RESOLUTION NO. 32-2015

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF LIVE OAK ADOPTING AND APPROVING THE CITY OF LIVE OAK PUBLIC WORKS IMPROVEMENT STANDARDS.

WHEREAS, the City Engineer has revised and updated various public works improvement standards, and

WHEREAS, the City Council deems it both necessary and appropriate to revise and update improvement standards as needed.

NOW THEREFORE BE IT RESOLVED AND ORDERED by the City Council of the City of Live Oak that the attached City of Live Oak Public Works Improvement Standards are hereby formally adopted and approved.

THE FOREGOING RESOLUTION of the City Council of the City of Live Oak was duly and regularly introduced, passed and adopted at a regular meeting of the Council on the 7th day of October, 2015 by the following vote:

AYES: Council Members Banks, Alvarado, Baland, Vice-Mayor Ghag & Mayor Hodges

NOES: None

ABSENT: None

ABSTAIN: None

APPROVED:

Diane Hodges

Diane Hodges, Mayor

ATTEST:

Melissa Dempsey

Melissa Dempsey, City Clerk

CITY OF LIVE OAK INCORPORATED JANUARY 28, 1947 LIVE OAK, CALIFORNIA

LIVE OAK

CALIFORNIA

PUBLIC WORKS IMPROVEMENT STANDARDS

OCTOBER 2015

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SECTION 1. INTRODUCTION

The following physical characteristics of the City of Live Oak require special design and construction consideration:

Extremely flat grades.
High groundwater table at all times.
Potentially unstable soils below the groundwater table.
Storm drain outlet restrictions into constructed agricultural drainage facilities.

The City Public Works Department is particularly concerned about:

Accurate establishment of grades, and careful construction practices to maintain the design grades.

Watertightness of gravity pipelines and structures.

Adequate construction and safety procedures regarding shoring, bracing, and dewatering of all excavations.

Building pad elevations established above potential high water elevations, with adequate lot grading to the back of sidewalk.

Storm drainage detention facilities designed to limit peak flows.

SECTION 2. STANDARD SPECIFICATIONS

It is intended that these Improvement Standards are to be used in conjunction with the State of California Department of Transportation Standard Specifications.

Earthwork, grading, paving, and concrete work shall conform to the applicable sections of the State Standard Specifications, unless modified by these Improvement Standards.

SECTION 3. GENERAL DESIGN CRITERIA

General Design Criteria shall apply to the design of all improvements within the City of Live Oak which are subject to review by the City Engineer.

Drawings shall be on standard size sheets (22” x 34", 24" x 36", 11" x 17", or 8-1/2" x 11") with standard title block. All lettering shall be 1/8" or larger to permit photographic reduction.

Title Sheets shall have an index or key map clearly indicating the sheet numbers for all drawings.

Designer shall sign each sheet. Designs for structures, and other design subjects required by law to be designed by a Registered Engineer or Architect shall be signed and stamped by the Registered Engineer or Architect.

Soils Report shall, when required, be signed by a Registered Engineer or Geologist.

Revisions to Original Drawings must be initialed by the Design Engineer and approved by the Department of Public Works.

Improvements are to be designed and constructed in accordance with these Public Works Improvement Standards.

Subdivisions shall have improvement drawings showing overall layout of the water, sewer, storm drainage, and streets. Public utility locations shall be shown on the as-built plans for all projects.

Profiles shall be shown on the improvement drawings for streets and street improvements. Vertical curves shall show all curve data, i.e., length, beginning, ending, P.I., et cetera. Typical design data shall be shown on all sheets, i.e., elevations, stationing, et cetera.

Scale for improvement plans shall normally be 1" = 40' for the horizontal and 1" = 2' for the vertical. The vertical scale should be changed to 1" = 5', or other appropriate scale where depths are great. For complex plans the scale shall be 1" = 20' or larger as necessary for clarity.

Improvement Plans shall be prepared in AutoCAD format and plotted on vellum, unless otherwise approved by the City Department of Public Works.

Street Survey Control, horizontal and vertical, storm drainage, subdivision boundary and lot calculations, shall accompany all submittals for checking and approval by the City of Live Oak Public Works Department.

Improvement Bonds, when required, shall include a detailed cost estimate, prepared by the Design Engineer, and approved by the City Department of Public works.

Original Drawings and AutoCAD electronic files shall be revised by the Design Engineer to reflect the as-built conditions, and duplicate or photographic mylar copies and electronic files shall be furnished to the City prior to final acceptance of the work by the City.

SECTION 4. IMPROVEMENT PLANS - REQUIRED CONTENTS

Project Title

Project Design Credits:
- Designer's Signature
- Date
- Scale
- Project Approval Signature

Existing pertinent topography, (i.e., street, curb, gutters, storm drains, sanitary sewers, water and gas line, trees, creeks, drainage swales, and other features that will effect design, existing R/W, property lines, street names.)

Profiles of existing improvements and/or ground.

Location of proposed improvements:
- R/W, easements, etc.
- Horizontal control points (2 min.) with ties
- North arrow, contours
- A minimum of 2 benchmarks on City Datum with location, description, elevations.
- Project stationing (Reading left to right)
- Typical sections of work
- Cross-sections as required
- Profiles of all improvements
- Horizontal and Vertical Curves:
  - Begin Curve (B.C. & B.V.C. or P.V.C.)
  - End Curve (E.C. & E.V.C.)
  - Point of Intersection (P.I. & P.V.I.)
  - Invert Station and Elevations:
  - All Structures
  - Gravity Pipelines

General Design Data
- Grades
- Lengths of design element
- Hydraulic gradient
- Energy gradient
- Other design data as required

Special Notes

References to City Public Works Improvement Standards

Drawing Legend

SECTION 5. SURVEY MONUMENTATION

SECTION 5.1 SURVEY MONUMENTS:

The procedure and practice of all survey work done upon any subdivision shall conform to the accepted standards of the engineering profession.

All monuments shall not be less substantial than a 3/4-inch diameter iron pipe or 5/8-inch diameter steel reinforcing bar, 18 inches long with a brass tag or plastic cap bearing the registration number of the engineer or surveyor who set the monument, and shall be subject to inspection and approval by the City Engineer. "Permanent" monuments shall be set in concrete. Before street improvements are accepted, all monuments disturbed by the improvements shall be reset.

In making the survey for a subdivision, the engineer or surveyor shall set "permanent" monuments at all angle and curve points on the exterior boundaries of the subdivision, in all street intersections, at all angle points of street lines, and at all points of curvature, both simple and compound, of street lines. "Permanent" monuments at street intersections and at angle and curved points of street lines shall be set on street centerlines, unless otherwise directed by the City Engineer; provided, however, that the "permanent" monuments need not be set at intervals of less than 400 feet.

The "permanent" monuments shall be set in the ground upright with the metal marker centered in the concrete, by excavating a six-inch minimum diameter hole two feet below the finished grade and pouring the same full of concrete. When streets are required to be paved, the location of such monument and access thereto shall be given by a suitable concrete or cast-iron sliding sleeve surmounted by a circular cast-iron frame and lid at street surface. In case the monument is not in a street, the metal marker may be set flush with the existing ground surface.

The engineer or surveyor shall set monuments at all lot corners and at all curve points on lot boundary lines.

There shall be one or more permanent bench marks for each subdivision, of a type approved by the City Engineer and referred to the City Datum, set at each street intersection in the curb return or other location approved by the City Engineer. The bench mark shall be a brass disc two inches +/- in diameter, set in concrete.

SECTION 6. STREET DESIGN CRITERIA

SECTION 6.1 GENERAL CRITERIA:

The design, layout, width, circulation, and other aspects of streets, both public and private, shall conform to the locations shown on the Circulation Element of the General Plan and approved by the City Public Works Department.

The final improvement plans for streets shall show the survey monuments and rights-of-way referenced to existing property corners, width of paving, and all improvements, i.e., sanitary sewer system, storm drain system, water system, concrete curb, gutter and sidewalk, driveways, et cetera. The widths and locations of adjacent streets shall be shown referenced to centerline stationing or monuments on the final improvement plans for streets.

SECTION 6.2 STREET WIDTHS:

Street widths and configurations shall conform to the street cross sections in Appendix C, “Standard Details” and the following dimensions:

STREET WIDTHS					
Class	Curb Width	Traffic Lane Width	Parking Lane Width	Bike Lane Width	R/W Width
Arterials (No Parking)					
4-Lane w/Median	74’	12’	NA	6’	98’
4-Lane	64’	12’	NA	8’	88’
2-Lane w/Median	50’	12’	NA	6’	74’
2-Lane	44’	12’	NA	10’	68’
Major Collectors					
4-Lane	74’	11’/12’	8’	6’	98’
4-Lane (No Parking)	64’	12’	NA	8’	88’
2-Lane	50’	11’	8’	6’	74’
2-Lane (No Parking)	44’	12’	NA	10’	68’
Minor Collectors					
2-Lane	50’	11’	8’	6’	74’
Local Streets					
2-Lane w/Median	50’	11’	8’	NA	74’
2-Lane	38’	11’	8’	NA	60’

The width of the roadway shall be measured perpendicular or radial to the centerline. Any exceptions to the above widths must be submitted to, and approved by the City Engineer.

Intersections of arterials, depending on estimated traffic volumes, may require special design. The need for single and double left turn pockets, free right turn lanes, right turn islands, raised medians, etc., shall be investigated.

The width of center medians shall be 14 feet, exclusive of curbs.

SECTION 6.3 STREET GRADES:

Maximum street grades shall not exceed the following limits:

Arterials and Major Collectors	8%
Minor Collectors	10%
Local Streets	15%

Minimum street grades for new streets shall not be less than 0.25% unless authorized by the City Engineer.

The gradient of a street entering an intersection shall not be more than 5% at the intersection. Vertical curves are required when grade breaks exceed 1.0%. Vertical curves shall be made with parabolic vertical curves determined by minimum stopping sight distance and good engineering practice established by the City Department of Public Works.

SECTION 6.4 STREET IMPROVEMENTS:

Concrete curbs and gutters shall conform to Appendix C, “Standard Details”, and Appendix D, “Standard Technical Specifications”. The minimum grade for curbs and gutters shall be 0.25% unless a reduction is authorized by the City Engineer. Rolled curb and gutter shall only be permitted in residential areas on local streets which do not have existing vertical curb and gutter. Installation of rolled curb and gutter on streets which have existing vertical curb and gutter must have specific approval by the Director of Public Works or the City Engineer.

Street improvement plans shall show gutter flowline profiles, including profiles for all curb returns and any approved cul-de-sacs (cul-de-sacs require specific approval of the Department of Public Works), as well as street centerline profiles.

Concrete sidewalk shall conform to Appendix C, “Standard Details”, and Appendix D, “Standard Technical Specifications”, 4-foot minimum width, exclusive of curbs, and no less than four inches thick for public and private sidewalks, and six inches thick for driveways. Maximum finished cross-slope on sidewalks shall be 2.0%. Concrete sidewalks may be adjacent and contiguous to curbs and gutters or may be non-contiguous, parkway sidewalk.

Curb returns shall be constructed on a curve having a minimum face-of-curb radius equal to that shown below:

Class	(Min.) Curb Return Radius
All Residential Street Intersections	30'
Cul-de-sac	40'
Arterial Street Intersections	30'

SECTION 6.5 CURB, GUTTER AND SIDEWALK REQUIREMENT:
In accordance with the provisions of Titles 12, 16 and 17 of the Live Oak Municipal Code, installation of concrete curb, gutter, and sidewalk improvements are required for all new development in the City.

SECTION 6.5.1 SIDEWALK REQUIREMENT BY PERMIT: The curb, gutter and sidewalk improvements requirement occurs in several areas under City procedures:

Building Permits: Pursuant to Chapter 12.01 of the Live Oak Municipal Code, any person obtaining a building permit to construct a new residence or develop property is required to construct curb, gutter, and sidewalk along all public street frontage adjacent to the lot. In addition, the builder or developer is required to pave between the edge of the existing pavement and the gutter. In situations where the City Engineer determines it is not currently practical to install the improvements, the property owner must sign a "Deferred Improvement Agreement" with the City which obligates the property owner to install the curb, gutter, and sidewalk improvements upon future demand of the City. This agreement also amounts to an automatic "yes" vote in any future assessment district for street improvements.

Subdivisions: It is the policy of the City that curb, gutter and sidewalk improvements are required as a condition of approval of any subdivision. For subdivisions by final map, curb, gutter and sidewalk improvements are required prior to the recording of the final map. For subdivisions by parcel map, curb, gutter and sidewalk improvements are required at the time of development. The map condition requiring curb, gutter and sidewalk construction shall be noted on the recorded parcel map, or on a document recorded concurrently with the parcel map.

Use Permits, Site Plan Reviews, and Variances: Curb, gutter, and sidewalk improvements are required as a condition of approval of use permits, site plan reviews, and variances. In addition, the developer is required to pave between the edge of the existing pavement and gutter.

SECTION 6.5.2 SIDEWALK REQUIREMENT BY LAND USE: There is some variation in the sidewalk requirements for property depending upon the use (zoning). In all cases, curb, gutter, and sidewalk are required. By type of use, sidewalk varies as follows:

Single Family: Four-foot sidewalk on both sides of the street.

Multiple Family: Four-foot sidewalk on both sides of the street.

Commercial: Full-width sidewalk (curb to property line) with irrigated tree wells on both sides.

Industrial: Four-foot sidewalk on one side only.

Planned Development and Mobile Home Parks: Curb, gutter, and sidewalk are only required on the public street frontages of planned development and mobile home parks. Internal roads within the projects are private and no sidewalk requirement is made.

SECTION 6.6 STREET TREE WELL LOCATION CRITERIA:

The only situations where tree wells for trees are specified are in commercial/industrial areas where full-width commercial sidewalk (curb to property line) is to be constructed. This provides sufficient room for the construction of a tree well immediately behind the curb and allows for the passage of pedestrians around the tree. Do not attempt to place tree wells in any sidewalk narrower than 7-1/2 feet. Some of the most common obstacles to pedestrians are signs, utility poles, hydrants, parking meters, and building doors that swing out.

General guidelines relating to the spacing of trees are that they be located not closer than 25 to 30 feet to intersections, have a spacing between trees of approximately 30 to 35 feet, and no tree is to be planted closer than 10 feet to a property line or a driveway. The former instance is to clearly indicate to a property owner that the tree is in front of their property and not on a common lot line where adjacent property owners could have conflicting views regarding tree maintenance or removal. Clearance to driveway locations is to insure that the tree does not create a blind spot for motorists attempting to exit the driveway into oncoming traffic.

Regarding the spacing of trees along the streets, a number of considerations are involved in addition to the above mentioned intersection, property lines, and driveways. Power poles, street light standards, fire hydrants, the location of underground utilities and services, the placement of parking meters and stalls along the street, and the architecture of a building itself often dictates when and where a tree is to be located. Do not place a tree immediately next to a parking meter where a person cannot get to the meter, nor in the middle of a parking stall so that it hinders or obstructs a person from opening a car door to enter or exit a vehicle.

Do not place a tree so close to power poles and street lights that the spread of the tree would interfere with access to the pole by utility companies or obliterate the lighting effect from the street light. Do not place a tree so close to a fire hydrant that it hinders the Fire Department's use of the hydrant.

Do not locate trees adjacent to water meters, nor over utility service lines. Consideration should be given to height clearances for traffic control signs and street sweeper operation in the selection of trees for planting.

Tree locations should be coordinated with building designs to provide shade for energy conservation without obstructing entrances or windows.

SECTION 6.7 DRIVEWAY STANDARDS AND CRITERIA:

SECTION 6.7.1 GENERAL: All driveway approaches in City right-of-way shall conform to Appendix C, “Standard Details”, and Appendix D, “Standard Technical Specifications”, or as modified for special situations described herein.

1. A residential driveway apron shall be constructed between the curb and the property line with Portland cement concrete per driveway standards.
2. A commercial driveway apron to a parking lot or "drive-in" business shall be constructed between the curb and the property line with Portland cement concrete, per driveway standards.

3. An industrial driveway apron shall be constructed between the curb and the property line with an approved Portland cement concrete structural section, based on the amount of truck traffic (TI) and ability of the soil (R-value) to withstand truck wheel loads.
4. In all cases, it shall be the responsibility of the abutting property owner to maintain the driveway apron in a safe and suitable condition for the traffic to be carried, whether pedestrian or vehicular.

Commercial-Industrial High Volume Driveways: Commercial and industrial driveways that serve a substantial number of vehicles or trucks shall have dimensions, sight distance, geometrics, spacing, etc., determined by the City Engineer.

One-Way Driveways: One-Way entrance or exit driveways shall conform to these Public Works Improvement Standards for commercial driveways or as modified by the City Engineer for special situations.

Amount of Frontage Allowed for Driveways: Not more than 60 percent of the frontage of any parcel may be devoted to driveways.

Driveway Width "W": The total width of driveways shall be measured between full height curb, as shown on the standard details.

Driveway Grade (Slope): The maximum grade for residential driveways shall be limited to 12.5%. Eight percent is a desirable maximum for commercial-industrial driveways.

Driveway Distances from Utility or Safety Devices: No driveway shall be located closer than five feet from a fire hydrant, traffic signal, street light standard, utility pole, or guy wire, nor less than 20 feet from the end of a curb return.

Utility Relocation: Relocation of utility company's facilities or other public improvements to accommodate a driveway shall be accomplished without cost to the City.

Signal and Electrical Conduit: Where traffic signal or highway lighting is planned or anticipated, a minimum of one 2-inch PVC-P&C TC-6 conduit shall be placed under any new driveway apron and extend a minimum of one foot beyond the ends of the driveway. The conduit shall be placed behind, and a minimum of 24 inches below, the top of curb.

Removal of Existing Driveways: When driveway construction is to take place on a parcel, any abandoned driveways shall be removed and replaced with standard curb, gutter, and sidewalk concurrently with the new construction and without cost to the City.

SECTION 6.7.2 MINIMUM DRIVEWAY BOTTOM WIDTH:

1. The minimum width of driveways for one and two family residences shall provide for a bottom width of 12 feet, exclusive of the transition to full curb height at both ends.
2. The minimum width of all other driveways shall provide for the safe, efficient, and economical movement of traffic and should be approximately 24 feet, exclusive of the transition to full curb height at both ends.

SECTION 6.7.3 MAXIMUM DRIVEWAY BOTTOM WIDTH:

1. The maximum width of driveways for one and two family residences shall provide for a bottom width of 24 feet, exclusive of the transition to full curb height at both ends.
2. The maximum width of all commercial driveways shall be 36 feet, exclusive of the transition to full curb height at both ends, except this may be increased by the City Engineer where necessary to provide for the safe, efficient, and economical movement of traffic.
3. In the case of a driveway located adjacent to an alley, if approved by the City Engineer, the driveway apron may be combined with the alley but the total combined width shall not exceed 40 feet.
4. The driveway width may be modified by the City Engineer to facilitate turning movements where curb lanes are used.

SECTION 6.7.4 DISTANCE BETWEEN DRIVEWAYS:

1. The minimum length of full height curb between a driveway and a side property line shall be 3 feet.
2. The minimum length of full height curb between driveways on adjacent lots shall be six feet unless specific approval of a shorter length is given by the City Engineer.
3. No driveway shall be located closer than six feet from an existing or future alley entrance except as provided elsewhere in these standards.
4. Where two or more driveways are constructed on the same lot, the minimum length of full height curb between driveways shall be 24 feet. Where practical to provide parking, the total length of full height curb between driveways shall be in multiples of 22 feet.

SECTION 6.7.5 MODIFICATION: The above standards may be modified by the City Engineer for hardship conditions or where necessary to provide for the safe and efficient movement of traffic.

SECTION 6.8 INTERSECTIONS:

Street centerlines shall intersect at an angle as near to a right angle as is practicable. Minimum tangent distances required at intersections are as follows:

Class	Tangent Distance Required at Street Intersections
Local Street	50'
Collector Street	100'
Arterial Street	Requires Special Design

Deviation from the above design standards shall be approved by the City Engineer.

Right-of-Way lines at intersections shall be rounded with a minimum radius of 20-feet. Larger radius curves may be required if streets intersect at other than right angles or if the street is either a collector or arterial street.

The centerline of streets entering upon opposite sides of any given street shall normally align, or shall be offset by at least 100 feet. Local streets shall normally be designed as "T" type intersections.

SECTION 6.9 CUL-DE-SACS:
Dead-end streets require special approval by the City Engineer, and if approved shall terminate in a paved turn-around. In residential subdivisions, the turn-around shall have a 40-foot minimum curb line radius. In industrial subdivisions, the turn-around shall have a 50-foot minimum curb line radius.

SECTION 6.10 HORIZONTAL CURVES:
The radius of curvature in the centerline of the street shall be not less than:

Arterial Streets	650'
Collector Streets	200'
Minor Streets	75'

SECTION 6.11 CROSS-SLOPE:
-2% from the center line towards the right-of-way line shall be typical cross-slope. Deviation from the typical cross-slope shall be considered due to gutter drainage run-off, horizontal curve requirements, et cetera.

SECTION 6.12 STRUCTURAL SECTION:
Structural design of pavement, which includes the structural section to be used, shall be based on soil tests results, the TI (Traffic Index), and standard gravel equivalent calculations according to good engineering practice and shall be approved by the City Engineer.

SECTION 6.13 EARTH SLOPES:
Earth slopes in cut or embankment sections shall not be steeper than two feet horizontal to one-foot vertical, unless steeper slopes have been approved by the City Engineer based on a soil report.

SECTION 6.14 STREET LIGHTS:
Street lights shall be located as directed by Pacific Gas and Electric Company, and approved by the City Engineer, and shall be installed on 25-foot tapered steel poles with 8-foot arms, as approved by the City Engineer. Pole bases shall be in accordance with the Pacific Gas and Electric Company’s Standard Details. Luminaires shall be minimum 100 Watt equivalent, Light Emitting Diode.

SECTION 7. COMPACTION DENSITY REQUIREMENTS

The following criteria shall apply to the compaction of street subgrade, trench and excavation backfill, and structural section materials within City rights-of-way or easements:

Maximum Density - Optimum moisture relationships (compaction tests), will be determined in accordance with ASTM Test Method D 1557, Procedure C (dry density).

Cohesive Soil - All silty or clay soil material (cohesive, clay) shall be compacted to a relative compaction of 92 percent.

Non-Cohesive Soil - All granular material (non-cohesive, granular soils) shall be compacted to a relative compaction of 95 percent.

Aggregate bases and subbases shall be compacted to 95 percent relative compaction.

Hot Mix Asphalt shall be compacted to 95 percent relative compaction.

Compaction test results will be acceptable as meeting the 95 percent requirement if the average of all tests is 95 percent with no individual test lower than 93 percent.

Compaction tests will be acceptable as meeting the 92 percent requirement if the average of all tests is 92 percent with no individual test lower than 90 percent.

SECTION 8. WATER SYSTEM DESIGN CRITERIA

SECTION 8.1 GENERAL CRITERIA:

Water system design shall comply with Title 22 of the California Code of Regulations, the standards of the American Water Works Association (AWWA), Chapter 13.04 of the Live Oak Municipal Code, the City of Live Oak Water Master Plan, and the following criteria:

Alignment and Location of Mains: Water mains shall generally be aligned parallel to street centerlines. Offsets are to be made through the use of fittings. Curved alignments should be avoided. Where curved alignment is approved by the City Engineer, the radius of curvature shall not be less than 400-feet and the deflection per joint of pipe shall not exceed the manufacture's recommended maximum deflection, or as permitted by the City Engineer. Major water mains shall be located and sized in accordance with the Water Master Plan.

