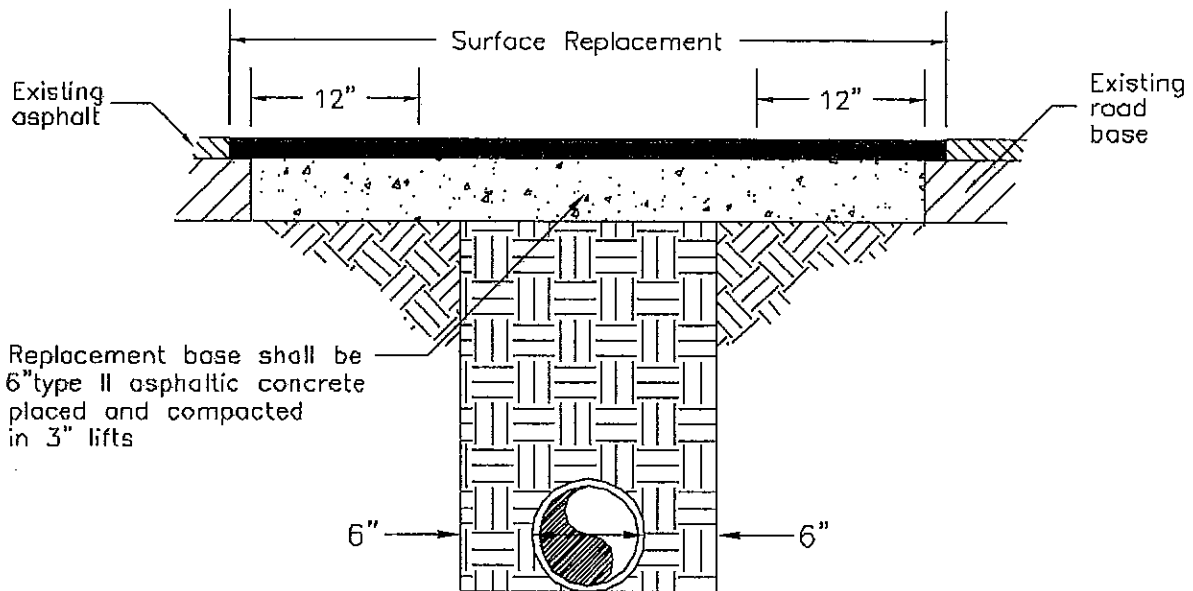
MACHINE OVERLAY PATCH DETAIL

NOTES

1. Patch work sub base material to be placed in 8" layers (max.), each layer to be tamped to a minimum of 40 lb.
2. Road cuts shall be: (a) Mechanically sawed to form a surface pavement joint. (b) Surface treatment pavement joint shall be lapped and feathered. (c) Surface material will be consistent and same material as the existing surface course. (d) Concrete replacement base poured in place with a minimum strength of 2500 psi.
3. Longitudinal road cuts of less than one half pavement width to be patched same as lateral patch. Longitudinal road cuts 1/2 or over to be patched with same base material and entire road resurfaced.
4. All open roadway cuts will have a density test performed to insure the roadbed has a 95% compaction. Failure to do so will result in repatching. A copy of the test results will be provided to the City of Milton.

DIRT ROAD PATCH DETAIL

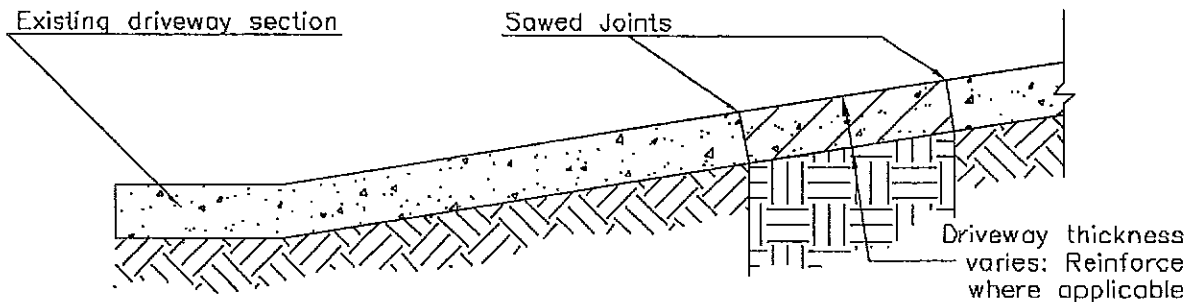
TYPICAL PATCH DETAILS (FOR CITY STREET)
N.T.S.