Pipe Materials for Mains:

Ductile Iron Pipe
PVC Pipe - AWWA C900 Cast Iron Dimensions

Minimum Pipe Size for Mains:

8" for distribution mains
10" for transmission mains between wells

Horizontal and vertical separation between water mains and other pipelines transporting non-potable water or hazardous fluids shall be in accordance with the requirements of California Department of Health Services Guidance Memo No. 2003-02, as revised October 16, 2003. Minimum separation is 1-foot above and 10 feet horizontally from sanitary sewer or hazardous fluids (4 feet horizontally from storm drain) unless the "Alternative Criteria for Construction", as outlined in the above memo are employed.

Minimum Cover for water mains shall be 30 inches, with 36 inches of cover desirable whenever possible.

Valves shall be resilient wedge gate valves installed in accordance with Appendix C, "Standard Details", and Appendix D, "Standard Technical Specifications". A sufficient number of valves shall be provided to permit isolation of each main, not more than 600 feet in length.

Fire Hydrants shall be the wet barrel type, located as directed by the Fire Chief, and not more than 400 feet apart. Hydrant installation shall be in accordance with Appendix C, "Standard Details", and Appendix D, "Standard Technical Specifications".

Services shall be in accordance with Appendix C, "Standard Details", and Appendix D, "Standard Technical Specifications". Single water services shall be 1" minimum diameter. Double water services shall be 1-1/2" minimum diameter from the main to the service tee and 1" minimum diameter from the tee to the meter stops. Backflow prevention devices shall be installed on all services to property with access to water from a private well or separate water service, and on all services to properties with potential contamination sources, as determined by the City Engineer and/or the California State Department of Health Services.

SECTION 8.2 AUTOMATIC FIRE SPRINKLER SYSTEMS:

SECTION 8.2.1 INSTALLATION:

All automatic fire sprinkler systems shall be installed in accordance with provisions of the Standards of the National Fire Protection Association Pamphlet No. 13 (NFPA #13), "Installation of Sprinkler Systems". All systems shall have a fire department connection as required by NFPA #13, unless waived by the Fire Chief.

Connections to the existing water system shall be made only at locations approved by the City Engineer. A gate valve shall be provided at the point of connection to isolate the new water mains from the existing system. All work related to the connection shall be done by the Contractor with full-time inspection by the Department of Public Works.

Hot tap connections shall be avoided, if possible, and will not be allowed on existing steel pipelines, nor when the diameter of the service line is greater than 2/3 of the diameter of the main. If hot tapping is approved by the City Engineer, the Contractor shall have the tapping sleeve and valve fully installed, thrust blocked, supported, and approved by the City prior to making the hot tap, and the tap shall be the full nominal diameter of the tapping sleeve and valve.

SECTION 8.2.2 CROSS-CONNECTION CONTROL:

Section 13114.7 of the Health and Safety Code states that Class I and Class II automatic fire sprinkler systems shall not require any backflow protection equipment at the service connection other than as required by standards for those systems contained in NFPA #13. Class I automatic fire sprinkler systems are those systems supplied by public water mains only (i.e., no pumps, tanks or reservoirs, physical connection from other water supplies, anti-freeze or other additives of any kind) and all sprinkler drains discharge to the atmosphere or other safe outlets. Class II systems are the same except that booster pumps, whose sole source of supply is the public water system, may be installed in the connection from the street main.

In accordance with NFPA #13, all automatic fire sprinkler systems shall have an alarm check valve, or equivalent, which is listed and approved for fire system use. Fire department connections shall be attached to the sprinkler system on the supply side of the alarm check valve assembly. Each fire department connection shall have a listed check valve as required by NFPA #13. No additional backflow protection equipment shall be required for Class I and Class II systems.

Automatic fire sprinkler systems which are not Class I or Class II systems shall have backflow protection equipment installed at the service connection as required by American Water Works Association Manual No. M-14.

SECTION 9. SANITARY SEWER DESIGN CRITERIA

SECTION 9.1 GENERAL CRITERIA:

Sanitary sewer collection system design shall comply with Chapter 13.32 of the Live Oak Municipal Code, the City of Live Oak Wastewater Collection System Master Plan, and the following criteria:

SECTION 9.2 MAIN LINE SEWERS:

SECTION 9.2.1 GENERAL:

Alignment and Location of Mains: Sanitary sewer mains shall generally be aligned parallel to street centerlines. Changes in direction, slope, type or size of pipe are to be made with manholes. Dead end mains may be terminated with a cleanout not more than 200 feet from a manhole. Major sanitary sewer mains shall be located and sized in accordance with the Wastewater Collection System Master Plan.

Pipe Materials for Mains:

Polyvinyl Chloride (PVC) Pipe - SDR 35, Bell and Spigot, Rubber-Gasket Joint
Ductile Cast Iron Pipe (DIP)

Minimum Pipe Size for Mains:

8" diameter, minimum

Horizontal and vertical separation between sanitary sewer mains and potable water pipelines shall be in accordance with the requirements of California Department of Health Services Guidance Memo No. 2003-02, as revised October 16, 2003. Minimum separation is 1-foot below and 10 feet horizontally from potable water pipelines unless the “Alternative Criteria for Construction”, as outlined in the above memo are employed.

Minimum Cover for sanitary sewer mains shall be 36 inches from street subgrade.

Design calculations shall be submitted to verify line size and bedding design, as well as Class or Type of pipe.

Manning “N” values to be used:

PVC N = 0.010
DIP N = 0.012

Sewer main slopes shall be selected to maintain a minimum velocity of 2 FPS, with the pipe flowing full.

SECTION 9.2.2 DESIGN FLOW CRITERIA:

Residential: In residential areas, 250 gallons per day per “equivalent household unit” may be used to calculate average daily flow. Peak daily flows should be based on the ratio of peak to average flows as determined by using a Peak Factor of:

$PF = 2.80 \times Q^{(-0.155)}$ (Q in MGD)
$PF = 7.72 \times Q^{(-0.155)}$ (Q in GPM)

Design flows shall be the peak daily flows plus 200 gallons per acre per day allowance for stormwater inflow and groundwater infiltration.

Commercial/Industrial: In commercial and industrial areas, design flows are to be based on the actual uses proposed and shall include 200 gallons per acre per day allowance for stormwater inflow and groundwater infiltration.

SECTION 9.2.3 MANHOLES:

Manholes shall be in accordance with Appendix C, “Standard Details”, and Appendix D, “Standard Technical Specifications”. Manholes are required:

- At changes of slope.
- At changes of pipe size.
- At changes of direction unless the design, as approved by the City Public Works Department, allows for large radius curves.
- Intersections of mains.
- Ends of lines more than 200 feet in length.

Maximum manhole spacing shall be 400 feet.

All manholes shall be numbered on the plans.

SECTION 9.3 SEWER LATERALS:

Pipe Materials for Laterals:

Polyvinyl Chloride (PVC)
Acrylonitrile Butadiene Styrene (ABS)
Ductile Cast Iron Pipe (DIP)

Minimum Pipe Size for Laterals:

4" diameter, minimum. Larger diameter laterals may be required by the City Engineer.

Minimum Depth for Laterals:

3' minimum below base of curb and gutter
1' minimum at building service

Minimum Pipe Slope for Laterals:

2% preferred, 1% minimum if approved by the City Engineer or Director of Public Works.

Slope designed by Registered Civil Engineer and approved by the City Engineer.

Connections:

All connections shall be made in a method approved and inspected by the City Department of Public Works.

SECTION 10. STORM DRAIN DESIGN CRITERIA

SECTION 10.1 GENERAL CRITERIA:

Drainage design shall be in accordance with the latest Master Drainage Study for the City of Live Oak, Reclamation District No. 777, and Sutter County.

Design calculations and flow maps for all tributary areas shall be submitted in duplicate with improvement plans.

Topographic maps shall have adequate ground elevations and/or contours (maximum interval - 1 foot), adequate to define boundaries and slope of drainage basin.

Drainage basins are to be identified and correlated to calculations for that basin.

Data and calculations shall be complete and shall have reasonable clarity. Computer program results shall be fully annotated with legends and lists of input data used.

Diversions of all types shall be in strict accordance with applicable laws.

Placement of fills of any magnitude across an existing drainage course shall incorporate a means by which excess flows not handled by the design drainage system can flow overland via essentially the same course as prior to placing the fill across the drainage course without inundating or damaging any structure.

Rational Method: The following storm drain design criteria and the rainfall intensity-duration data presented in Appendix A shall be used with the rational method for calculating hydrologic and pipe and/or channel design characteristics, ie., size, type, slope, velocities and entrance, and outlet structures, etc.

Onsite and offsite underground storm drain systems, in addition to standard curbs and gutters, shall be required:

- To limit inlet spacing to 500 feet maximum.
- To eliminate valley gutters.
- To eliminate drainage flow across sidewalks, except on streets abutting single family residential development.
- To eliminate all concentrated discharges of drainage into the street.
- When the flow of water in the gutter, caused by storm water based on a 10-year storm design criteria, would extend more than eight feet from the face of curb or overtop the curb.

The type of drainage facility shall be selected on the basis of Master Drainage Study criteria.

The use of valley gutters on collector streets and arterial streets is not acceptable.

Concentrated drainage shall not be discharged to any City Street, unless specifically approved in advance by the City Engineer.

SECTION 10.2 DESIGN CRITERIA:

Building pads shall not be inundated during a 100-year frequency (1% probability) storm.

Traffic lanes shall not be inundated during a design frequency storm.

All existing streets shall be assumed to be constructed to ultimate standards.

All major drainage channels and natural streams shall be assumed to be constructed to ultimate standards.

Culverts shall be analyzed using a ponded (no velocity) condition upstream unless a definite channel exists or is proposed upstream. Inlet and outlet transition structures shall be provided to minimize entrance and exit losses.

Minimum size of proposed culverts shall be 12-inches in diameter.

Level of development as shown in the current City of Live Oak General Plan.

Recurrence Interval (Storm Frequency):

1. A frequency of ten years for areas less than forty acres and where the proposed drainage structure will not be placed in a natural or constructed sump. Culverts under moderate fills to pass a ten-year storm without static head, and under high fills to pass a 25-year storm with head; however, no damage due to ponding is to occur.
2. A 25-year frequency for areas larger than 40 acres and less than 160 acres. Culverts under moderate fills on collector and local streets are to pass a 25-year storm without static head, and under high fills to pass a 100-year storm with head; however, no damage due to ponding is to occur.
3. A 100-year frequency for areas larger than 160 acres, or where culverts are to be placed under high fills; where a sump condition exists and damage would result due to ponding and where major streets or a freeway are to be crossed. Culverts to pass 100-year storm with head; however, no damage due to ponding is to occur.

STORM FREQUENCY TABLE			
Drainage Area (Acres)	**Design Frequency**	**Culverts under moderate fills without head**	**Culverts under high fills with head**
0-40	10 yr.	10 yr.	25 yr.
40-160	25 yr.	25 yr.	100 yr.
>160	100 yr.*	100 yr.	100 yr.

*All major streets or highways, 100 years with head.

Design Time of Concentration:
For the undeveloped site, the overland flow portion of the time of concentration shall be determined with the following overland flow equation:

$$t_o = \frac{1.80\ (1.10 - C)\ (L^{0.50})}{S^{0.333}}$$

Where: t_o = Overland flow travel time in minutes.
C = Runoff coefficient used in the Rational Formula.
L = Length of overland flow path in feet.
S = Slope of overland flow path in percent.

For the developed site, the time of concentration shall be a combination of overland flow time, as determined by the above equation, and the flow time in gutters and/or pipes to the point being evaluated. However, the time of concentration need not be less than 10 minutes.

Design Runoff Coefficients:
Design runoff coefficients for use with the Rational Method shall be “weighted average” values for different surface permeabilities, using values compatible with the following representative values:

Unsaturated Agricultural Land	0.25
Landscaped Areas	0.30
Gravel Walks or Driveways (loose)	0.40
Saturated Agricultural Land	0.80
Compacted Aggregate Base	0.80
Asphalt or Concrete Surfaces	0.90
Roof Areas	0.95

Runoff rates used to determine storm runoff volumes shall include flows from public areas, including streets, sidewalks, driveways and landscape areas, as well as private areas including buildings, porches, patios, walkways, driveways and landscape areas.

Minimum Pipe Size:
Minimum pipe size shall be 12" diameter within City rights-of-way or if the City is to maintain.

Design Slope:
Storm drain pipe slopes should be designed to maintain a minimum velocity of 2 feet per second with the pipe flowing full.

Pipe Design Load:
D-Load criteria shall be used to design all pipes.

Vertical Alignment:
Match soffit elevations of different sized pipes (not flowline elevations).

Drainage Inlets and Manholes:
Drainage inlets and manholes shall be in accordance with Appendix C, “Standard Details”, and Appendix D, “Standard Technical Specifications”.

Drainage inlets shall be placed at return points, upstream from the intersection, whenever possible.

Manholes or junction drainage inlets are required:

- At changes of slope.
- At changes of pipe size.
- At changes of direction unless the design, as approved by the City Public Works Department, allows for large radius curves.
- Pipe intersections.

Maximum spacing of drainage inlets and manholes shall be 500 feet.

All drainage inlets and manholes shall be numbered on the plans.

SECTION 10.3 PIPE MATERIALS:

The material for storm drain pipes shall be:

1. Reinforced Concrete Pipe (RCP) - Class III minimum, Bell and Spigot, Rubber-Gasket Joint
2. Polyvinyl Chloride (PVC) Pipe - SDR 35, Bell and Spigot, Rubber-Gasket Joint
3. High Density Polyethylene (HDPE) Pipe - Watertight, Bell and Spigot, Rubber-Gasket Joint
4. Cast-In-Place Concrete Pipe (CIPCP) - only when approved by the City Engineer.

Precast RCP is required in all roadway areas unless top of pipe is more than 36" below subgrade.

For non-traffic areas (front yard, back yard, etc.) non-reinforced concrete pipe may be allowed.

Precast pipes 24" or larger in diameter may be laid on a horizontal curve. The radius of curve shall not be less than 300' unless special pipe joints with longer lips are used.

The use of cast-in-place concrete pipe shall be subject to the specific approval of the City Engineer, subject to the following minimum cover criteria:

CAST-IN-PLACE CONCRETE PIPE COVER REQUIREMENTS	
Depth from subgrade to top of pipe (Roadway Area)	**Cover**
0 - 12"	Not allowed.
12 - 36"	6" reinforced slab with 4" sand over pipe.
36" or more	No special requirement.

Cast-in-place concrete pipe may be laid on a curve as follows:

Pipe I.D. (inches)	Minimum Radius (feet)
24"	50'
30"	50'
36"	50'
42"	65'
48"	80'
54"	100'
60"	120'
72"	130'

SECTION 10.4 VALLEY GUTTERS:
Minimum slope across the valley gutter shall be 0.50%, and grade breaks will not be allowed. A minimum of three elevations will be required.

The difference in elevation between the top of the curb at the midpoint of the return and the flowline of valley gutter at the “elephant ear” shall not to exceed 1.0 foot.

Do not use a valley gutter if there is a storm drain to which water could be dropped in from above. The gutter is to carry water tributary from not more than 500' of street (or one block) whichever is shorter.

Do not use a valley gutter on arterial or collector streets.

SECTION 10.5 EXISTING CONSTRUCTED AGRICULTURAL DRAINS:
Existing constructed agricultural drains belonging to Reclamation District No. 777 adjoining the City shall be piped, improved, or graded and/or enlarged as necessary to carry the design flows listed in the Master Drainage Study at the design grade of the channel.

Headwalls and wingwalls shall be provided at each end of pipes or box culverts to minimize entrance and exit losses, and cleanout access structures shall be provided at intervals of 1,000 feet maximum.

The subdivider and/or contractor shall make all necessary downstream drainage improvements in accordance with the Master Drainage Study sufficient to carry the design flow for a 100-year frequency storm as shown in the Study without inundating the building pads within the subdivision. Complete, detailed hydraulic calculations prepared by a registered civil engineer shall be submitted to demonstrate compliance with this requirement, and shall be subject to the approval of the City Engineer.

Roadway crossings of existing ditches shall be a reinforced concrete pipe, box culvert, or slab bridge with headwalls and wingwalls, sized to carry the design flow of the ditch, at the design grade of the ditch. All crossings shall be subject to the approval of the City Engineer.

SECTION 11. STORM DRAINAGE DETENTION FACILITIES

SECTION 11.1 DESIGN OBJECTIVE:

The peak stormwater discharge flow rate from the gross area of the land development project site, and all tributary public rights-of-way, after full development during a 100-year (1% probability) design storm event of any duration shall not exceed the unit runoff rate for that drainage subshed as shown in the existing conditions hydrologic model of the City of Live Oak Master Drainage Study. Large, complicated or highly impervious developments will require a project specific model run to assess the project's impact on downstream water surface elevations (need to be determined on a case-by-case basis). The modeled water surface elevations in Reclamation District No. 777 shall not increase as a result of the project.

Design calculations and drawings shall be prepared by a registered civil engineer to demonstrate that this design objective is fulfilled. Calculations and drawings shall be site-specific for the proposed land development site, and shall be based upon actual construction conditions. (The improvements to be constructed must be hydraulically consistent with the design assumptions presented in the calculations.)

The property owner shall have the design engineer inspect the construction of the storm drainage detention facilities, and the engineer shall provide the City with reproducible "As-Built" plans for the improvements, together with his or her certification that the improvements were constructed in accordance with the approved design and that the completed facility will operate and function in accordance with the engineer's design. The required certification must be approved by the City Engineer.

SECTION 11.2 DESIGN STORM PARAMETERS:

The 100-year (1% probability) design storm events for the development site shall be based upon the rainfall intensity-duration data presented in Appendix A. The storm drainage detention facility shall have adequate storage capacity for a 100-year (1% probability) design storm event of any duration (not just for the time of concentration for the site) with adequate freeboard (1-foot minimum, unless otherwise approved), subject to the approval of the City Engineer.

SECTION 11.3 DESIGN TIME OF CONCENTRATION:

For the undeveloped site, the overland flow portion of the time of concentration shall be determined with the following overland flow equation:

$$t_o = \frac{1.80\,(1.10 - C)\,(L^{0.50})}{S^{0.333}}$$

Where: t_o = Overland flow travel time in minutes.
C = Runoff coefficient used with the Rational Method.
L = Length of overland flow path in feet.
S = Slope of overland flow path in percent.

For the developed site, the time of concentration shall be a combination of overland flow time, as determined by the above equation, and the flow time in gutters and/or pipes to the point being evaluated. However, the time of concentration need not be less than 10 minutes.

SECTION 11.4 DESIGN RUNOFF COEFFICIENTS:

Design runoff coefficients for use with the Rational Method shall be “weighted average” values for different surface permeabilities, using values compatible with the following representative values:

Unsaturated Agricultural Land	0.25
Landscaped Areas	0.30
Gravel Walks or Driveways (loose)	0.40
Saturated Agricultural Land	0.80
Compacted Aggregate Base	0.80
Asphalt or Concrete Surfaces	0.90
Roof Areas	0.95

Runoff rates used to determine storm runoff detention volumes shall include flows from public areas, including streets, sidewalks, driveways and landscape areas, as well as private areas including buildings, porches, patios, walkways, driveways and landscape areas.

SECTION 11.5 DETENTION FACILITIES OUTFLOW RATES:

The outflow rate used to design the detention facility shall be the rate actually flowing from the facility under design conditions. The maximum allowable discharge rate shall only be used when the design calculations demonstrate that this flow rate will be achieved by the facility as constructed.

NOTE: Many computer programs used to calculate required detention volumes assume uniform outflow at the maximum allowable rate. If used, this assumption must be confirmed by the design calculations for the proposed physical construction.

Adequate provisions shall be included in the detention facilities design to accommodate overflows of the detention facilities from storms of greater intensity than the design storm, or for malfunction of the detention facilities, and for discharge of the water without damaging structures or property.

SECTION 11.6 DETENTION BASIN DESIGN FEATURES:

Surface impoundments used for storm water detention and/or storage shall have adequate security fencing to control access, while providing adequate clearance for maintenance.

Side slopes of impoundments shall not exceed 2:1, or the maximum slope recommended by a site-specific soils report, whichever is flatter. Adequate erosion control materials shall be provided to ensure the stability of the banks. Adequate freeboard (1-foot minimum, unless otherwise approved by the City Engineer) shall be provided.

Surface impoundments with a least dimension of the top width greater than twenty feet, as well as impoundments which do not have adequate clearance on the tops of the banks for maintenance equipment, shall include ramps to facilitate equipment access to the bottom of the basin for maintenance.

The basin and all appurtenances shall be designed to minimize standing water which may promote mosquito breeding.

SECTION 11.7 ASSURANCE OF LONG-TERM OPERATION:

All storm drainage detention facilities shall be constructed to ensure reliable long-term operation. Facilities serving more than one parcel of land shall be located on easements or rights-of-way dedicated to a public agency. Provision shall be made for the assessment of operation and maintenance fees to the parcels served by the facility to pay the full cost of operating and maintaining the detention facilities. (The estimated cost shall be approved by the City Engineer, and the maximum allowable fee or assessment must be sufficient for public agency operation and maintenance of the facilities in case of default by the designated maintenance authority.) If it is necessary to form a special assessment district to facilitate collection of operation and maintenance costs, the property owner and/or the subdivider proposing the special assessment district will be responsible for formation of the district.

Facilities serving one parcel only shall be located on a public easement or right-of-way, or the property owner shall enter into an agreement with the City (acceptable to the City Attorney) that requires the property owner to maintain the detention facilities in perpetuity. Said agreement shall be recorded, and shall run with the land.

SECTION 11.8 MODIFICATION OF EXISTING DETENTION FACILITIES:

The alteration or modification of an existing storm drainage detention facility shall be subject to the same design requirements as for construction of a new facility.

SECTION 11.9 EXCEPTIONS FROM THE STORM DRAINAGE DETENTION REQUIREMENTS:

Only the following development situations will be exempt from full compliance with these storm drainage detention requirements:

A. Parcels tributary to existing storm drainage detention facilities, when the proposed project or improvement is consistent with the design parameters used for the design of the detention facilities.
B. Parcels tributary to existing City storm drainage facilities which provide flow restriction and/or detention within the City, and the proposed project or improvement will not increase the peak rate of flow discharged from the City storm drainage system, if approved by the City Engineer.
C. Residentially zoned parcels:
    1. Existing undeveloped residential parcels which were legally created before January 1, 2002.
    2. Existing developed residential parcels when the proposed improvements will not cumulatively increase the structural coverage by more than 500 square feet from the structural coverage which existed on January 1, 2002.
D. Commercial or Industrially zoned parcels:
    1. Alteration, modification, improvement or change that will not increase the computed composite “C” value (runoff coefficient) by more than 5% from the computed composite “C” value for the conditions that existed on the site on January 1, 2002.

APPENDIX A

RAINFALL INTENSITY-DURATION DATA

APPENDIX A

APPENDIX A

CITY OF LIVE OAK

RAINFALL INTENSITY-DURATION DATA

T_d MINS.	I(10) INS./HR.	I(25) INS./HR.	I(50) INS./HR.	I(100) INS./HR.	T_d MINS.
10	2.104	2.630	2.893	3.156	10
11	1.991	2.489	2.738	2.987	11
12	1.893	2.366	2.603	2.840	12
13	1.807	2.259	2.485	2.711	13
14	1.731	2.164	2.380	2.597	14
15	1.663	2.079	2.287	2.495	15
16	1.602	2.003	2.203	2.403	16
17	1.547	1.933	2.127	2.320	17
18	1.496	1.870	2.057	2.245	18
19	1.450	1.813	1.994	2.175	19
20	1.408	1.760	1.936	2.111	20
21	1.368	1.710	1.882	2.053	21
22	1.332	1.665	1.831	1.998	22
23	1.298	1.623	1.785	1.947	23
24	1.266	1.583	1.741	1.900	24
25	1.237	1.546	1.701	1.855	25
26	1.209	1.511	1.662	1.813	26
27	1.183	1.478	1.626	1.774	27
28	1.158	1.448	1.592	1.737	28
29	1.135	1.418	1.560	1.702	29
30	1.113	1.391	1.530	1.669	30
31	1.092	1.365	1.501	1.638	31
32	1.072	1.340	1.474	1.608	32
33	1.053	1.316	1.448	1.579	33
34	1.035	1.293	1.423	1.552	34
35	1.017	1.272	1.399	1.526	35

APPENDIX A

CITY OF LIVE OAK

RAINFALL INTENSITY-DURATION DATA

T_d MINS.	I(10) INS./HR.	I(25) INS./HR.	I(50) INS./HR.	I(100) INS./HR.	T_d MINS.
36	1.001	1.251	1.376	1.502	36
37	0.985	1.232	1.355	1.478	37
38	0.970	1.213	1.334	1.455	38
39	0.956	1.194	1.314	1.433	39
40	0.942	1.177	1.295	1.412	40
41	0.928	1.160	1.276	1.392	41
42	0.915	1.144	1.259	1.373	42
43	0.903	1.129	1.242	1.354	43
44	0.891	1.114	1.225	1.337	44
45	0.879	1.099	1.209	1.319	45
46	0.868	1.085	1.194	1.303	46
47	0.858	1.072	1.179	1.286	47
48	0.847	1.059	1.165	1.271	48
49	0.837	1.046	1.151	1.256	49
50	0.827	1.034	1.138	1.241	50
51	0.818	1.022	1.125	1.227	51
52	0.809	1.011	1.112	1.213	52
53	0.800	1.000	1.100	1.200	53
54	0.791	0.989	1.088	1.187	54
55	0.783	0.979	1.076	1.174	55
56	0.775	0.968	1.065	1.162	56
57	0.767	0.959	1.054	1.150	57
58	0.759	0.949	1.044	1.139	58
59	0.752	0.940	1.033	1.127	59

APPENDIX A

CITY OF LIVE OAK

RAINFALL INTENSITY-DURATION DATA

T_d HRS.	I(10) INS./HR.	I(25) INS./HR.	I(50) INS./HR.	I(100) INS./HR.	T_d HRS.
1	0.744	0.930	1.023	1.116	1
2	0.498	0.622	0.685	0.747	2
3	0.394	0.492	0.541	0.590	3
4	0.333	0.416	0.458	0.500	4
5	0.293	0.366	0.402	0.439	5
6	0.263	0.329	0.362	0.395	6
7	0.241	0.301	0.331	0.361	7
8	0.223	0.279	0.306	0.334	8
9	0.208	0.260	0.286	0.312	9
10	0.196	0.245	0.269	0.294	10
11	0.185	0.232	0.255	0.278	11
12	0.176	0.220	0.242	0.264	12
13	0.168	0.210	0.231	0.252	13
14	0.161	0.201	0.221	0.242	14
15	0.155	0.193	0.213	0.232	15
16	0.149	0.186	0.205	0.224	16
17	0.144	0.180	0.198	0.216	17
18	0.139	0.174	0.191	0.209	18
19	0.135	0.169	0.186	0.202	19
20	0.131	0.164	0.180	0.196	20
21	0.127	0.159	0.175	0.191	21
22	0.124	0.155	0.170	0.186	22
23	0.121	0.151	0.166	0.181	23
24	0.118	0.147	0.162	0.177	24

APPENDIX A

LIVE OAK RAINFALL INTENSITIES

Rainfall Intensity/Duration Equations:
The following equations are good approximations of the plotted data from the Wheatland Gage, which is the basis for the data in the Live Oak Improvement Standards.

$I_{100} = 12.0 (T^{-0.58})$

$I_{50} = 11.0 (T^{-0.58})$

$I_{25} = 10.0 (T^{-0.58})$

$I_{10} = 8.0 (T^{-0.58})$

"I" is in Inches/Hour

"T" is in Minutes (For T_c or T_d)

APPENDIX B

MASTER
TREE LIST

APPENDIX B

CITY OF LIVE OAK DEPARTMENT OF PUBLIC WORKS

MASTER TREE LIST

NAME	SIZE	RATE OF GROWTH	ROOT SYSTEM	PESTS & DISEASES	CARE	REMARKS
A. EVERGREENS						
1. HOLLY OAK (quereus ilix)	h = 25' to 50' b = 20' to 40'	Moderate	Deep	Susceptible to caterpillars, mites, thrips (host)	Fall pruning to remove suckers, spray	Selected, upright forms
2. CAMPHOR TREE (cinnamomum camphore)	h = 20' to 40' b = 30' to 50'	Slow	Shallow	Relatively free	Prune when young, water well to root	10' parkways or 8' from sidewalk
3. JAPANESE PRIVET (liqustrum lucidum)	h = 20' to 30' b = 20' to 30'	Rapid	Deep	Scale	Prune when young and annually to shape	Excellent hedge
4. SOUTHERN MAGNOLIA (magnolia grandiflora samuel summer or St. Marys)	h = 40' to 60' b = 40' to 55'	Moderate	Deep	Relatively free	Deep water monthly, prune when young, fertilize	
B. DECIDUOUS						
* 1. PURPLE LEAF PLUM (prunus bi)	h = 10' to 20' b = 8' to 15'	Rapid	Average	Relatively disease free, aphids	Prune, water spray for aphids	
2. RED HORSE CHESTNUT (aesculis carnea briot)	h = 30' to 40' b = 20' to 30'	Moderate	Average	Some aphids	Prune when young	
3. MAIDENHAIR TREE (ginko biloba, autumn gold, fairmount)	h = 50' to 70' b = 30' to 50'	Moderate	Deep	Relatively free	Little or no pruning, heavy water	An excellent tree
* 4. EUROPEAN WHITE BARK BIRCH (betula vercucasa)	h = 20' to 40' b = 12' to 20'	Rapid	Deep	Bronze birch borers, aphids	Little or no pruning, spray	Beautiful, borers may kill
* 5. CUTLEAF WEEPING BARK BIRCH (betula dalicarlica)	h = 20' to 40' b = 12' to 20'	Rapid	Deep	Bronze birch borers, aphids	Little or no pruning, spray	Beautiful, borers may kill
* 6. GOLDENRAIN TREE (koelreuteria paniculata)	h = 20' to 35' b = 15' to 20'	Rapid	Deep	Relatively free	Little or no pruning, good drainage	
* 7. SAWLEAF ZELKOVA (zelkova serrata)	h = 30' to 50' b = 30' to 50'	Rapid	Shallow	Relatively free, scale	Prune, spray	10' parkway
* 8. CHINESE PISTACHIO (pistachio chinensis)	h = 30' to 50' b = 30' to 50'	Moderate	Deep	Relatively free	Prune when young	Excellent street tree
* 9. SCHWEDLERI MAPLE (acer platenoides schwedleri)	h = 25' to 50' b = 20' to 50'	Rapid	Deep	Relatively free	Annual prune, spray aphids, water monthly	Good street tree
* 10. NORWAY MAPLE (acer platenoides)	h = 25' to 50' b = 30' to 50'	Rapid	Deep	Relatively free	Annual pruning, water monthly	
* 11. LITTLE LEAF LINDEN (tilia cordata)	h = 40' to 60' b = 30' to 50'	Rapid	Deep	Relatively free, aphids	Prune, spray for aphids, water plentifully	Excellent street tree
12. AMERICAN LINDEN (tilia americana)	h = 40' to 60' b = 30' to 50'	Rapid	Deep	Relatively free, aphids	Prune, plenty of water, spray	Excellent street tree
13. CREPE MYRTLE (lagerstroemia indica)	h = 15' to 25' b = 15' to 20'	Moderate	Shallow	Relatively free, aphids	Prune annually, water monthly, spray	May mildew during damp weather
14. SCARLETT OAK, RED OAK (quercus coccinea, borealis)	h = 60' to 80' b = 50' to 65'	Moderate	Deep with laterals	Relatively free, scale & caterpillars infest	Prune when young, spray for scale	Difficult to transplant
15. EUROPEAN HACKBERRY (celtis australis)	h = 30' to 50' b = 20' to 30'	Moderate	Average	Relatively free	Little pruning, stands neglect	Excellent street tree
16. CHINESE PAGODA (sophera japonica)	h = 20' to 30' b = 20' to 40'	Slow	Deep	Relatively free	Little pruning, water deep	Excellent street tree
17. SHADEMASTER HONEY LOCUST (gladitsia triacanthos inermis)	h = 30' to 40' b = 20' to 30'	Rapid	Deep and spreading	Relatively free	Prune to lighten crown	Drops pods in winter otherwise good
18. TULIP TREE (liriodendren tulipifera)	h = 50' to 70' b = 25' to 35'	Rapid	Deep and spreading	Relatively free, scale & aphids	Prune when young, water deeply, spray	

* NOTE: Only these trees may be planted near electric utility wires.

APPENDIX B

APPENDIX C

STANDARD DETAILS

APPENDIX C

APPENDIX C

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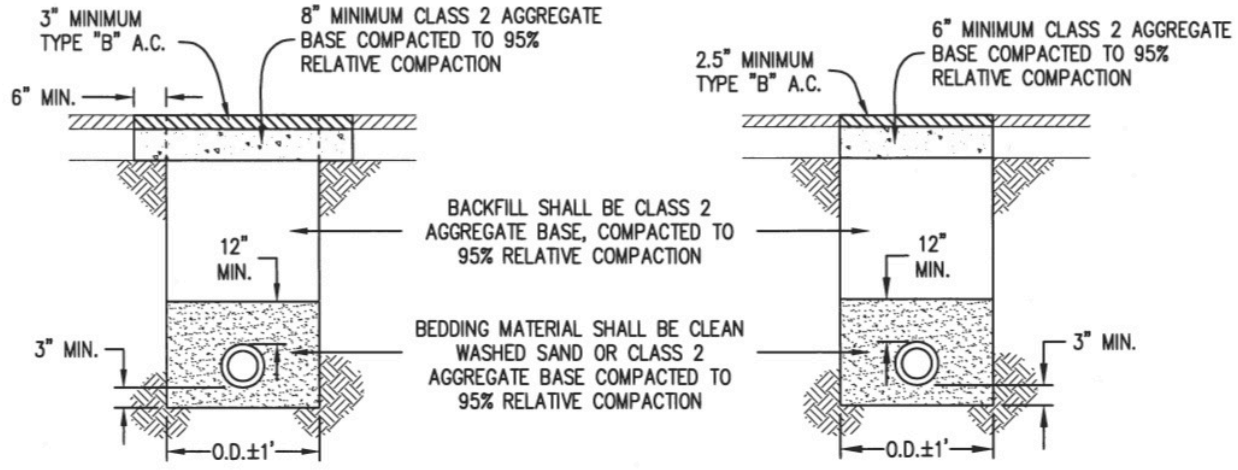
APPENDIX C

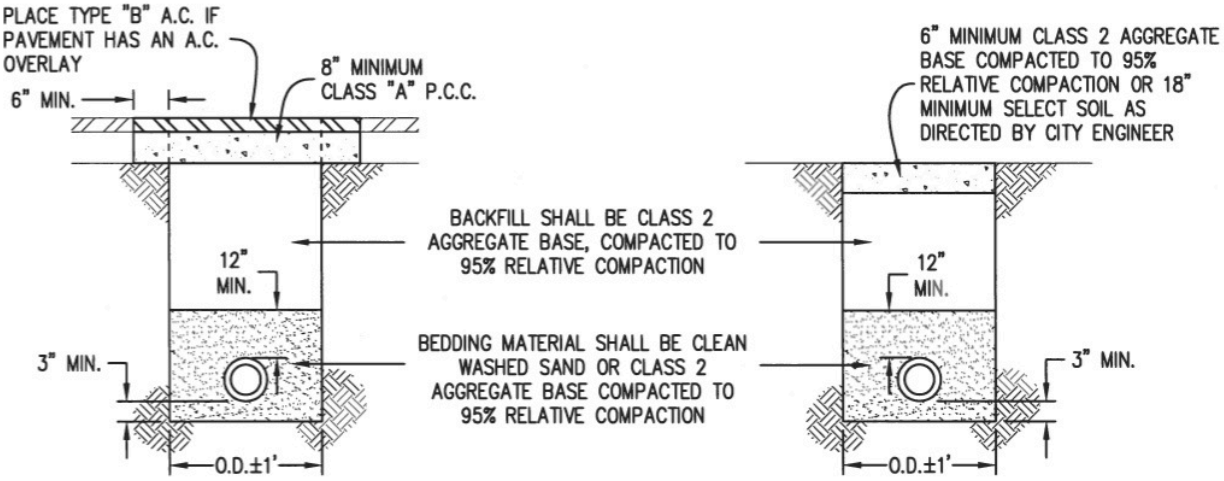


TYPE "A"

IMPROVED ASPHALTIC CONCRETE OR PLANT-MIX CONCRETE

TYPE "B"

IMPROVED ARMOR COAT OR SEAL COAT STREETS



TYPE "C"

PORTLAND CEMENT CONCRETE STREETS

TYPE "D"

UNIMPROVED STREETS ALLEYS OR EASEMENTS

CONSTRUCTION MATERIALS AND NOTES

1. TYPE "A" & "C" TRENCHES REQUIRE (2) TWO CUTS; FIRST CUT INITIAL TRENCH WIDTH, THEN AFTER WORK HAS BEEN COMPLETED, SAW CUT 6" WIDER ON BOTH SIDES. EDGES OF ALL EXISTING ASPHALT SHALL BE TACKED WITH SS-1 EMULSION.
2. TYPE "A" & "C" TRENCHES REQUIRE PLACEMENT AND MAINTENANCE OF TEMPORARY PAVEMENT (SC-800 COLD MIX) UNTIL PLACEMENT OF PERMANENT PAVING UNLESS OTHERWISE DIRECTED BY PUBLIC WORKS.
3. STRUCTURAL SECTION THICKNESS SHOWN IS MINIMUM ALLOWABLE. GREATER THICKNESS OF STRUCTURAL SECTION MAY BE REQUIRED BY CITY ENGINEER IF EXISTING STRUCTURAL SECTION EXCEEDS THESE MINIMUMS.
4. ALL TRENCH WORK 5' AND DEEPER SHALL HAVE APPROVED SHORING, ALL IN ACCORDANCE WITH OSHA AND CALIFORNIA INDUSTRIAL SAFETY REGULATIONS.
5. PERMITTEE IS REQUIRED TO NOTIFY DEPARTMENT OF PUBLIC WORKS, 695-3436, 24 HOURS PRIOR TO THE CLOSING OF ANY LIVE OAK CITY STREET. ALL WORK DONE WITHIN CITY STREET RIGHT-OF-WAY SHALL REQUIRE AN ENCROACHMENT PERMIT.

BACKFILL & TRENCH RESTORATION

DATE	REVISIONS	BY

CITY OF LIVE OAK

STANDARD DETAIL

101

Scott R. Ruble APPROVED 10/7/15 DATE

FIG - 1

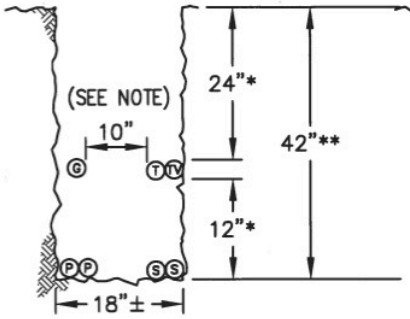


FIG - 2

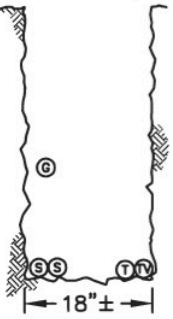


FIG - 3

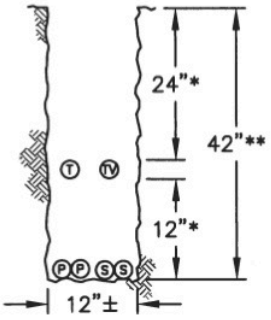
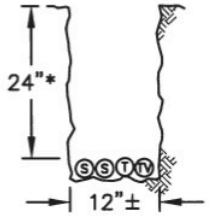


FIG - 4



LEGEND

- (G) — GAS
- (P) — ELECT. PRIMARIES
- (S) — ELECT. SECONDARIES
- (T) — TELEPHONE
- (TV) — TELEVISION

NOTE

SEPARATION MAY BE REDUCED TO NOT LESS THAN 6" WHEN NECESSARY, INSTEAD OF INCREASING TRENCH WIDTH.

* – INCREASE TO 30" IN STREET AREA
** – INCREASE TO 48" IN STREET AREA

TYPICAL SIDEWALK & STREET JOINT TRENCH CONFIGURATIONS

JOINT TRENCH OCCUPANCY GUIDE

SECT.	(G)	(P)	(S)	(T)	(TV)	FIG.
A	X	X	12" Trench Width			1
B	X	X	X	12" Trench Width		1
C	X	X	X	X		1
D	X	X		X		1
E	X		X	12" Trench Width		1
F	X		X	X		2
G	X	X			X	1
H	X		X		X	2
I	X			X		1

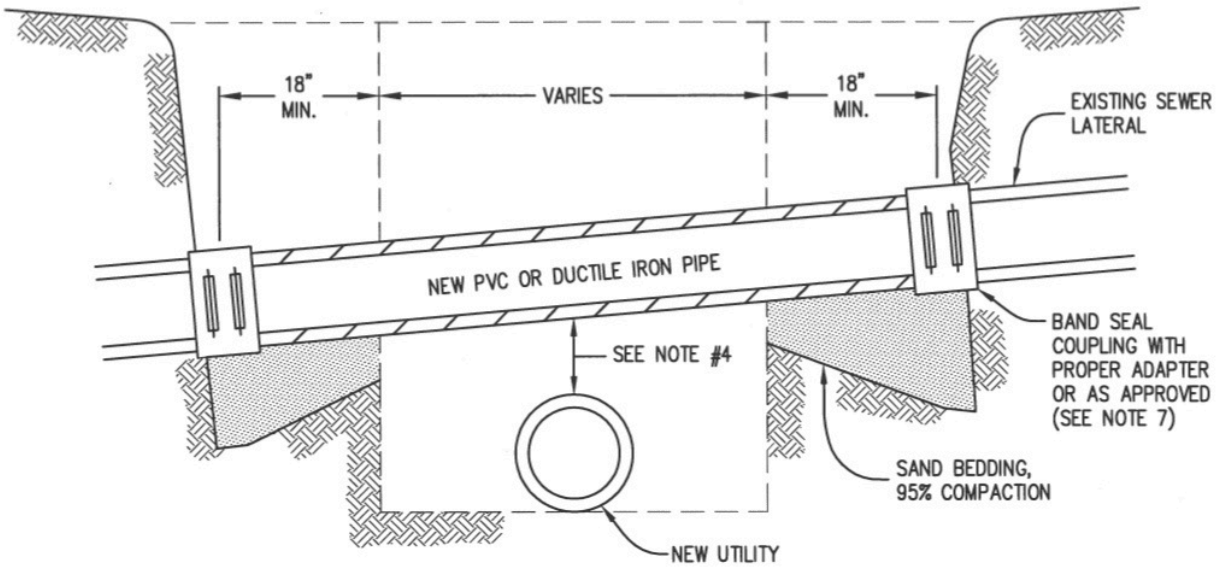
SECT.	(G)	(P)	(S)	(T)	(TV)	FIG.
J	X			X	X	1
K	X				X	1
L		X	X	36" Min. Cover		3
M		X	X	X		3
N		X		X		3
P		X		X	X	3
Q		X	X		X	3
R		X			X	3
S			X	X		4

SECT.	(G)	(P)	(S)	(T)	(TV)	FIG.
T			X		X	4
U				X	X	4
V	X	X	X	X	X	1
W	X		X	X	X	2
X		X	X	X	X	3
Y			X	X	X	4

JOINT TRENCH CONFIGURATIONS FOR UTILITY COMPANIES

DATE	REVISIONS	BY

CITY OF LIVE OAK
STANDARD DETAIL
102
APPROVED 10/7/15 DATE



CONSTRUCTION MATERIALS AND NOTES

1. THIS STANDARD DETAIL SHALL BE USED IF THE EXISTING SEWER LATERAL IS DAMAGED DURING INSTALLATION OF A NEW UTILITY.
2. INSIDE DIAMETER OF PIPE TO BE THE SAME AS THE PIPE TO WHICH IT CONNECTS.
3. ALTERATIONS OF SEWER GRADES WILL BE PERMITTED ONLY AFTER PERMISSION HAS BEEN RECEIVED FROM THE CITY ENGINEER.
4. MINIMUM CLEARANCE BETWEEN AN EXISTING SEWER LATERAL AND A NEW WATER PIPE SHALL BE 12". MINIMUM CLEARANCE BETWEEN AN EXISTING SEWER LATERAL AND ALL OTHER NEW UTILITIES SHALL BE 3".
5. IF THE NEW UTILITY IS A WATER PIPE, CENTER AN 18 FOOT LENGTH OF PIPE WITH NO JOINTS UNDER THE EXISTING SEWER LATERAL.
6. TRIM THE END OF THE SEWER LATERAL TO A CLEAN CUT UNDAMAGED END WITH MECHANICAL PIPE CUTTER.
7. BAND SEAL COUPLING SHALL HAVE STAINLESS STEEL SHEAR RING. ROMAC LSS SEWER CLAMP OR APPROVED EQUAL.