STREET PATCH

GENERAL NOTES

1. Asphaltic concrete pavement joints shall be mechanically sawed.
2. Surface treatment paved joints shall be lapped and feathered.
3. Surface replacement course to be 1 1/2" type S-1 asphaltic concrete.
4. Sub base material is to be placed and compacted in 8" lifts to a minimum density of 98% of standard proctor.
5. Minimum surface replacement course of longitudinal cuts to be one half of existing road or 12'.
6. Longitudinal cut replacement base shall be full depth asphaltic concrete.
7. Any variance must be approved on an individual basis by the city.
8. Permit from the City of Milton is required. Inspection by the street division or a compaction test by a testing lab is required.
9. Contact the Public Works division and all emergency services (police, fire, and emergency medical services) before completely closing a road and notify same when the road has been re-opened.



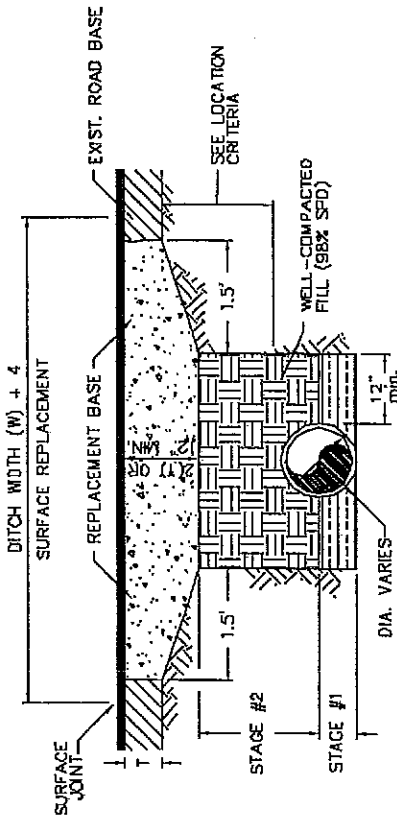
DRIVEWAY PATCH

TYPICAL PATCH DETAILS

(CITY OF PENSACOLA)

N.T.S.

FIGURE II-12



GENERAL NOTES

Base and backfill materials shall be either of the same type and composition as the materials removed, or of equal or greater structural adequacy. Materials contaminated with deleterious substances during excavation shall not be used.

Replaced base material over ditch shall be twice the thickness of the original base.

Base material shall be placed in two or three layers and each layer thoroughly rolled or tamped to the specified density.

Asphalt concrete pavement joints shall be mechanically sawed.

Surface treatment pavement joints shall be lapped and feathered.

Surface material will be consistent with the existing surface.

LIME-ROCK, SAND-CLAY, SHELL, etc. BASES:

- 6" Layers Compacted Thickness Density Requirements:
 - 98% Under Roadway
 - 95% Outside the Traveled Roadway, such as Intersections, Crossovers, Turnouts, etc.
 - 95% Shoulder Pavement
- METHOD AASHTO T-180

DENSITY PROCEDURES:

The backfill for the first and second stages shall be placed in 6" layers; (compacted thickness) and shall be compacted to 100% of maximum density as determined by AASHTO T-99.