SEWER LATERAL CROSSING

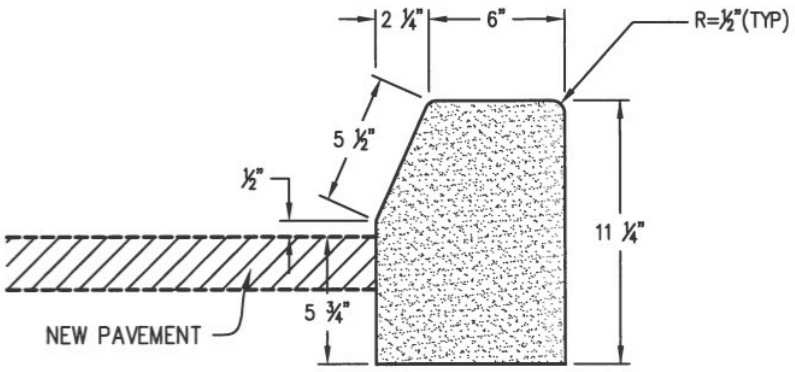
DATE	REVISIONS	BY

CITY OF LIVE OAK

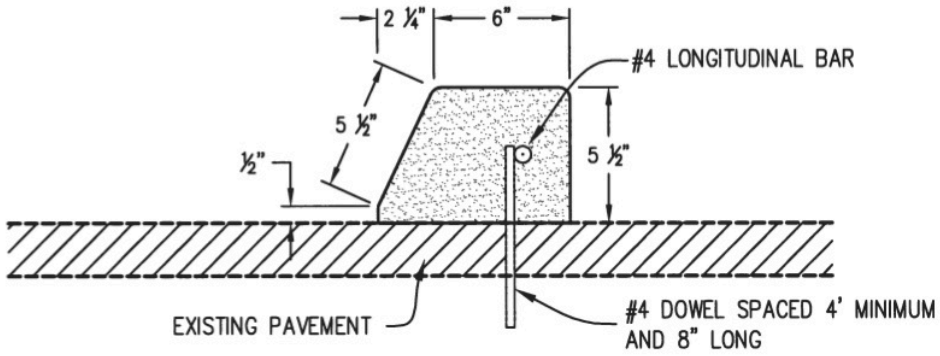
STANDARD DETAIL

103

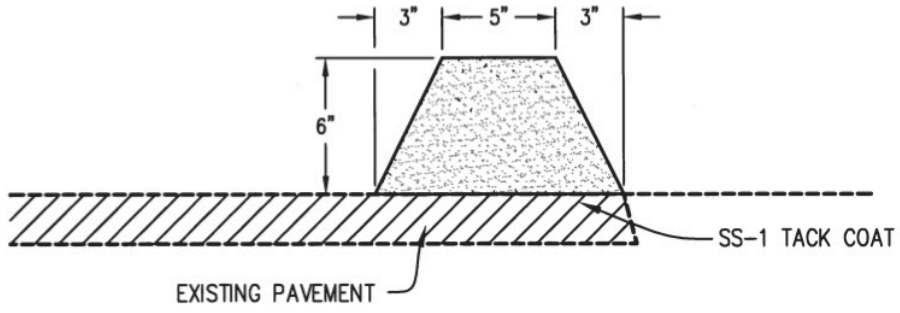
APPROVED — DATE 10/7/15



6" P.C.C. CURB (TYPE A)



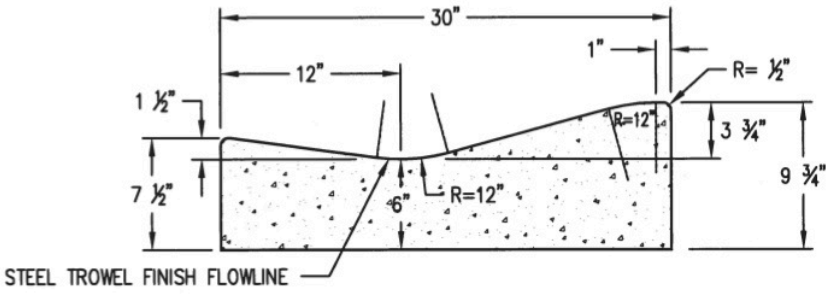
6" P.C.C. CURB (TYPE B)



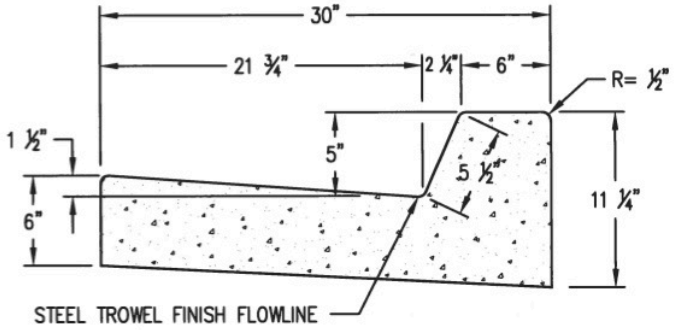
6" A.C. DIKE

			CITY OF LIVE OAK
			STANDARD DETAIL
			201
DATE	REVISIONS	BY	APPROVED 10/7/15 DATE

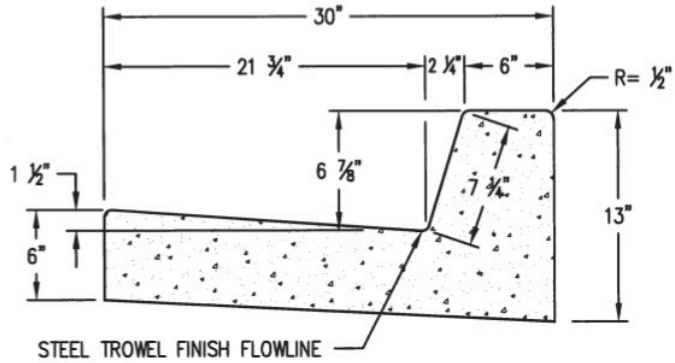
6" CURB AND 6" ASPHALT DIKE



ROLLED CURB



5" BARRIER CURB



7" BARRIER CURB

CURB & GUTTER

DATE	REVISIONS	BY

CITY OF LIVE OAK

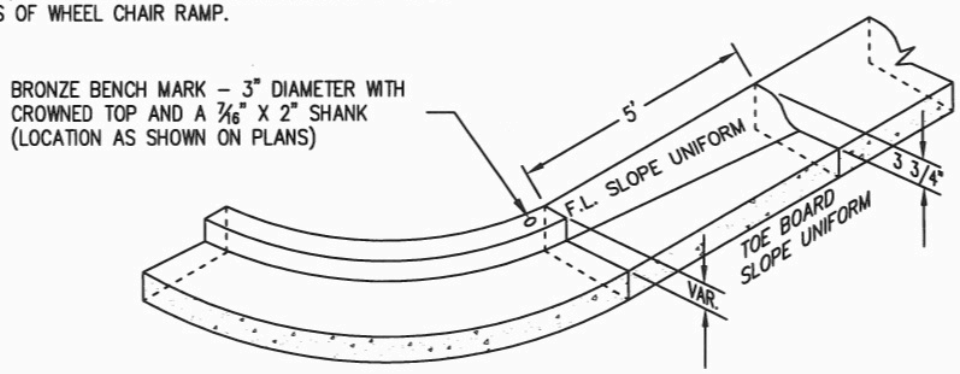
STANDARD DETAIL

202

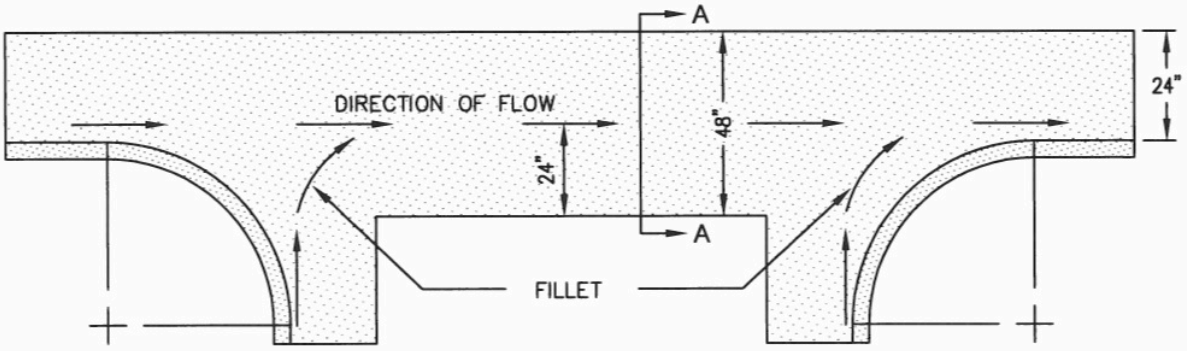
APPROVED — DATE: 10/7/15

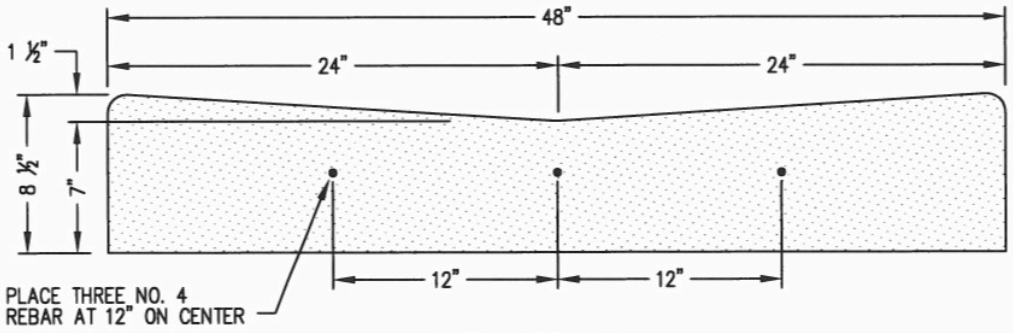
NOTE

VERTICAL CURB & GUTTER TO BE USED AT ALL CURB RETURNS WITH ¼" EXPANSION JOINT AT BOTH ENDS OF CURB RETURN AND EDGES OF WHEEL CHAIR RAMP.



BARRIER C & G TO ROLLED C & G TRANSITION





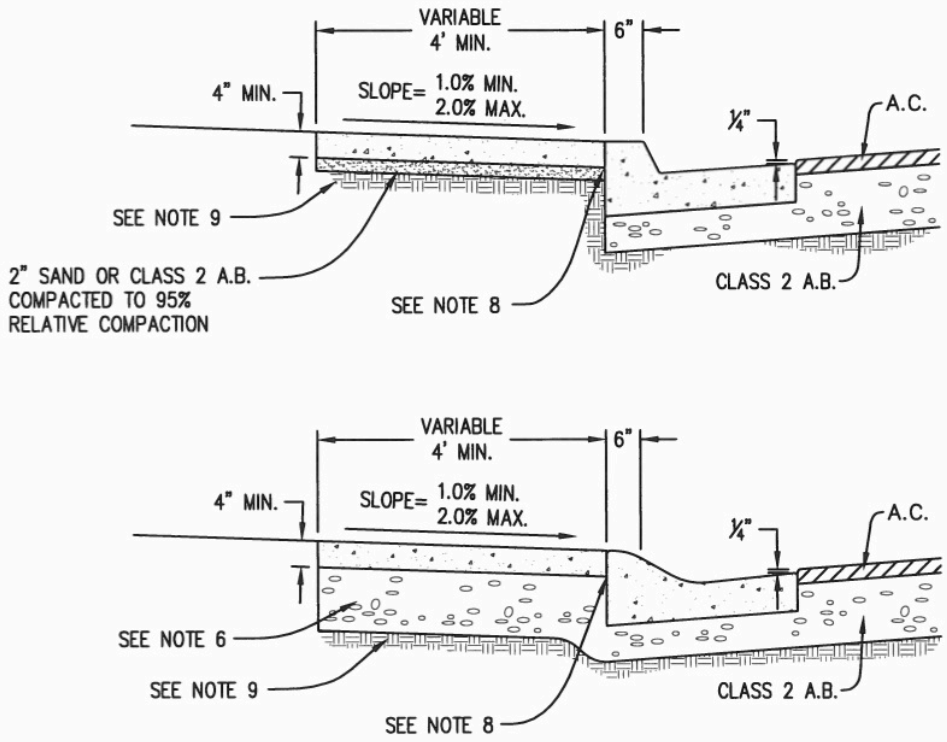
SECTION A-A

CROSS GUTTER

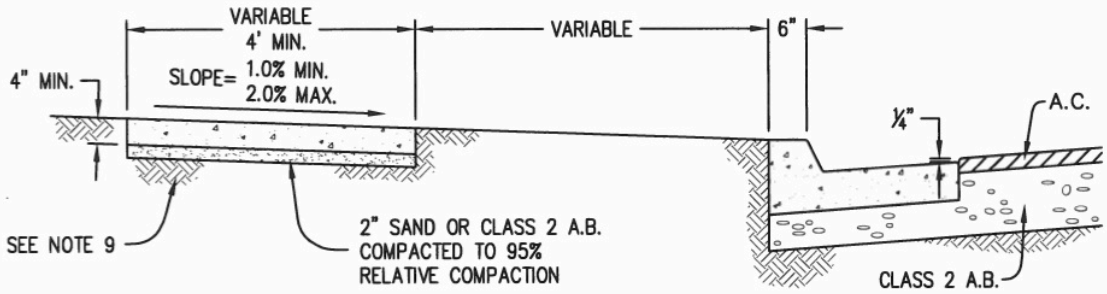
CITY OF LIVE OAK
STANDARD DETAIL
203
APPROVED 10/7/15 DATE

CURB & GUTTER

DATE	REVISIONS	BY

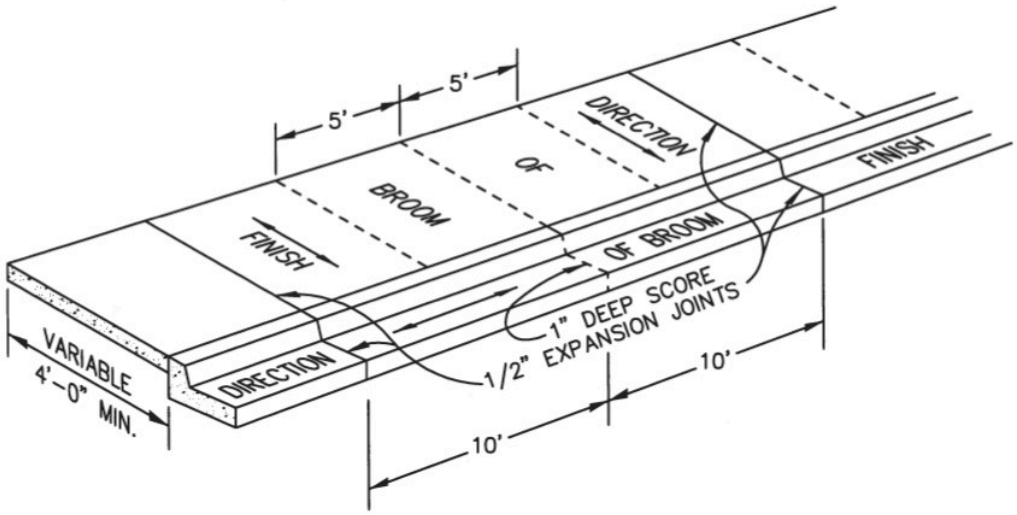


CONTIGUOUS TYPE



PARKWAY TYPE

			CITY OF LIVE OAK
			STANDARD DETAIL
SIDEWALKS CURB & GUTTER			204A
DATE	REVISIONS	BY	APPROVED 10/7/15 DATE



TYPICAL SIDEWALK SCORE LINES

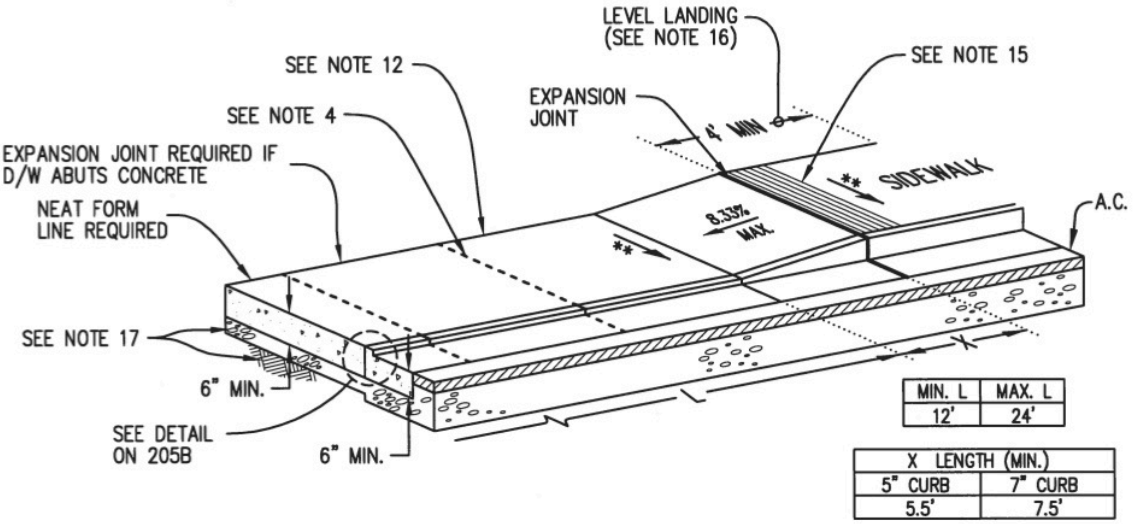
CONSTRUCTION MATERIALS AND NOTES

1. ALL CONCRETE SHALL BE CLASS B P.C.C. WITH LAMPBLACK OF APPROVED QUALITY ADDED AT THE RATE OF 0.5 POUNDS PER CUBIC YARD.
2. 1/2 INCH, PRE-MOLDED JOINT FILLER SHALL BE INSTALLED IN EXPANSION JOINTS AT REGULAR INTERVALS NOT EXCEEDING 20 FEET, AT THE BEGINNING AND END OF ALL CURB RETURNS AND AT THE END OF ALL DRIVEWAYS, AND SHALL BE FULL-DEPTH AND COMPLETELY FILL THE JOINT.
3. A MINIMUM OF 2 INCHES OF SAND, OR CLASS 2 AGGREGATE BASE, TO BE PLACED UNDER THE SIDEWALK. (SEE NOTE 6 BELOW)
4. ALL WORK DONE AND ALL MATERIALS SUPPLIED SHALL CONFORM TO THE CITY OF LIVE OAK IMPROVEMENT STANDARDS.
5. THE CONTRACTOR SHALL NOTIFY THE CITY ENGINEER FOR INSPECTION AT LEAST 24 HOURS PRIOR TO PLACING CONCRETE.
6. FOR SIDEWALK ABUTTING ROLLED CURB AND GUTTER, THE THICKNESS OF AGGREGATE BASE UNDER THE SIDEWALK SHALL BE THE SAME AS THE THICKNESS PLACED UNDER THE STREET PAVEMENT.
7. EXPANSION JOINTS IN SIDEWALK SHALL BE ADJACENT TO EXPANSION JOINT IN CURB AND GUTTER.
8. PROVIDE COLD JOINT AT BACK OF CURB. IF MONOLITHIC CONSTRUCTION IS APPROVED BY THE CITY ENGINEER, PROVIDE 1" DEEP SCORE AT BACK OF CURB.
9. SUBGRADE UNDER SIDEWALK COMPACTED TO 92% RELATIVE COMPACTION.

CITY OF LIVE OAK		
STANDARD DETAIL		
204B		
Scott R. Ruble 10/7/15 APPROVED DATE		

SIDEWALKS CURB & GUTTER

DATE	REVISIONS	BY

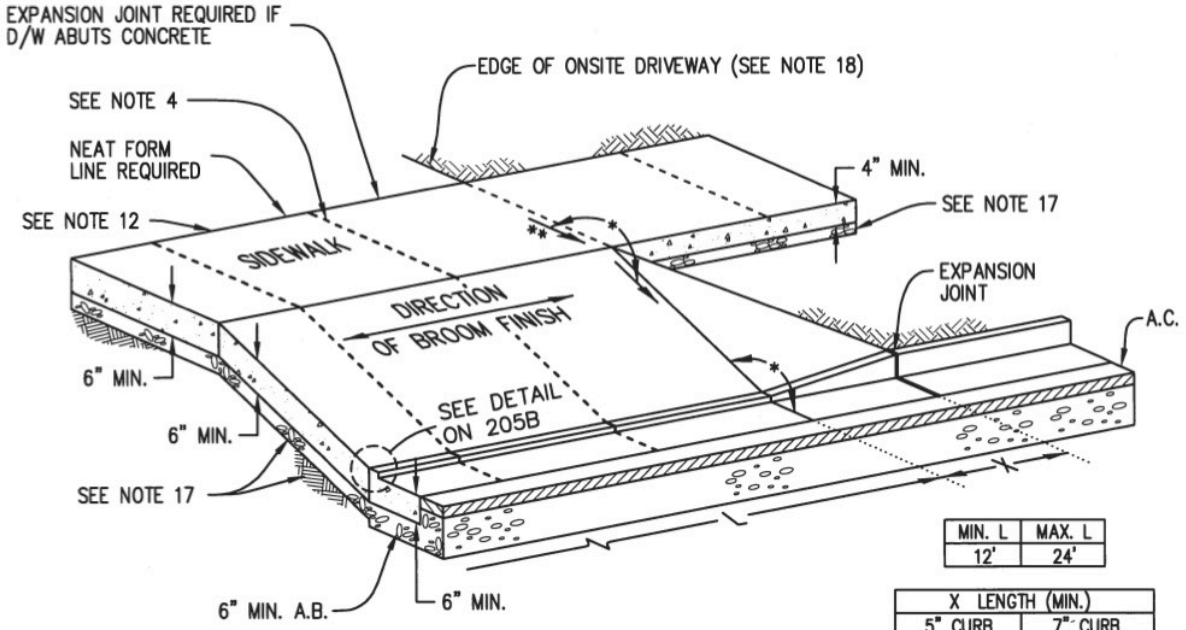


MIN. L	MAX. L
12'	24'

X LENGTH (MIN.)	
5" CURB	7" CURB
5.5'	7.5'

** SIDEWALK SLOPE SHALL BE A MINIMUM OF 1.0% AND SHALL NOT EXCEED 2.0%

CONTIGUOUS SIDEWALK



MIN. L	MAX. L
12'	24'

X LENGTH (MIN.)	
5" CURB	7" CURB
5'	7'

* MAX. ALGEBRAIC DIFFERENCE OF 14.5% UNLESS APPROVED BY THE CITY ENGINEER
** SIDEWALK SLOPE SHALL BE A MINIMUM OF 1.0% AND SHALL NOT EXCEED 2.0%

PARKWAY SIDEWALK

RESIDENTIAL DRIVEWAY

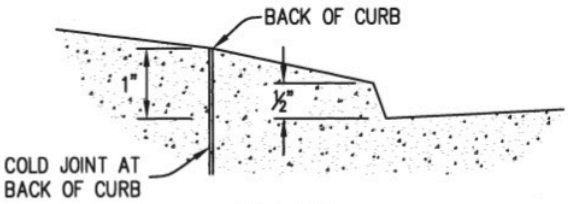
DATE	REVISIONS	BY

CITY OF LIVE OAK

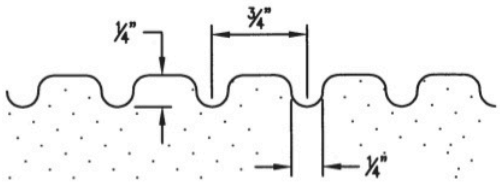
STANDARD DETAIL

205A

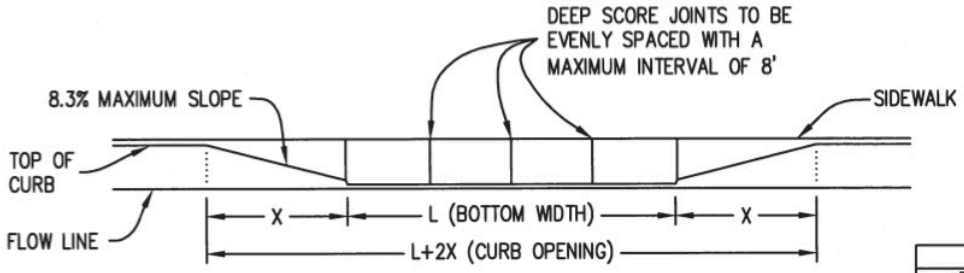
APPROVED — DATE 10/7/15



DETAIL



GROOVED BORDER
N.T.S.



ELEVATION

MIN. L	MAX. L
12'	24'

X LENGTH (MIN.)	
5" CURB	7" CURB
5.5'	7.5'

CONSTRUCTION MATERIALS AND NOTES

1. ALL WORK TO BE DONE AND ALL MATERIALS TO BE SUPPLIED SHALL CONFORM TO THE CITY OF LIVE OAK PUBLIC WORKS IMPROVEMENT STANDARDS.
2. ALL CONCRETE SHALL BE CLASS B P.C.C. WITH LAMPBLACK OF APPROVED QUALITY ADDED AT A RATE OF 0.5 POUNDS PER CUBIC YARD.
3. THE AREA INCLUDED WITHIN THE SLOPES OF THE DRIVEWAY SHALL BE GIVEN A HEAVY BROOM FINISH AFTER BEING TROWELED.
4. SCORING LINES SHALL CORRESPOND WITH SCORING LINES IN THE ADJACENT SIDEWALK UNLESS OTHERWISE SPECIFIED. CONTROL JOINTS SHALL EXTEND FROM LIP OF GUTTER TO THE BACK OF SIDEWALK UNLESS OTHERWISE SPECIFIED. CONTROL JOINTS SHALL BE EVENLY SPACED AND NOT EXCEED 8 FOOT INTERVALS.
5. TOP OF LIP AT THE FLOWLINE TO BE TROWELED STRAIGHT AND TRUE.
6. WHERE CURB IS EXISTING AND NO DEPRESSION HAS BEEN PROVIDED, THE EXISTING CURB SHALL BE REMOVED TO THE FIRST EXPANSION JOINT BEYOND EITHER SIDE.
7. WHERE AN EXISTING SIDEWALK IS IN PLACE, IT SHALL BE REMOVED TO THE FIRST EXPANSION JOINT BEYOND EITHER SIDE.
8. ALLEY CURB DEPRESSIONS MAY BE INCORPORATED AS PART OF THE DRIVEWAY ONLY WHEN APPROVED BY THE CITY ENGINEER.
9. DRIVEWAYS SHALL NOT BE CONSTRUCTED CLOSER THAN 20 FEET TO THE STREET CURB RETURNS UNLESS APPROVED BY THE CITY ENGINEER.
10. THE MINIMUM LENGTH OF FULL HEIGHT CURB BETWEEN DRIVEWAYS ON THE SAME LOT SHALL BE 24 FEET.
11. THE MINIMUM LENGTH OF FULL HEIGHT CURB BETWEEN DRIVEWAYS ON ADJACENT LOTS SHALL BE 6 FEET.
12. ONSITE GRADING MAY BE REQUIRED TO ELIMINATE EXCESSIVE GRADE CHANGE AND TO MAINTAIN SUITABLE DRAINAGE.
13. MAXIMUM CURB OPENING MAY BE INCREASED DUE TO SPECIAL CONDITIONS WITH APPROVAL OF THE CITY ENGINEER.
14. DRIVEWAY APPROACH SHALL BE POURED SEPARATELY FROM CURB UNLESS OTHERWISE APPROVED BY THE CITY ENGINEER.
15. SIDEWALK ADJACENT TO THE TOP OF RAMPS SHALL HAVE A 12" WIDE GROOVED BORDER STRIP WITH 1/4" GROOVES AT 3/4" ON CENTER, SEE GROOVED BORDER DETAIL.
16. SIDEWALK ADJACENT TO THE TOP OF RAMP SHALL HAVE A MINIMUM 4 FOOT LEVEL LANDING WITH SLOPES LESS THAN 2.0% IN ANY DIRECTION.
17. 2" SAND OR CLASS 2 A.B. COMPACTED TO 95% RELATIVE COMPACTION OVER SUBGRADE COMPACTED TO 92% RELATIVE COMPACTION.
18. BOTTOM WIDTH OF PROPOSED DRIVEWAY SHALL BE THE SAME AS THE ONSITE DRIVEWAY.

RESIDENTIAL DRIVEWAY

DATE	REVISIONS	BY

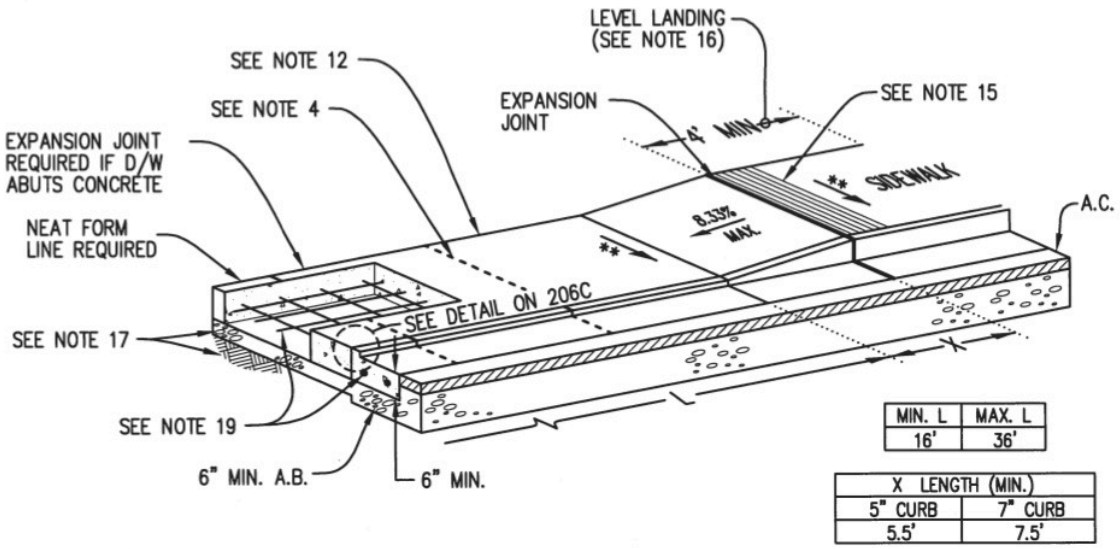
CITY OF LIVE OAK

STANDARD DETAIL

205B

Scott R. Ruble 10/7/15

APPROVED DATE

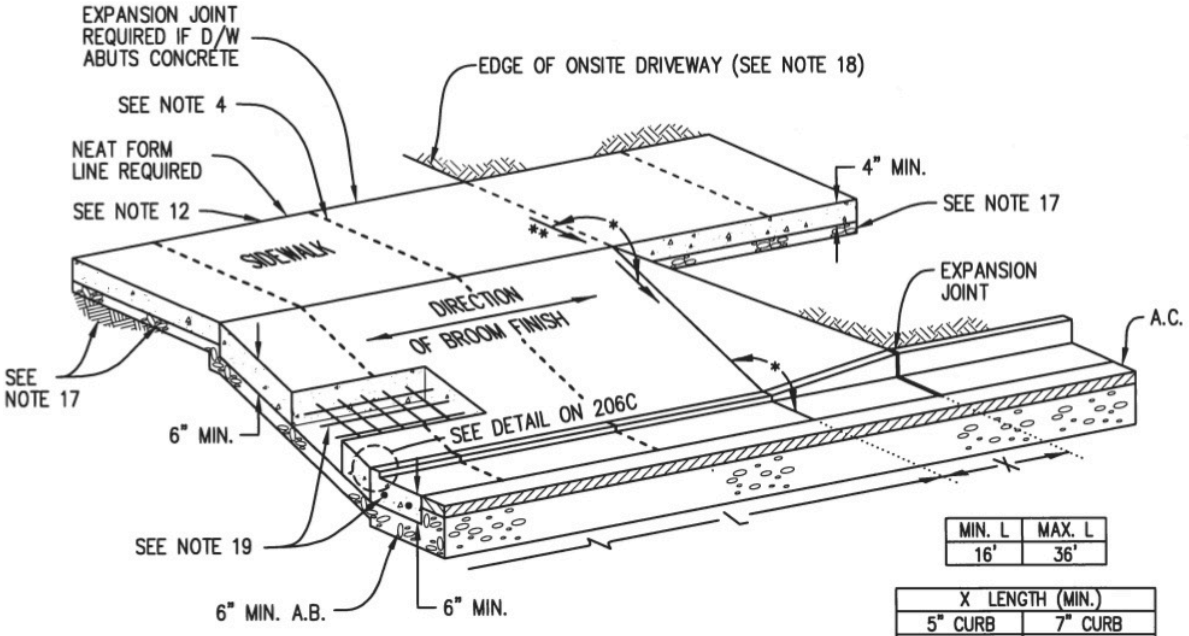


MIN. L	MAX. L
16'	36'

X LENGTH (MIN.)	
5" CURB	7" CURB
5.5'	7.5'

** SIDEWALK SLOPE SHALL BE A MINIMUM OF 1.0% AND SHALL NOT EXCEED 2.0%

CONTIGUOUS SIDEWALK



MIN. L	MAX. L
16'	36'

X LENGTH (MIN.)	
5" CURB	7" CURB
5'	7'

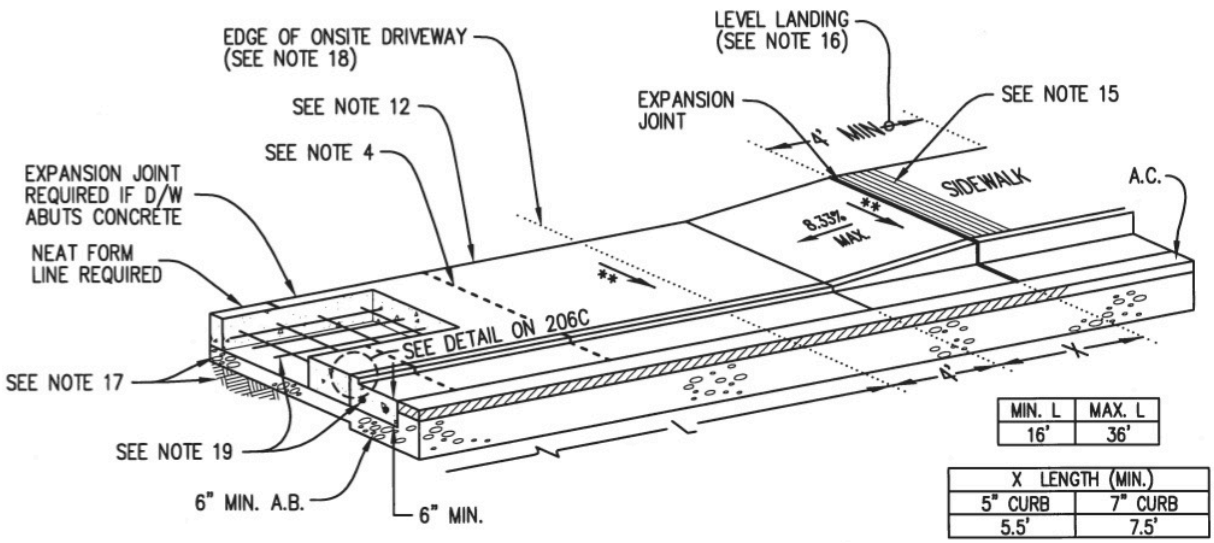
* MAX. ALGEBRAIC DIFFERENCE OF 14.5% UNLESS APPROVED BY THE CITY ENGINEER
** SIDEWALK SLOPE SHALL BE A MINIMUM OF 1.0% AND SHALL NOT EXCEED 2.0%

PARKWAY SIDEWALK

COMMERCIAL DRIVEWAY

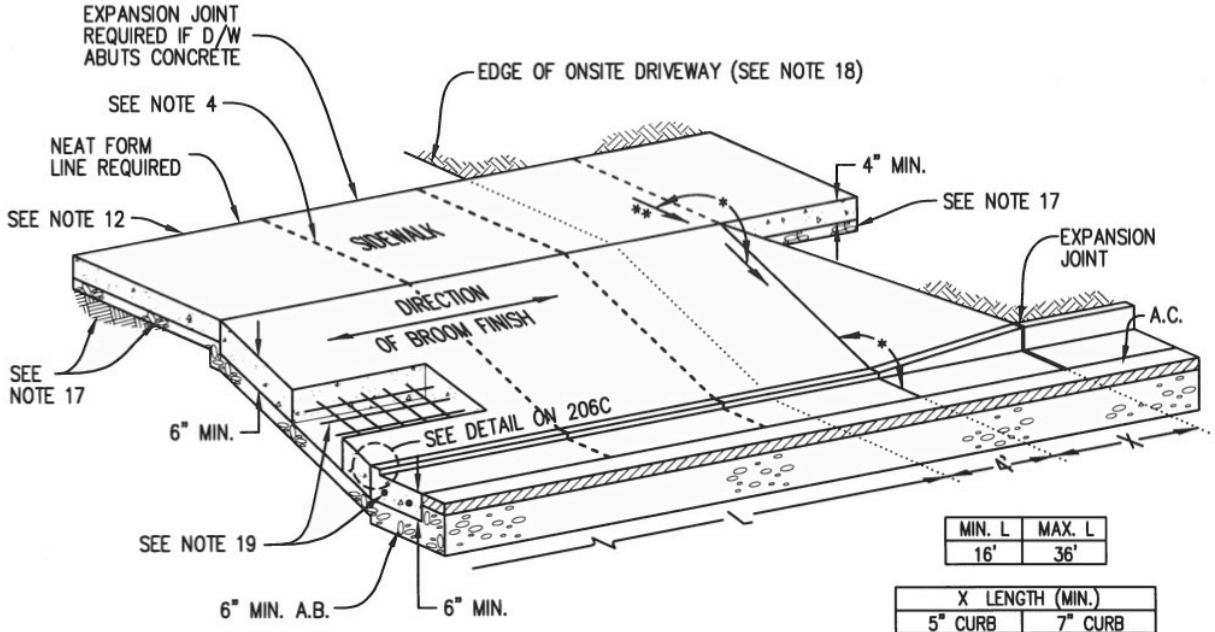
DATE	REVISIONS	BY

CITY OF LIVE OAK
STANDARD DETAIL
206A
APPROVED 10/7/15 DATE



** SIDEWALK SLOPE SHALL BE A MINIMUM OF 1.0% AND SHALL NOT EXCEED 2.0%

CONTIGUOUS SIDEWALK



* MAX. ALGEBRAIC DIFFERENCE OF 14.5% UNLESS APPROVED BY THE CITY ENGINEER
** SIDEWALK SLOPE SHALL BE A MINIMUM OF 1.0% AND SHALL NOT EXCEED 2.0%

PARKWAY SIDEWALK

MODIFIED COMMERCIAL DRIVEWAY

DATE	REVISIONS	BY

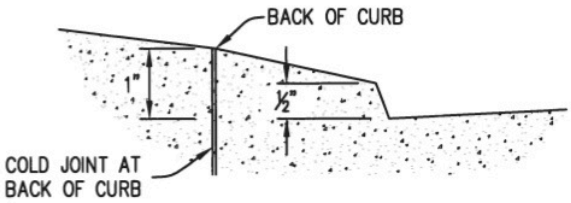
CITY OF LIVE OAK

STANDARD DETAIL

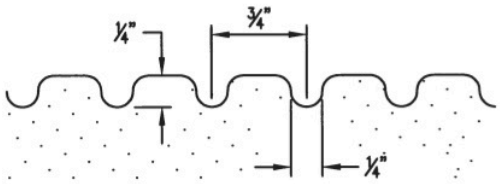
206B

Scott R. Delk 10/7/15

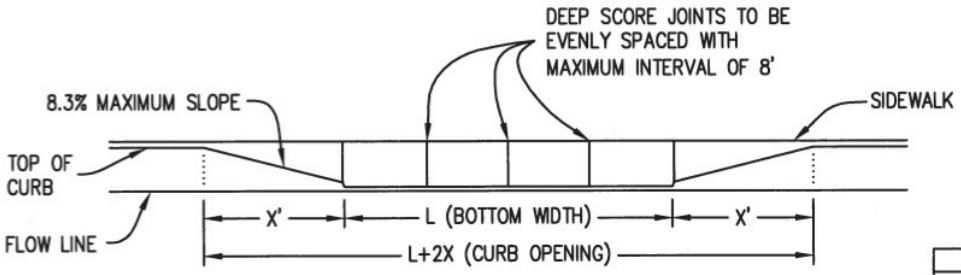
APPROVED DATE



DETAIL



GROOVED BORDER
N.T.S.



ELEVATION

MIN. L	MAX. L
16'	36'

X LENGTH (MIN.)	
5" CURB	7" CURB
5.5'	7.5'

CONSTRUCTION MATERIALS AND NOTES

1. ALL WORK TO BE DONE AND ALL MATERIALS TO BE SUPPLIED SHALL CONFORM TO THE LIVE OAK PUBLIC WORKS IMPROVEMENT STANDARDS.
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4. SCORING LINES SHALL CORRESPOND WITH SCORING LINES IN THE ADJACENT SIDEWALK UNLESS OTHERWISE SPECIFIED. CONTROL JOINTS SHALL EXTEND FROM LIP OF GUTTER TO THE BACK OF SIDEWALK UNLESS OTHERWISE SPECIFIED. CONTROL JOINTS SHALL BE EVENLY SPACED AND NOT EXCEED 8 FOOT INTERVALS.
5. TOP OF LIP AT THE FLOWLINE TO BE TROWELED STRAIGHT AND TRUE.
6. WHERE CURB IS EXISTING AND NO DEPRESSION HAS BEEN PROVIDED, THE EXISTING CURB SHALL BE REMOVED TO THE FIRST EXPANSION JOINT BEYOND EITHER SIDE.
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16. SIDEWALK ADJACENT TO THE TOP OF RAMP SHALL HAVE A MINIMUM 4 FOOT LEVEL LANDING WITH SLOPES LESS THAN 2.0% IN ANY DIRECTION.
17. 2" SAND OR CLASS 2 AB COMPACTED TO 95% RELATIVE COMPACTION OVER SUBGRADE COMPACTED TO 92% RELATIVE COMPACTION.
18. BOTTOM WIDTH OF PROPOSED DRIVEWAY SHALL BE THE SAME AS THE ONSITE DRIVEWAY.
19. ALL DRIVEWAYS SHALL HAVE 2 NO. 4 REBAR 12" O.C. IN THE GUTTER AND 6" x 6" 10 GA. WIRE MESH THROUGHOUT THE APPROACH.

COMMERCIAL DRIVEWAY

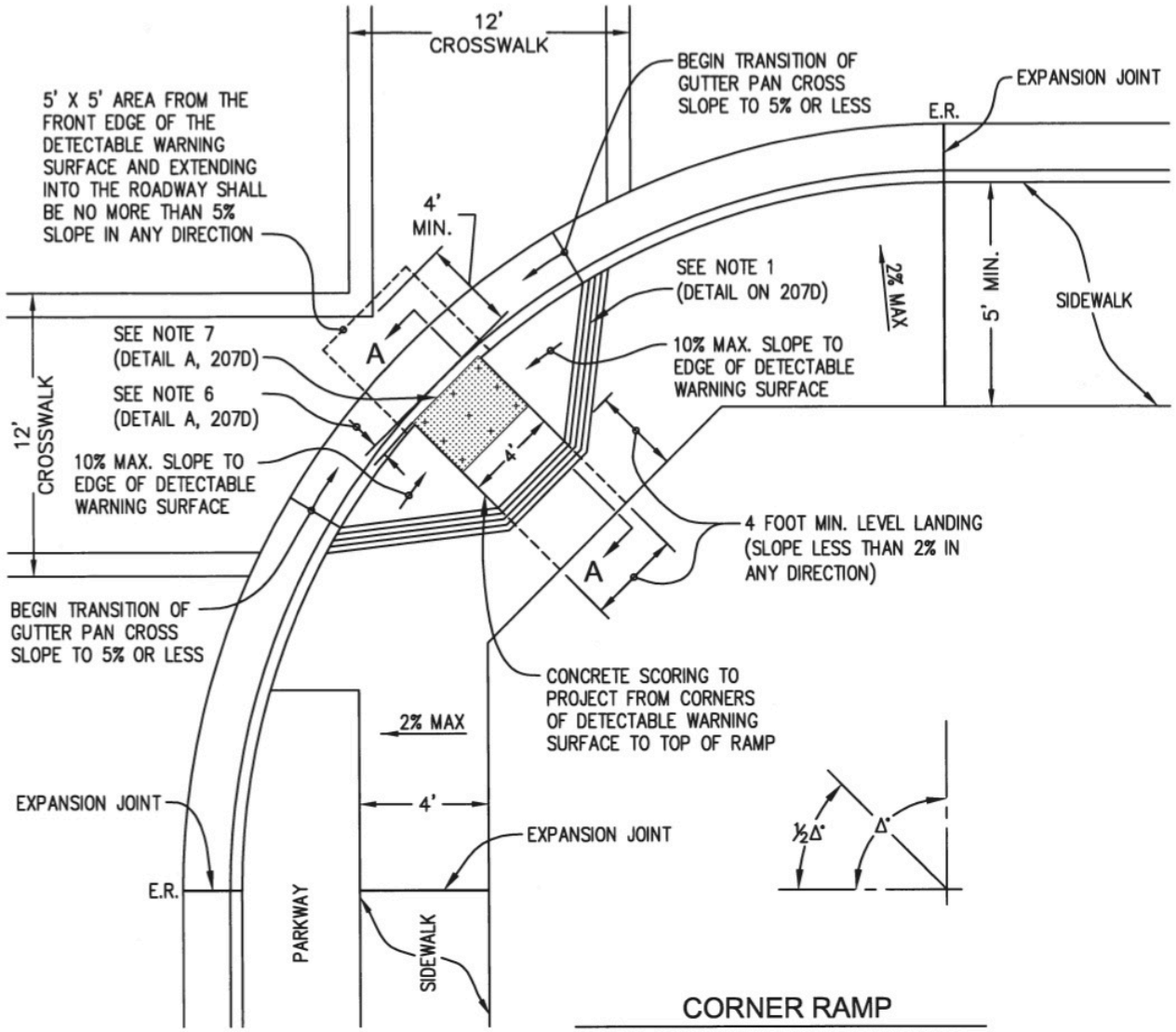
DATE	REVISIONS	BY

CITY OF LIVE OAK

STANDARD DETAIL

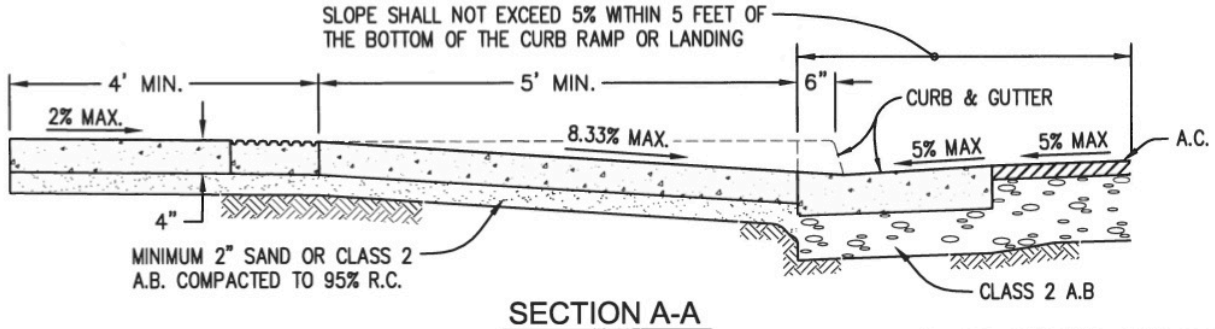
206C

APPROVED — DATE 10/7/15



CORNER RAMP

FOR PARKWAY SIDEWALKS AND SIDEWALKS 5' AND GREATER



SECTION A-A

N.T.S

DATE	REVISIONS	BY

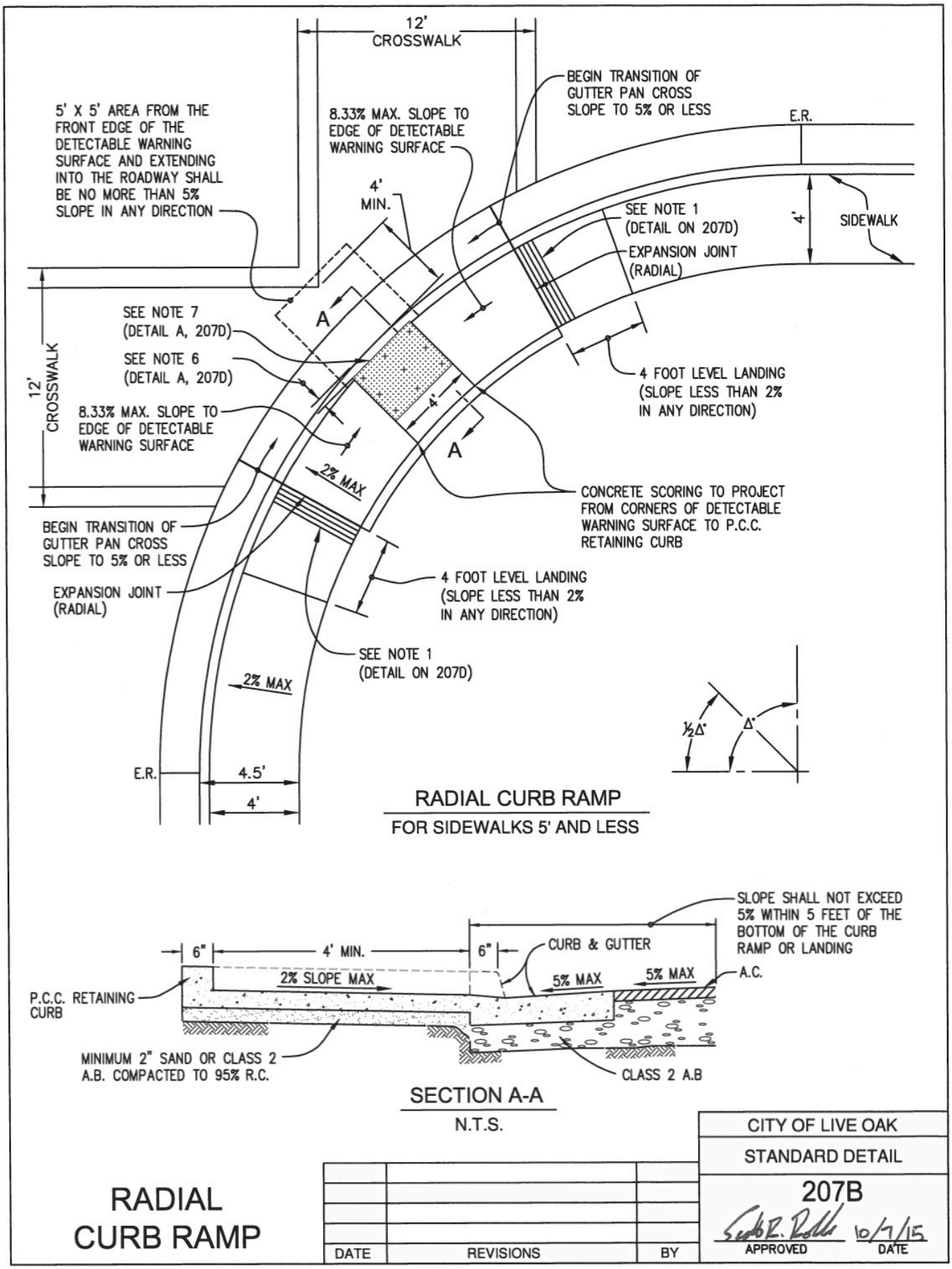
CITY OF LIVE OAK

STANDARD DETAIL

207A

APPROVED 10/7/15 DATE

CORNER RAMP



RADIAL CURB RAMP
FOR SIDEWALKS 5' AND LESS

SECTION A-A
N.T.S.