STAGE #1

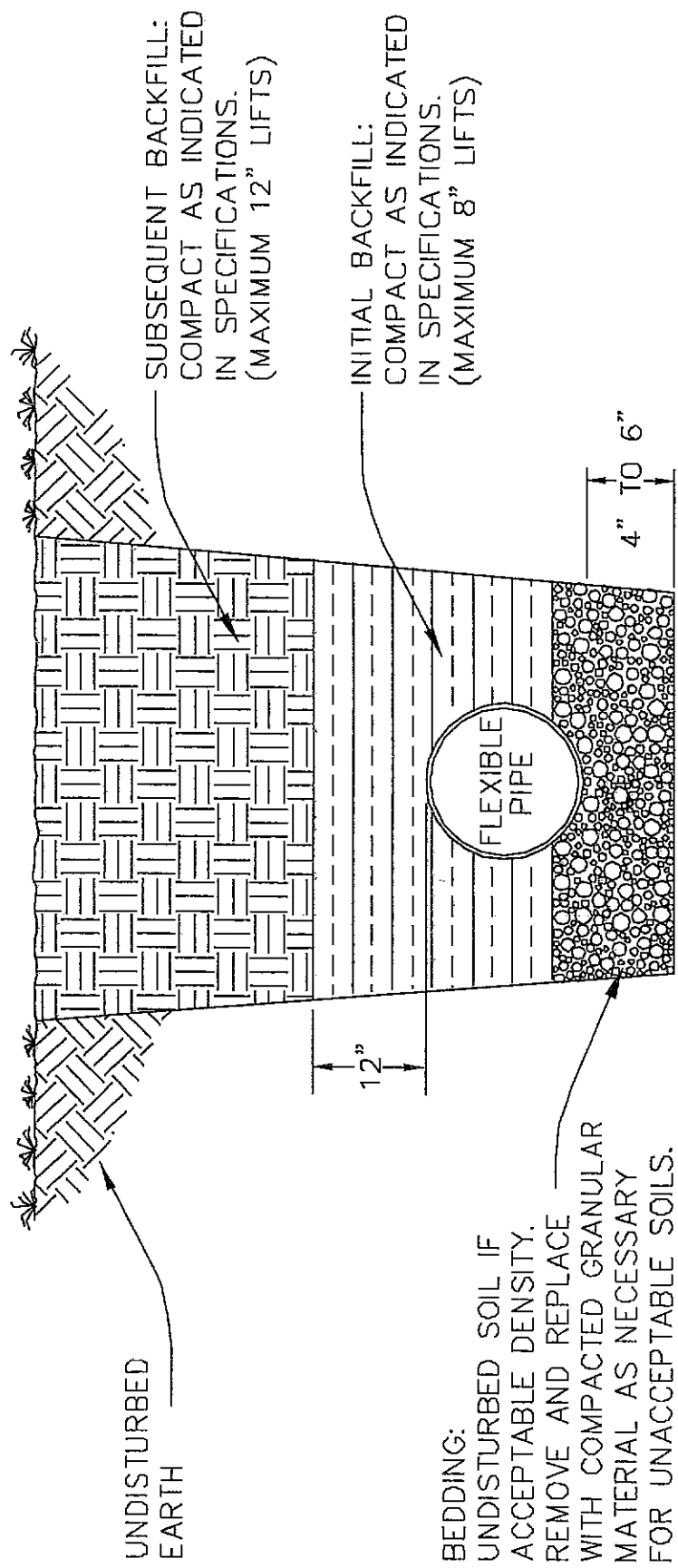
The permittee shall provide adequate compacted fill beneath the haunches of the pipe, using mechanical tamps suitable for this purpose. This compaction applies to the material placed beneath the haunches of the pipe and above any bedding required.

STAGE #2

The permittee shall obtain a well-compacted bed and fill along the sides of the pipe and to a point indicating the top of sub grade material.

REPLACEMENT OF FLEXIBLE PAVEMENT
FOR PERMITTED PAVEMENT CUT

N.T.S.



UNDISTURBED
EARTH

SUBSEQUENT BACKFILL:
COMPACT AS INDICATED
IN SPECIFICATIONS.
(MAXIMUM 12" LIFTS)

12"

INITIAL BACKFILL:
COMPACT AS INDICATED
IN SPECIFICATIONS.
(MAXIMUM 8" LIFTS)

FLEXIBLE
PIPE

4" TO 6"

BEDDING:
UNDISTURBED SOIL IF
ACCEPTABLE DENSITY.
REMOVE AND REPLACE
WITH COMPACTED GRANULAR
MATERIAL AS NECESSARY
FOR UNACCEPTABLE SOILS.

FLEXIBLE PIPE BEDDING DETAIL

N. T. S.

FIGURE II-14