RADIAL CURB RAMP

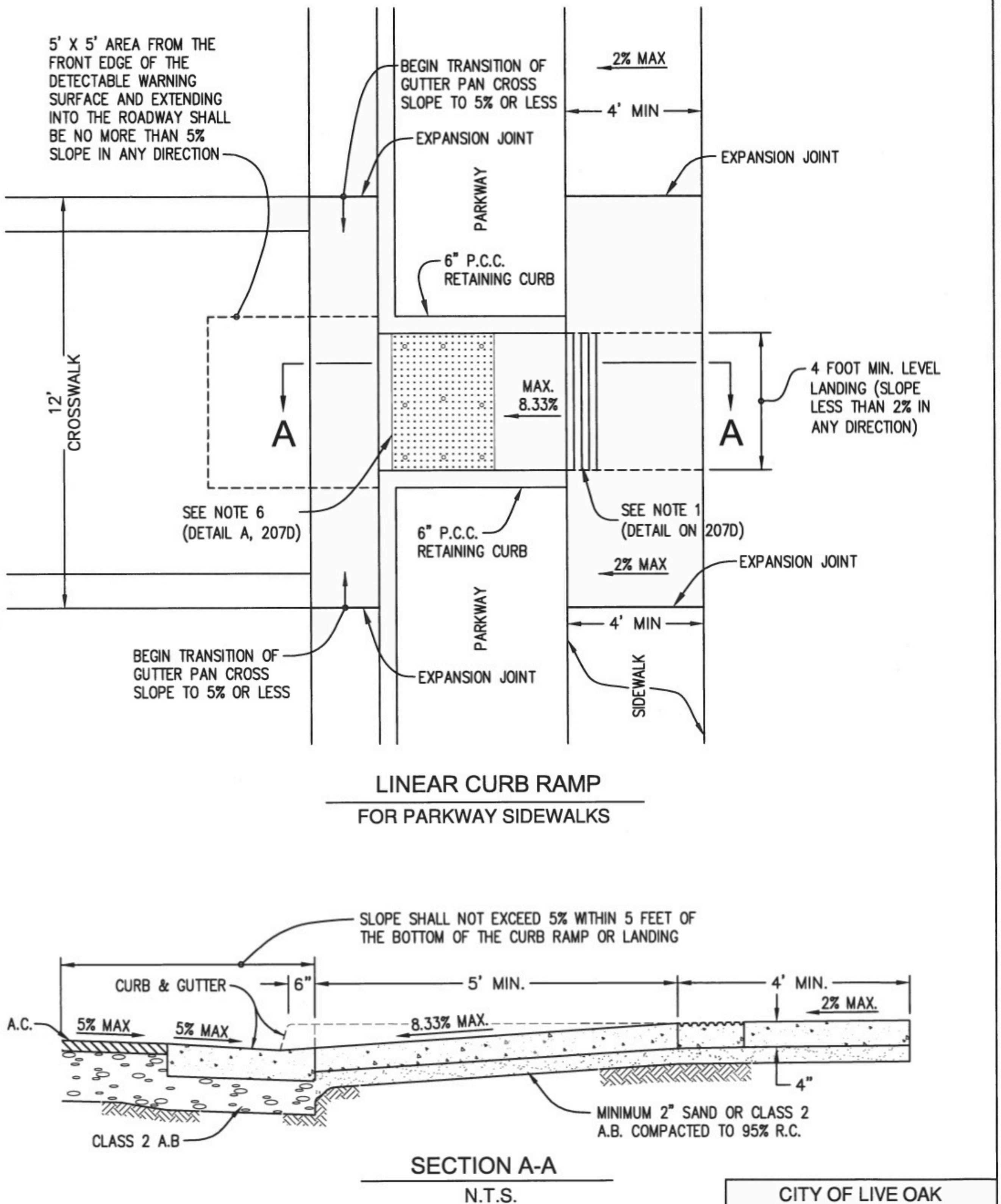
DATE	REVISIONS	BY

CITY OF LIVE OAK

STANDARD DETAIL

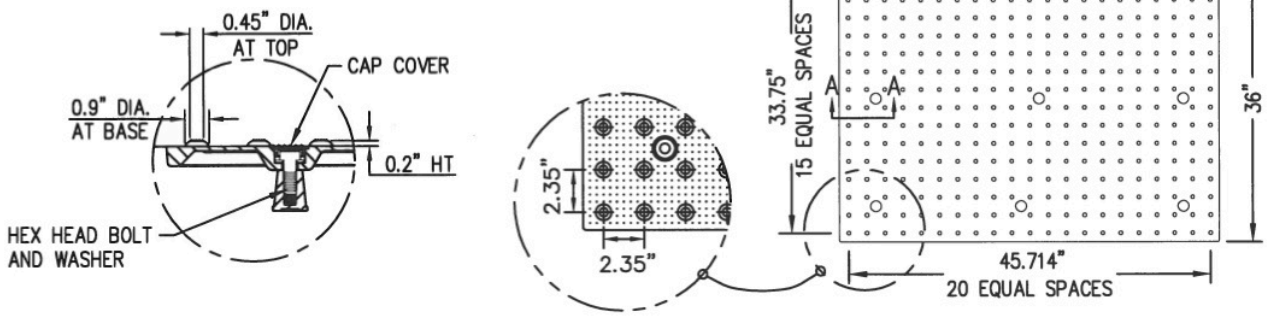
207B

Scott R. Robb 10/7/15
APPROVED DATE



			CITY OF LIVE OAK
			STANDARD DETAIL
			207C
			APPROVED 10/7/15 DATE
DATE	REVISIONS	BY	

LINEAR CURB RAMP

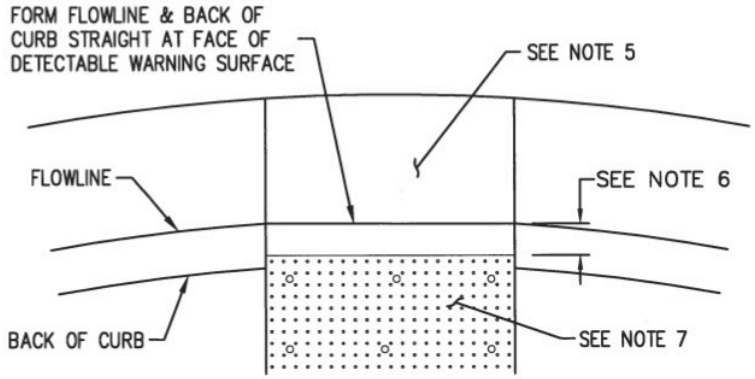


TYPICAL SECTION A-A

TYPICAL PLAN

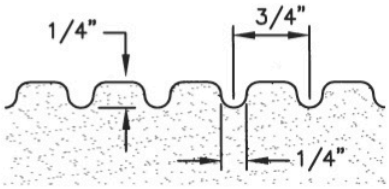
DETECTABLE WARNING SURFACE

N.T.S.



DETAIL A

N.T.S.



GROOVED BORDER

N.T.S.

CONSTRUCTION MATERIALS AND NOTES

1. SIDEWALK ADJACENT TO THE TOP OF RAMPS SHALL HAVE A 12" WIDE GROOVED BORDER STRIP WITH 1/4" GROOVES AT 3/4" O.C. (SEE GROOVED BORDER DETAIL). THE GROOVED BORDER MUST BE ON THE LEVEL SURFACE AT THE TOP OF THE RAMP.
2. RAMPS OR LANDINGS SHALL HAVE A DETECTABLE WARNING SURFACE THAT EXTENDS THE FULL WIDTH OF THE LANDING AND A MINIMUM DEPTH OF 36" IN THE DIRECTION OF TRAVEL. THE DETECTABLE WARNING SURFACE SHALL BE A REPLACEABLE COMPOSITE, WET SET TACTILE UNIT AND THE SURFACE SHALL CONSIST OF TRUNCATED DOMES. SEE DETECTABLE WARNING SURFACE DETAIL. RAMP LANDINGS SHALL HAVE A MAXIMUM SLOPE OF 2% IN ANY DIRECTION.
3. DETECTABLE WARNING SURFACE SHALL BE SAFETY YELLOW (FEDERAL COLOR 33538), UNLESS OTHERWISE SPECIFIED BY THE CITY ENGINEER, AND THE MATERIAL USED TO PROVIDE THE SAFETY YELLOW COLOR SHALL BE AN INTEGRAL PART OF THE WALKING SURFACE. AT NO TIME SHALL THE DETECTABLE WARNING SURFACE BE CUT, TRIMMED OR MODIFIED UNLESS DIRECTED TO DO SO BY THE CITY ENGINEER.
4. TRANSITIONS FROM RAMPS TO WALKS, GUTTERS OR STREETS SHALL BE FLUSH AND FREE OF ABRUPT CHANGE PER CBC 1127B.5.3
5. A 5-FOOT BY 5-FOOT AREA BEGINNING AT THE FRONT EDGE OF THE DETECTABLE WARNING SURFACE AND EXTENDING INTO THE ROADWAY, SHALL HAVE NO MORE THAN A 5% SLOPE IN ANY DIRECTION. WHERE THE LIP OF A CONCRETE GUTTER PAN AND THE EDGE OF AN ASPHALT OR CONCRETE ROADWAY MEET, NEITHER SURFACE SHALL EXCEED A 5% SLOPE IN ANY DIRECTION.
6. THE EDGE OF THE DETECTABLE WARNING SURFACE NEAREST THE STREET SHALL BE BETWEEN 6" AND 8" FROM THE GUTTER FLOWLINE.
7. THE BACK AND FACE OF CURB ADJACENT TO THE DETECTABLE WARNING SURFACE SHALL BE FORMED STRAIGHT.

ACCESSIBLE RAMP DETAILS

DATE	REVISIONS	BY

CITY OF LIVE OAK

STANDARD DETAIL

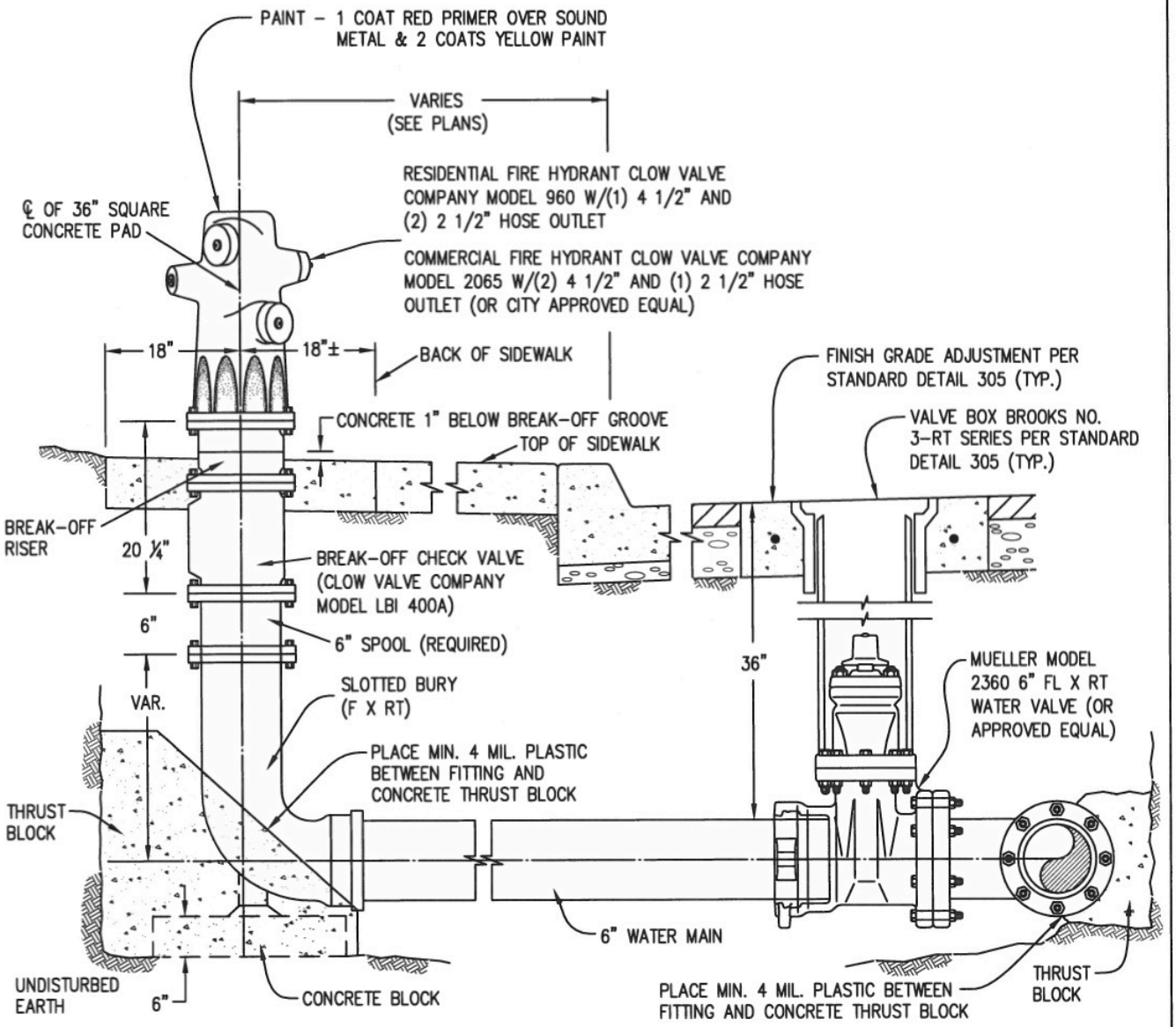
207D

Scott R. Robb 10/7/15

APPROVED DATE

NOTE

BLUE REFLECTIVE PAVEMENT MARKERS SHALL BE PLACED 6" FROM CENTERLINE STRIPE ON THE SIDE NEAREST THE FIRE HYDRANT ON A TWO OR MULTI-LANE STREET. TWO MARKERS ARE REQUIRED AT AN INTERSECTION HAVING A FIRE HYDRANT. THE MARKER SHALL BE PLACED 6" FROM THE EDGE OF THE CONTINUOUS LEFT TURN LANE LINE ON THE SIDE NEAREST THE FIRE HYDRANT. ON A FOUR LANE STREET WITH TURN LANE AT INTERSECTION, THE MARKER SHALL BE PLACED 6" FROM THE NEAREST WHITE LANE LINE ON THE SIDE NEAREST THE FIRE HYDRANT.



CITY OF LIVE OAK

STANDARD DETAIL

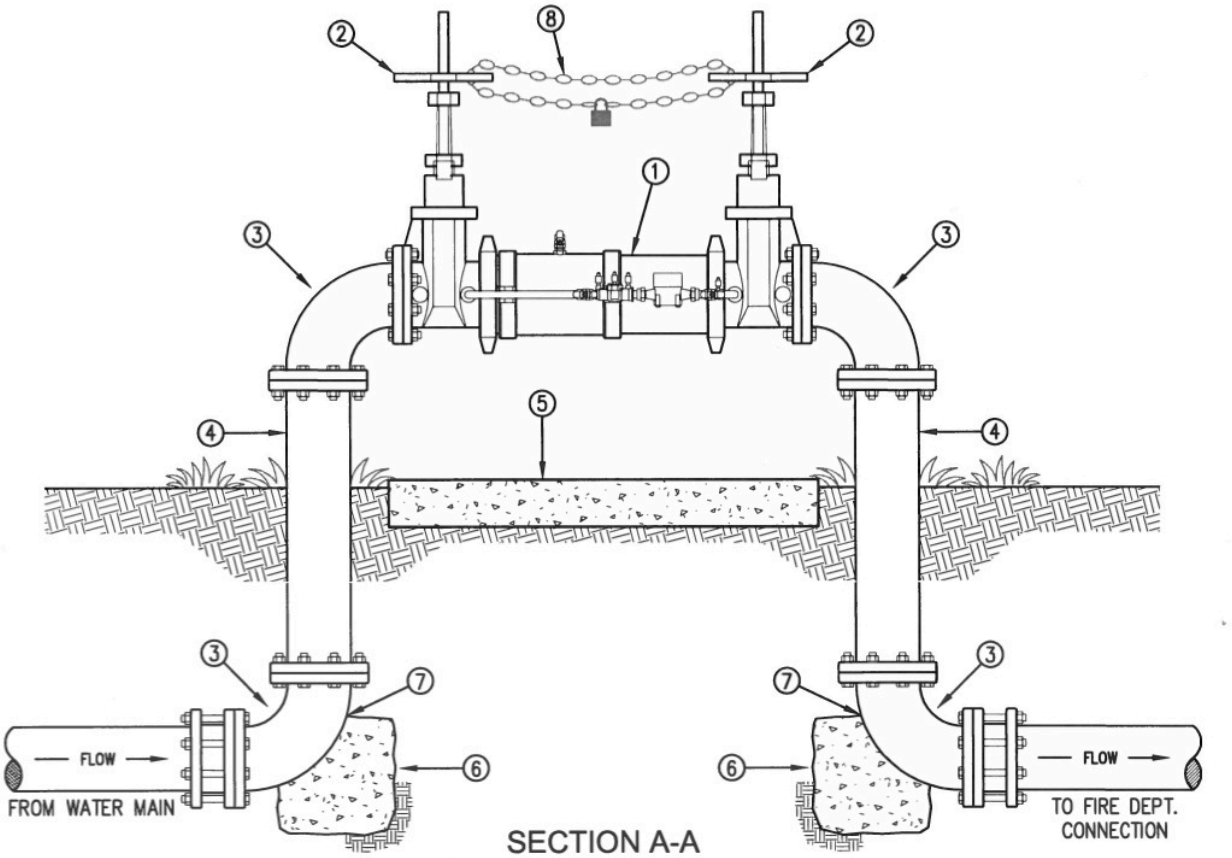
301

FIRE HYDRANT

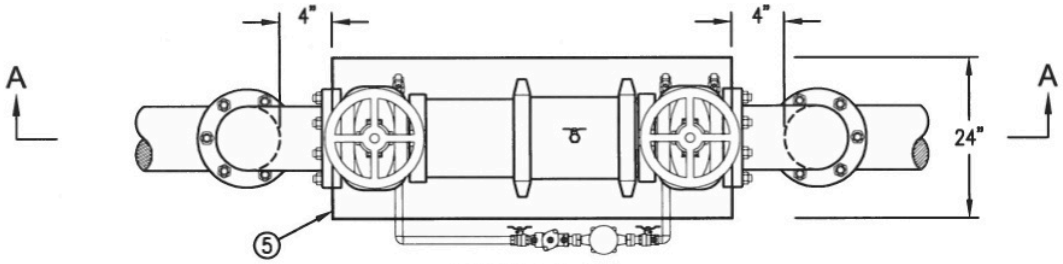
DATE	REVISIONS	BY

Scott R. Robb 10/7/15

APPROVED DATE



SECTION A-A



PLAN VIEW

CONSTRUCTION MATERIALS AND NOTES

1. AMES COLT SERIES DETECTOR ASSEMBLY WITH ¾" METERED BY–PASS, OR APPROVED EQUAL.
2. OS&Y RESILIENT SEAT GATE VALVE.
3. FLANGE x FLANGE DUCTILE IRON 90° ELBOW.
4. FLANGE x FLANGE DUCTILE IRON SPOOL, LENGTH AS REQUIRED.
5. 6" THICK CONCRETE SLAB.
6. THRUST BLOCK.
7. PLACE MINIMUM 4 MILLIMETER PLASTIC BETWEEN FITTING AND CONCRETE THRUST BLOCK.
8. INSTALL ⅜" NON CASE HARDENED CHAIN WITH BREAKAWAY LOCK BETWEEN VALVES. LOCK TO BE APPROVED BY BATALLION CHIEF PRIOR TO INSTALLATION. TWO KEYS FOR THE LOCK ARE TO BE PROVIDED TO THE CITY OF LIVE OAK.

NOTE: FIRE PROTECTION ASSEMBLY SHALL BE INSULATED WITH A CITY APPROVED FREEZE PROTECTION BAG.

CITY OF LIVE OAK

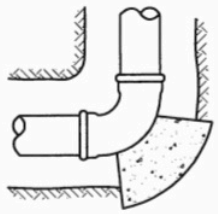
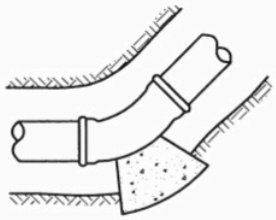
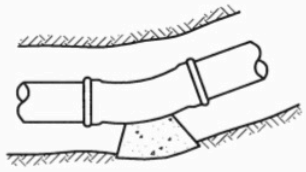
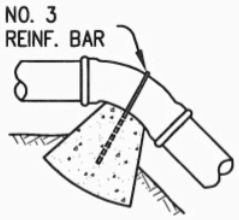
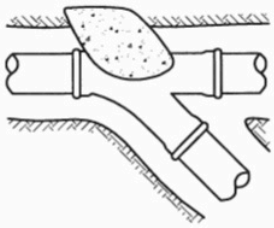
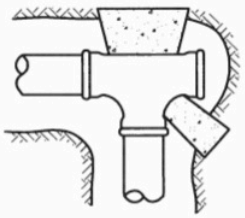
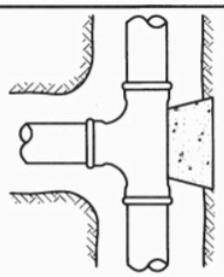
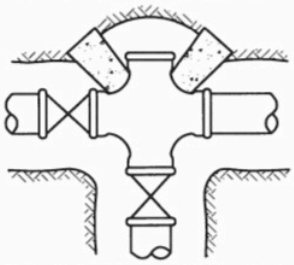
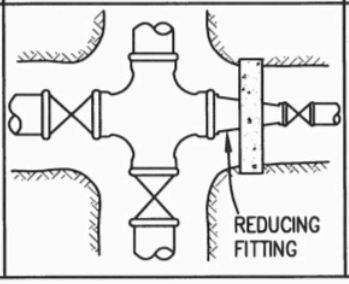
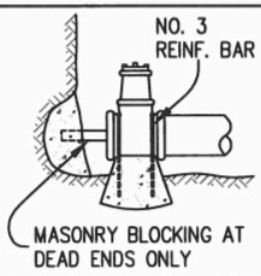
STANDARD DETAIL

TYPICAL FIRE SERVICE CHECK VALVE DETAIL

302

DATE	REVISIONS	BY

APPROVED 10/7/15 DATE

90° BEND	45° BEND	11 1/2° OR 22 1/2° BEND	VERTICAL SECTION
			
45° TEE	**TEE WITH PLUG**	**90° TEE**	**FLANGED CROSS WITH PLUGS**
			
FLANGED CROSS WITH PLUG	**FLANGED REDUCER**	**GATE VALVE**	
			

CONSTRUCTION MATERIALS AND NOTES

1. THRUST BLOCKS SHALL BE CONSTRUCTED SO THAT THE BEARING SURFACE IS IN DIRECT LINE WITH THE MAJOR FORCE CREATED BY THE PIPE OR FITTING.
2. ALL CONCRETE SHALL BE CLASS C P.C.C.
3. CONCRETE SHALL BE FLUID ENOUGH SO THAT IT MAY BE WORKED AROUND THE FITTING.
4. CONCRETE SHALL BE KEPT BEHIND THE BELL OF THE FITTING AND AWAY FROM BOLTS AND FITTINGS. A MINIMUM 4 MIL. PLASTIC SHALL BE PLACED BETWEEN FITTINGS AND CONCRETE THRUST BLOCK.
5. THRUST BLOCK BEARING SURFACE SHALL BE PLACED AGAINST UNDISTURBED EARTH AND SHALL HAVE A MINIMUM VOLUME OF 6 CU. FT. AND A MINIMUM BEARING AREA OF 1 SF PER INCH OF DIAMETER. PIPES LARGER THAN 10" REQUIRE SPECIAL DESIGN.
6. A CONCRETE PAD SHALL BE POURED UNDER ALL VALVES 12" OR LARGER, OR AS DIRECTED BY THE ENGINEER.
7. ALL ANCHOR BLOCKS SHALL BE CONSTRUCTED AS SPECIFIED. SIZE OF BLOCK AND NUMBER OF STRAPS TO BE DESIGNED IN EACH SITUATION.

THRUST BLOCKS

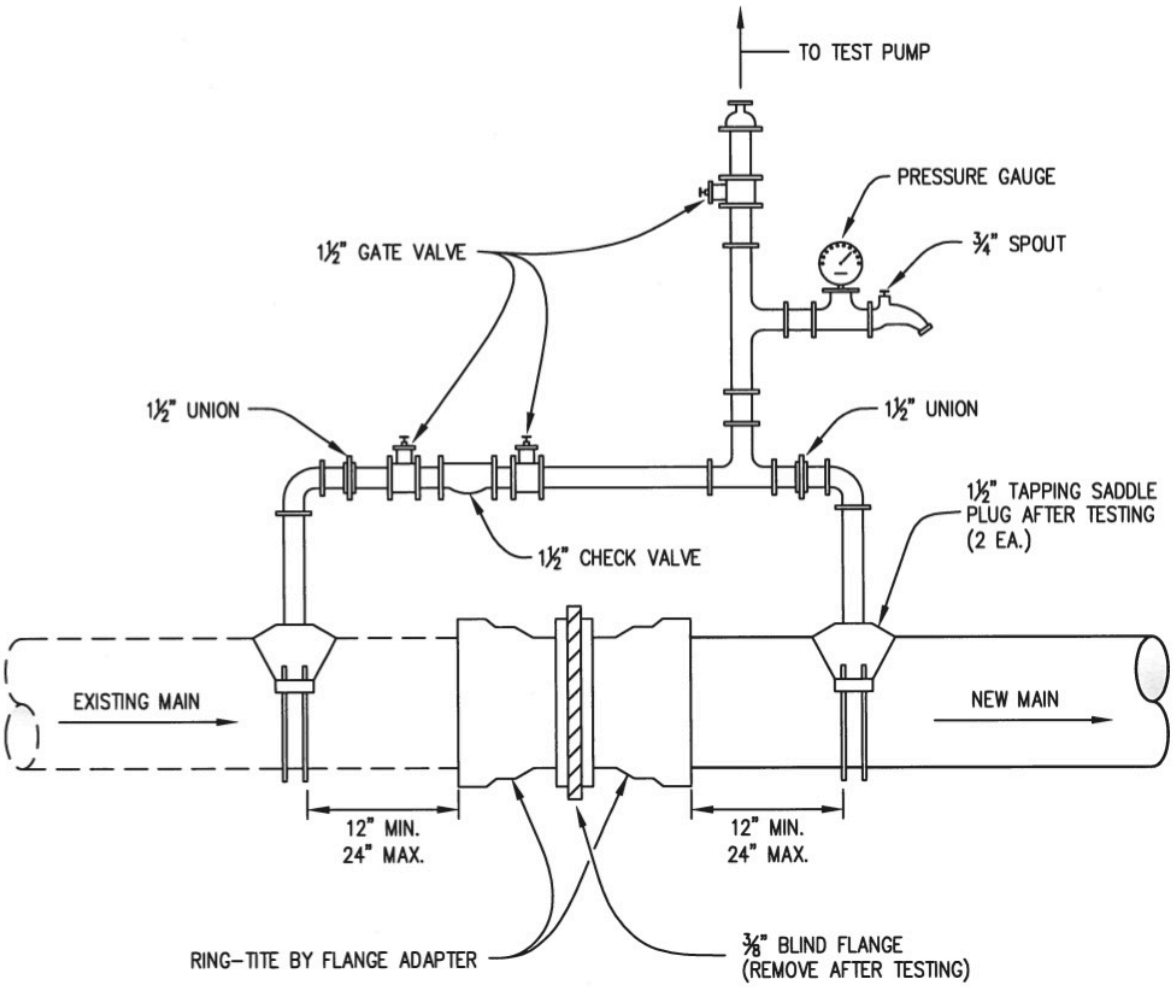
DATE	REVISIONS	BY

CITY OF LIVE OAK

STANDARD DETAIL

303

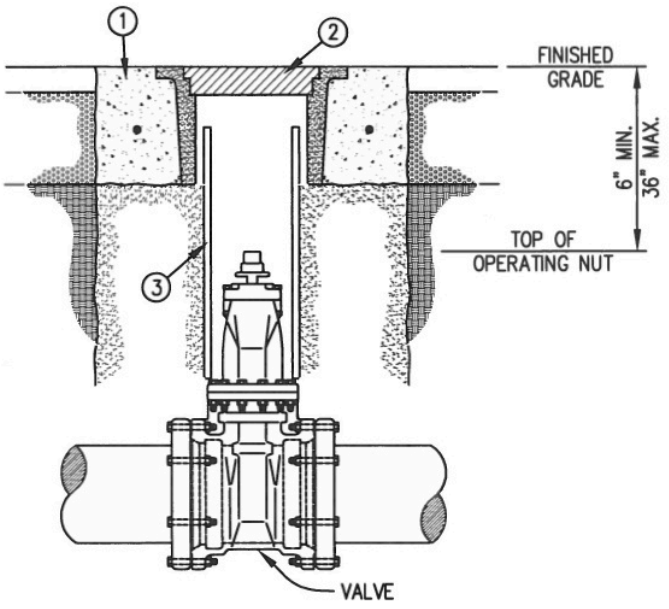
APPROVED 10/7/15 DATE



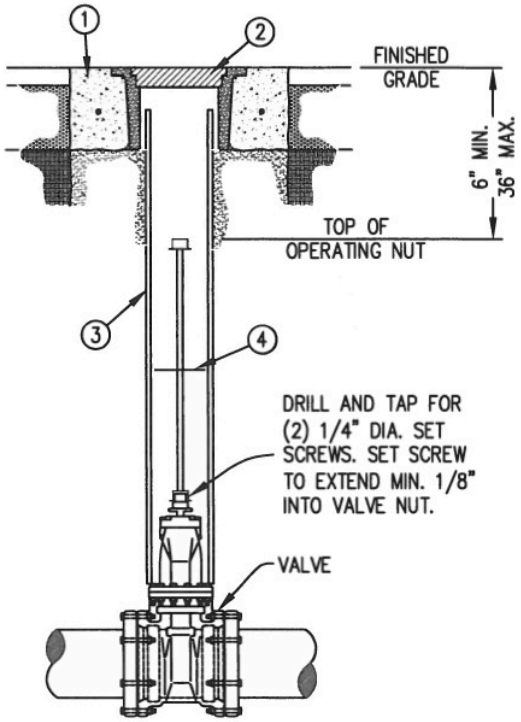
FOR NEW WATER MAIN CONSTRUCTION

**NOTE: ALL MATERIAL INSTALLATION AND RECONNECTION TO BE FURNISHED BY CONTRACTOR

			CITY OF LIVE OAK
			STANDARD DETAIL
TESTING BLOCK AND BYPASS			304
			Scott R. Ruble 10/7/15
DATE	REVISIONS	BY	APPROVED DATE

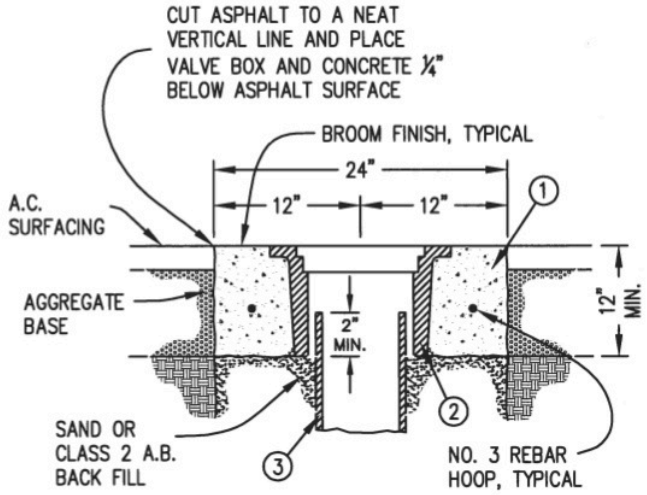


VALVE COVER DETAIL



OPERATING NUT EXTENSION DETAIL

REQUIRED WHERE DISTANCE BETWEEN FINISHED GRADE AND TOP OF OPERATING NUT EXCEEDS 36"



VALVE COVER ADJUSTMENT

CONSTRUCTION MATERIALS AND NOTES

1. 24" DIA. x 12" DEEP CONCRETE COLLAR WITH ONE NO. 3 REBAR HOOP. CLASS B CONCRETE WITH 10 LBS. LAMPBLACK PER CUBIC YARD.
2. VALVE BOX AND COVER MARKED "WATER". (BROOKS PRODUCTS 3-RT, CHRISTY G5 OR APPROVED EQUAL).
3. 8" I.D. PVC PIPE EXTENSION SHALL BE VERTICAL.
4. OPERATING NUT EXTENSION WITH 7" DIA. PLATE WASHER WELDED TO MINIMUM 1" DIA. EXTENSION PIPE AT MIDPOINT OF ROD. (MIN. LENGTH OF EXTENSION ROD SHALL BE 24")

WATER VALVE BOX

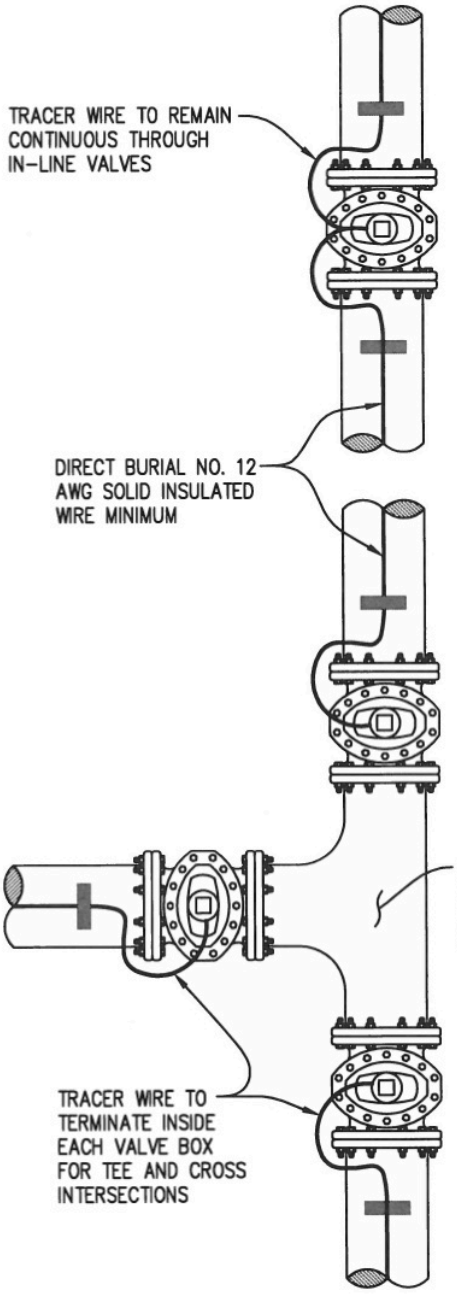
DATE	REVISIONS	BY

CITY OF LIVE OAK

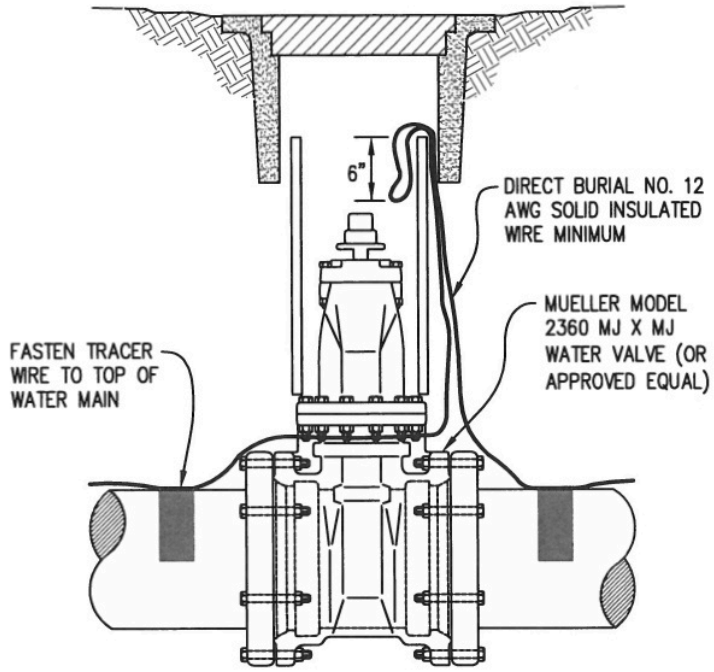
STANDARD DETAIL

305

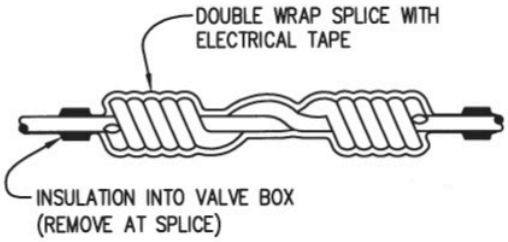
Scott R. Robb — APPROVED — 10/7/15 DATE



TYPICAL LAYOUT



VALVE DETAIL



SPLICE DETAIL

CONSTRUCTION MATERIALS AND NOTES

1. WATER VALVES SHALL BE RESILIENT WEDGE GATE VALVES WITH NON-RISING STEM AND 2-INCH OPERATING NUT, AND SHALL BE IN COMFORMANCE WITH SECTION C-509 OF THE A.W.W.A. STANDARDS. VALVES SHALL OPEN COUNTERCLOCKWISE. ALL CONNECTIONS SHALL BE MADE WITH FLANGED OR MECHANICAL JOINTS UNLESS OTHERWISE APPROVED BY THE CITY ENGINEER.
2. DETECTOR RISERS SHALL BE INSTALLED AT 500' INTERVALS MAXIMUM.
3. LOCATOR WIRE TO BE TAPED TO TOP OF WATER MAIN.
4. LOCATOR WIRE MUST BE TESTED & BE IN WORKING ORDER AFTER ALL UNDERGROUND WORK IS DONE, AND PRIOR TO STREET PAVING.

WATER VALVE AND LOCATING WIRE FOR WATER MAINS

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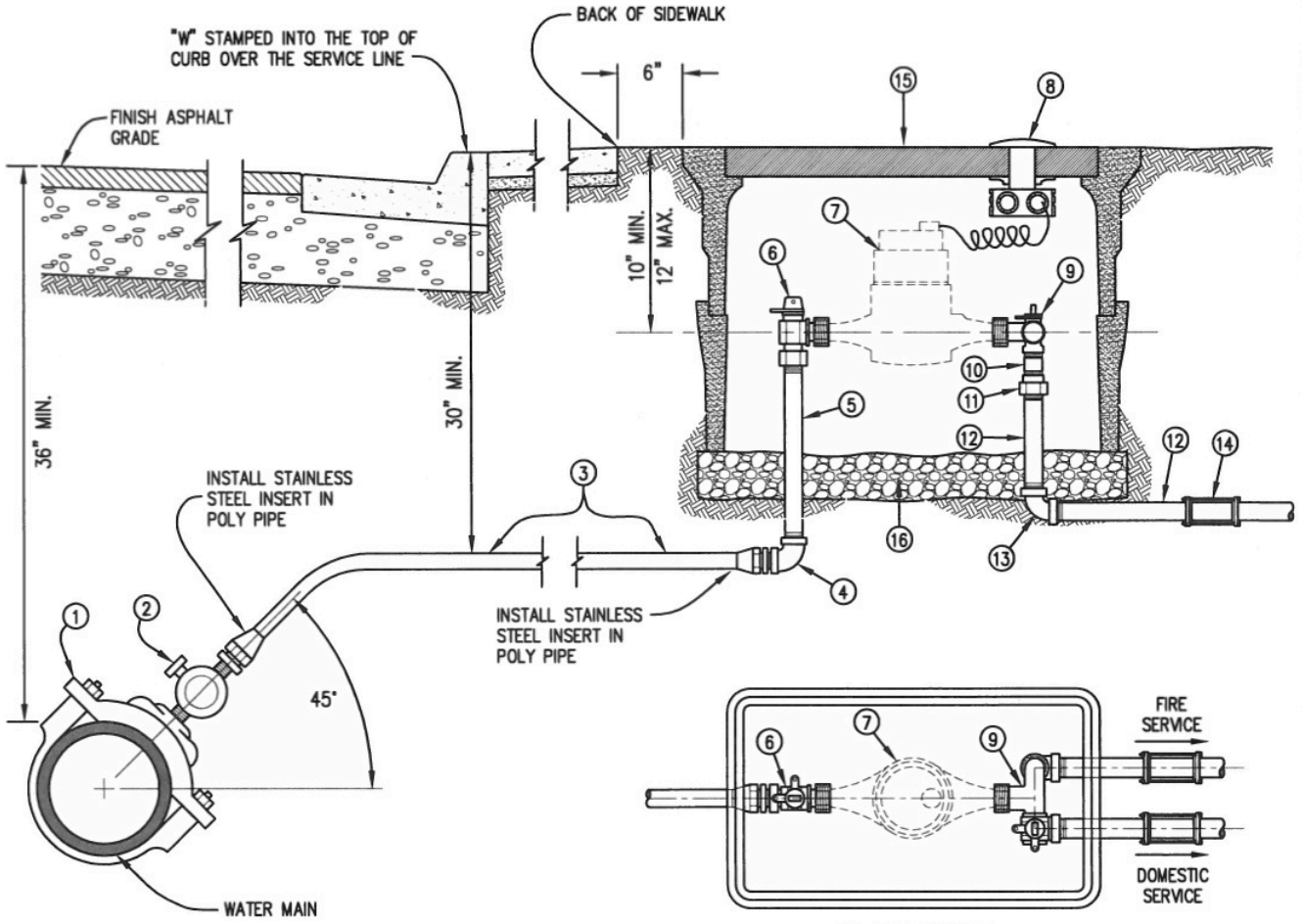
CITY OF LIVE OAK

STANDARD DETAIL

306

APPROVED Scott R. Robb DATE 10/7/15



CONSTRUCTION MATERIALS AND NOTES

1. ROMAC TYPE 202U OR 202S DOUBLE STRAP SERVICE SADDLE, OR APPROVED EQUAL.
2. BALL-TYPE CORPORATION STOP (M.I.P. THREAD BY C.T.S. COMPRESSION). JAMES JONES COMPANY E1935SG OR APPROVED EQUAL.
3. PE 3408 SDR9 POLYETHYLENE SERVICE PIPE WITH DIRECT BURIAL NO. 12 AWG SOLID COPPER INSULATED TRACER WIRE.
4. QUARTER BEND BRASS UNION (C.T.S. COMPRESSION BY F.I.P. THREAD). JAMES JONES COMPANY E 2621SG, OR APPROVED EQUAL.
5. 18" BRASS NIPPLE, THREADED BOTH ENDS.
6. ANGLE BALL METER VALVE (F.I.P. THREAD BY METER CONNECTION). JAMES JONES COMPANY E1966W, OR APPROVED EQUAL.
7. 3/4" SENSUS SR II LOW LEAD WATER METER WITH AUTOMATIC METER READING REGISTER TO BE FURNISHED BY THE OWNER AND INSTALLED BY THE CITY OF LIVE OAK PUBLIC WORKS. OWNER IS RESPONSIBLE FOR PROVIDING AND INSTALLING A TEMPORARY RIGID PLACE HOLDER THAT IS THE SAME LAY LENGTH AS THE METER.
8. SENSUS MODEL 520M PIT SET RADIO READ UNIT
9. JAMES JONES ONE INCH RESIDENTIAL FIRE SERVICE VALVE (METER SWIVEL NUT BY F.I.P. THREAD)
10. 3" BRASS NIPPLE, THREADED BOTH ENDS.
11. BRASS UNION
12. 12" BRASS NIPPLE.
13. QUARTER BEND BRASS UNION (F.I.P. THREAD BY F.I.P. THREAD).
14. COMPRESSION COUPLING. ROMAC INDUSTRIES, INC. STYLE "511", OR APPROVED EQUAL. PLACE COMPRESSION COUPLING NUTS TOWARDS METER.
15. METER BOX, CHRISTY CONCRETE PRODUCTS, B16 BOX, B16X12 EXTENSION AND N16RP LID WITH 2" PROBE HOLE, OR APPROVED EQUAL.
16. MINIMUM 6" OF 3/4" CRUSHED ROCK.

*NOTE: ALL BRASS FITTINGS AND PIPE SECTIONS SHALL BE NSF61 COMPLIANT

SINGLE WATER SERVICE MAIN CONNECTION

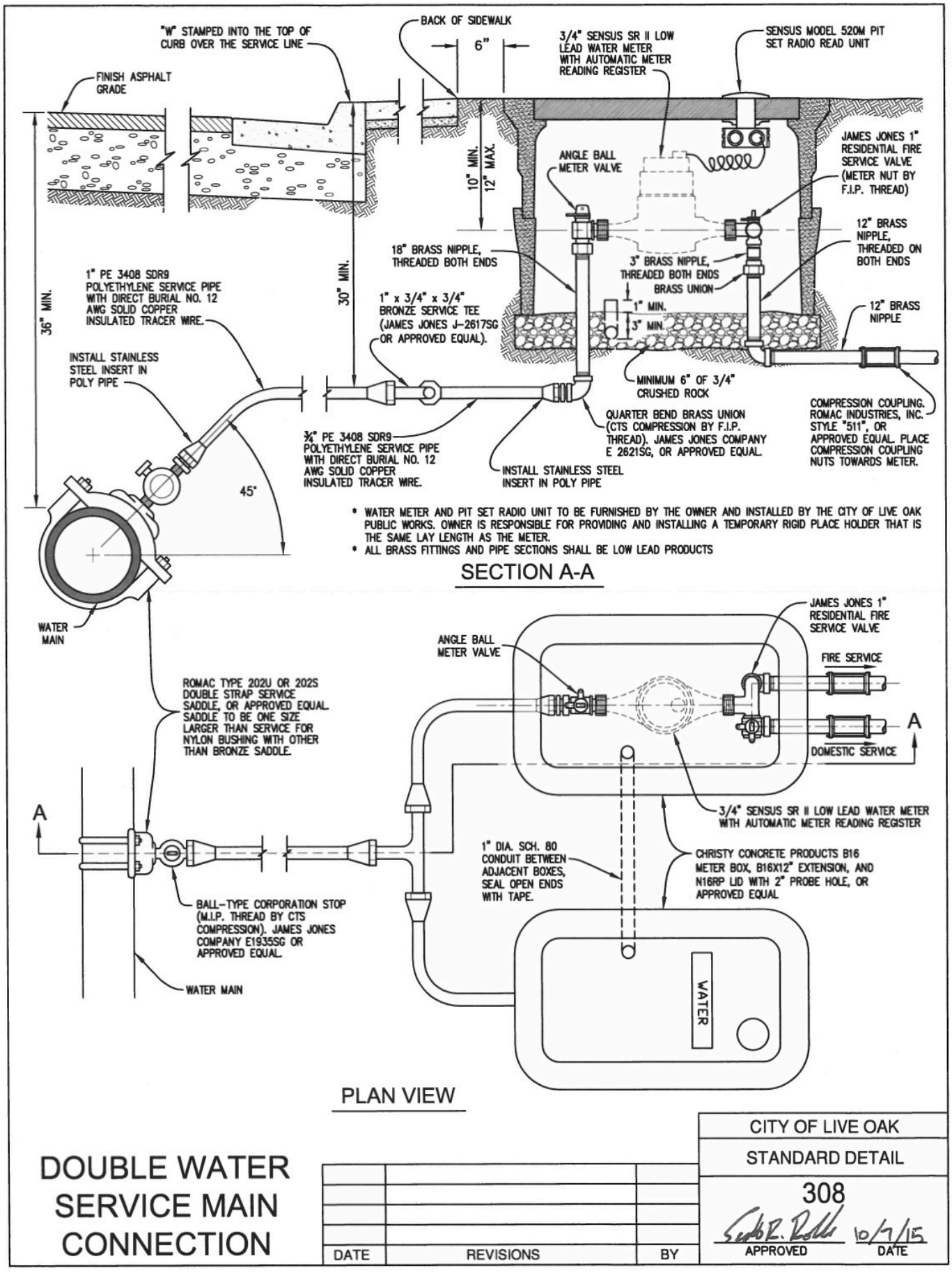
DATE	REVISIONS	BY

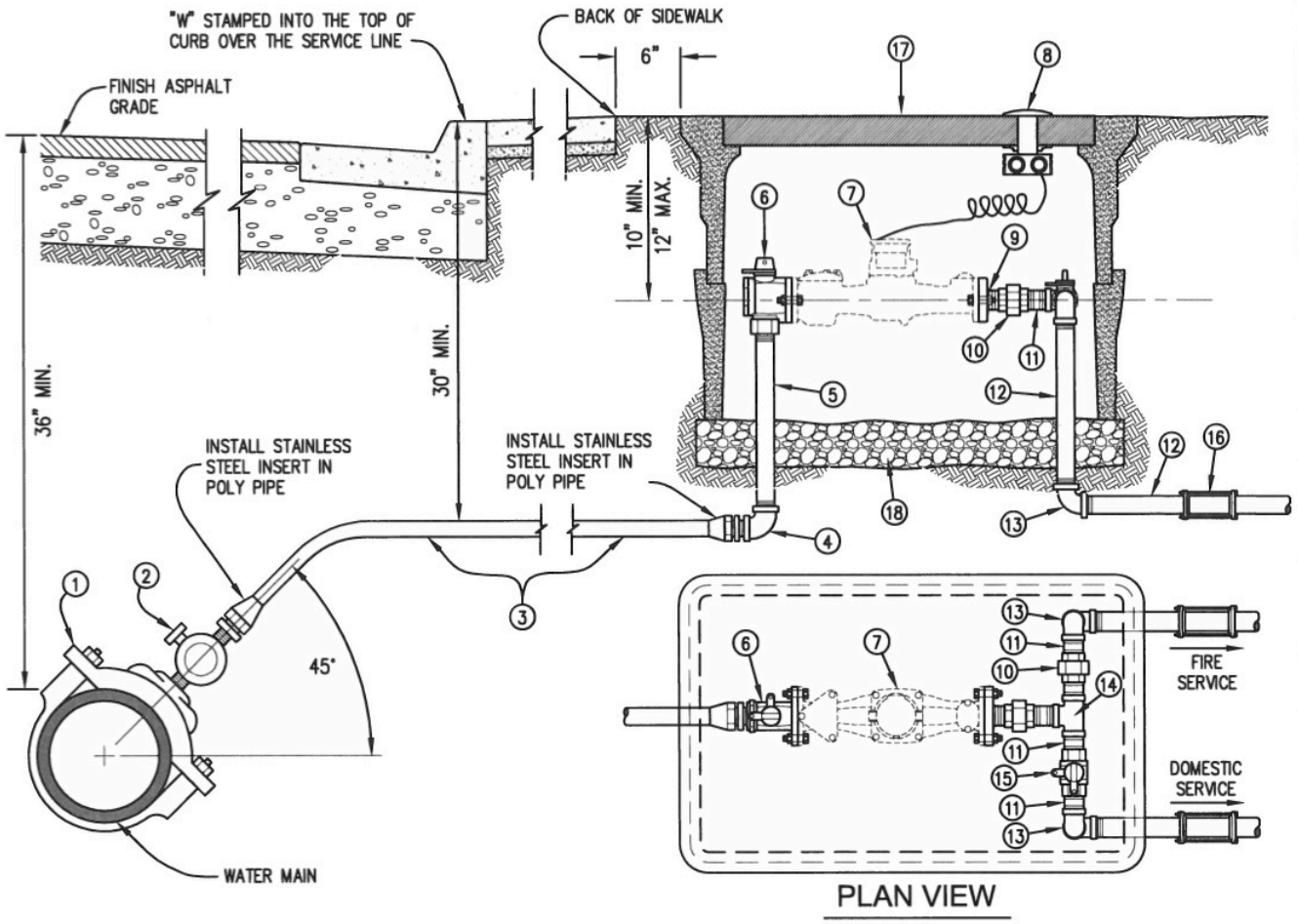
CITY OF LIVE OAK

STANDARD DETAIL

307

Scott R. Robb APPROVED 10/7/15 DATE


"W" STAMPED INTO THE TOP OF CURB OVER THE SERVICE LINE
BACK OF SIDEWALK
6"
3/4" SENSUS SR II LOW LEAD WATER METER WITH AUTOMATIC METER READING REGISTER
SENSUS MODEL 520M PIT SET RADIO READ UNIT
FINISH ASPHALT GRADE
10" MIN. 12" MAX.
ANGLE BALL METER VALVE
JAMES JONES 1" RESIDENTIAL FIRE SERVICE VALVE (METER NUT BY F.I.P. THREAD)
12" BRASS NIPPLE, THREADED ON BOTH ENDS
18" BRASS NIPPLE, THREADED BOTH ENDS
3" BRASS NIPPLE, THREADED BOTH ENDS
BRASS UNION
1" MIN.
3" MIN.
12" BRASS NIPPLE
36" MIN.
30" MIN.
1" PE 3408 SDR9 POLYETHYLENE SERVICE PIPE WITH DIRECT BURIAL NO. 12 AWG SOLID COPPER INSULATED TRACER WIRE.
1" x 3/4" x 3/4" BRONZE SERVICE TEE (JAMES JONES J-2617SG OR APPROVED EQUAL).
INSTALL STAINLESS STEEL INSERT IN POLY PIPE
MINIMUM 6" OF 3/4" CRUSHED ROCK
COMPRESSION COUPLING. ROMAC INDUSTRIES, INC. STYLE "511", OR APPROVED EQUAL. PLACE COMPRESSION COUPLING NUTS TOWARDS METER.
QUARTER BEND BRASS UNION (CTS COMPRESSION BY F.I.P. THREAD). JAMES JONES COMPANY E 2621SG, OR APPROVED EQUAL.
3/4" PE 3408 SDR9 POLYETHYLENE SERVICE PIPE WITH DIRECT BURIAL NO. 12 AWG SOLID COPPER INSULATED TRACER WIRE.
INSTALL STAINLESS STEEL INSERT IN POLY PIPE
45°
* WATER METER AND PIT SET RADIO UNIT TO BE FURNISHED BY THE OWNER AND INSTALLED BY THE CITY OF LIVE OAK PUBLIC WORKS. OWNER IS RESPONSIBLE FOR PROVIDING AND INSTALLING A TEMPORARY RIGID PLACE HOLDER THAT IS THE SAME LAY LENGTH AS THE METER.
* ALL BRASS FITTINGS AND PIPE SECTIONS SHALL BE LOW LEAD PRODUCTS
SECTION A-A
WATER MAIN
JAMES JONES 1" RESIDENTIAL FIRE SERVICE VALVE
ANGLE BALL METER VALVE
FIRE SERVICE
A
DOMESTIC SERVICE
ROMAC TYPE 202U OR 202S DOUBLE STRAP SERVICE SADDLE, OR APPROVED EQUAL. SADDLE TO BE ONE SIZE LARGER THAN SERVICE FOR NYLON BUSHING WITH OTHER THAN BRONZE SADDLE.
3/4" SENSUS SR II LOW LEAD WATER METER WITH AUTOMATIC METER READING REGISTER
1" DIA. SCH. 80 CONDUIT BETWEEN ADJACENT BOXES, SEAL OPEN ENDS WITH TAPE.
CHRISTY CONCRETE PRODUCTS B16 METER BOX, B16X12" EXTENSION, AND N16RP LID WITH 2" PROBE HOLE, OR APPROVED EQUAL
BALL-TYPE CORPORATION STOP (M.I.P. THREAD BY CTS COMPRESSION). JAMES JONES COMPANY E1935SG OR APPROVED EQUAL.
WATER MAIN
WATER
PLAN VIEW
DOUBLE WATER SERVICE MAIN CONNECTION
DATE
REVISIONS
BY
CITY OF LIVE OAK
STANDARD DETAIL
308
APPROVED
10/7/15
DATE



CONSTRUCTION MATERIALS AND NOTES

*NOTE: ALL BRASS FITTINGS AND PIPE SECTIONS SHALL BE NSF61 COMPLIANT

1. ROMAC TYPE 202U OR 202S DOUBLE STRAP SERVICE SADDLE, OR APPROVED EQUAL.
2. BALL-TYPE CORPORATION STOP (M.I.P. THREAD BY C.T.S. COMPRESSION). JAMES JONES COMPANY E1935SG OR APPROVED EQUAL.
3. PE 3408 SDR9 POLYETHYLENE SERVICE PIPE WITH DIRECT BURIAL NO. 12 AWG SOLID COPPER INSULATED TRACER WIRE.
4. QUARTER BEND BRASS UNION (C.T.S. COMPRESSION BY F.I.P. THREAD). JAMES JONES COMPANY E 2621SG, OR APPROVED EQUAL.
5. 18" BRASS NIPPLE, THREADED BOTH ENDS.
6. ANGLE BALL METER VALVE (F.I.P. THREAD BY METER FLANGE). MUELLER COMPANY B-24286, OR APPROVED EQUAL.
7. SENSUS OMNI R² COMPOUND WATER METER WITH AUTOMATIC METER READING COMPATIBILITY TO BE FURNISHED BY THE OWNER AND INSTALLED BY THE CITY OF LIVE OAK PUBLIC WORKS. OWNER IS RESPONSIBLE FOR PROVIDING AND INSTALLING A TEMPORARY RIGID PLACE HOLDER THAT IS THE SAME LAY LENGTH AS THE METER.
8. SENSUS MODEL 520M PIT SET RADIO READ UNIT
9. METER FLANGE (METER FLANGE BY M.I.P. THREAD). JAMES JONES COMPANY E129M, OR APPROVED EQUAL.
10. BRASS UNION
11. 2" BRASS NIPPLE, THREADED BOTH ENDS.
12. 12" BRASS NIPPLE.
13. BRASS ELBOW (F.I.P. THREAD BY F.I.P. THREAD)
14. BRASS TEE (F.I.P. THREAD BY F.I.P. THREAD BY F.I.P. THREAD)
15. STRAIGHT SERVICE BALL VALVE (F.I.P. THREAD BY F.I.P. THREAD). MUELLER COMPANY B-20200, OR APPROVED EQUAL.
16. COMPRESSION COUPLING. ROMAC INDUSTRIES, INC. STYLE "511", OR APPROVED EQUAL. PLACE COMPRESSION COUPLING NUTS TOWARDS METER.
17. METER BOX, CHRISTY CONCRETE PRODUCTS, N36 BOX, B36X12 EXTENSION AND N36RP LID OR APPROVED EQUAL.
18. MINIMUM 6" OF 3/4" CRUSHED ROCK.

1½" AND 2" WATER SERVICES

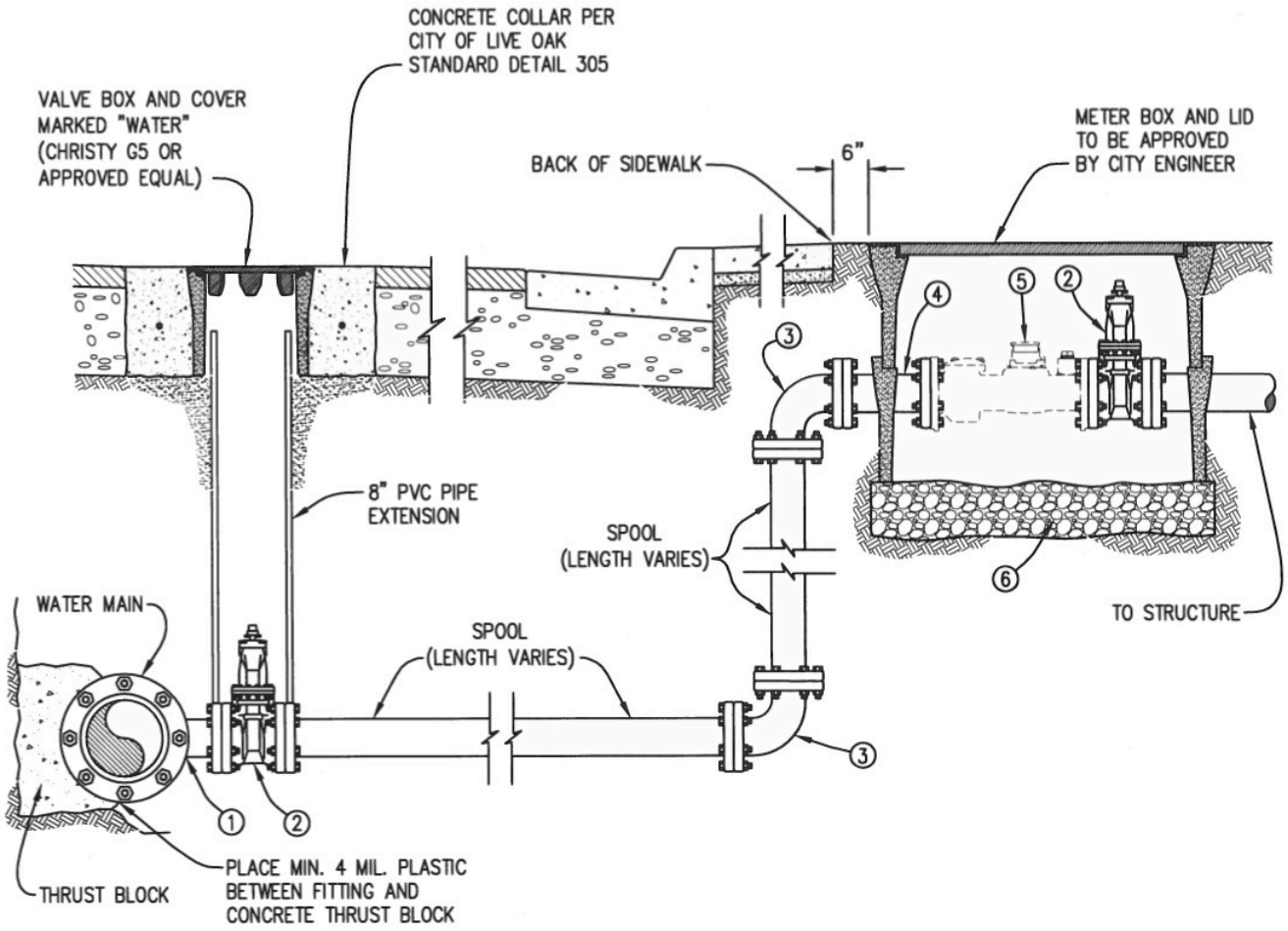
DATE	REVISIONS	BY

CITY OF LIVE OAK

STANDARD DETAIL

309

APPROVED 10/7/15 DATE



CONSTRUCTION MATERIALS AND NOTES

1. FL X FL X FL CAST IRON TEE
2. MUELLER MODEL 2360 FL X FL WATER VALVE (OR APPROVED EQUAL)
3. FL X FL 90° BEND
4. 12" SPOOL
5. SENSUS OMNI C² COMPOUND WATER METER WITH AUTOMATIC METER READING COMPATABILITY TO BE FURNISHED BY THE OWNER AND INSTALLED BY THE CITY OF LIVE OAK PUBLIC WORKS. OWNER IS RESPONSIBLE FOR PROVIDING AND INSTALLING A TEMPORARY RIGID PLACE HOLDER THAT IS THE SAME LAY LENGTH AS THE METER.
6. MINIMUM 6" OF 3/4" CRUSHED ROCK.

3" AND LARGER WATER SERVICES

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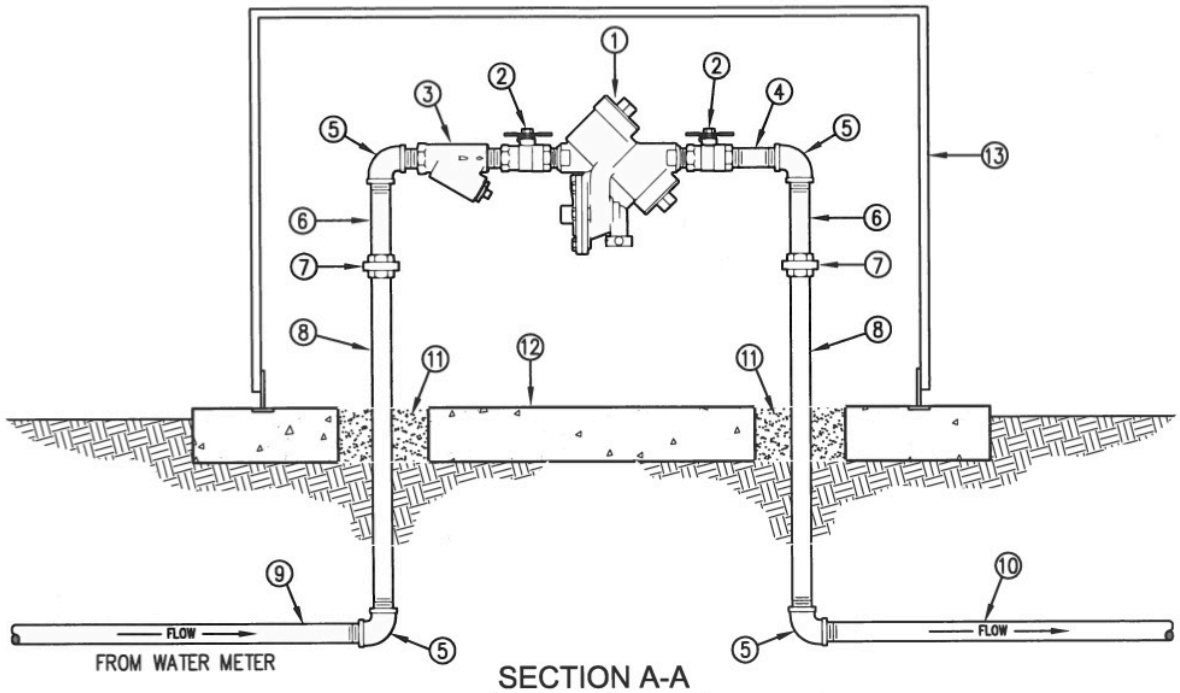
CITY OF LIVE OAK

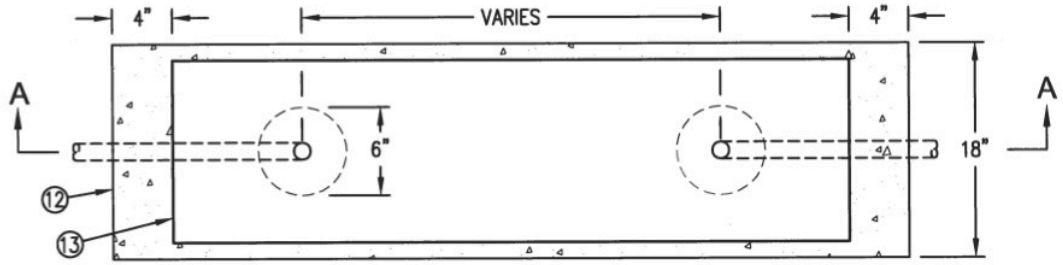
STANDARD DETAIL

310

APPROVED — DATE: 10/7/15



SECTION A-A



PLAN VIEW

CONSTRUCTION MATERIALS AND NOTES *NOTE: ALL BRASS FITTINGS AND PIPE SECTIONS SHALL BE NSF61 COMPLIANT

1. REDUCED PRESSURE BACKFLOW ASSEMBLY SHALL BE A WILKINS MODEL 975XL OR APPROVED EQUAL.
2. BRASS UNION BALL VALVE
3. "Y" TYPE STRAINER
4. BRASS NIPPLE
5. 90° BRASS ELBOW
6. 6" BRASS NIPPLE
7. BRASS UNION
8. RIGID BRASS PIPE (LENGTH VARIES)
9. RIGID BRASS PIPE (LENGTH AS REQUIRED)
10. RIGID BRASS PIPE TO EXTEND A MINIMUM OF 12" BEYOND EDGE OF CONCRETE BASE
11. 6" DIAMETER CIRCULAR OPENING FILLED WITH SAND
12. 6" MINIMUM THICK CONCRETE BASE WITH BOLT ANCHORS EMBEDDED AS REQUIRED FOR ENCLOSURE. EXTEND CONCRETE BASE 4" BEYOND OUTSIDE DIMENSIONS OF ENCLOSURE.
13. BACKFLOW ENCLOSURE SHALL BE A STRONGBOX SBBC-XXAL OR APROVED EQUAL, WITH A CITY APPROVED FREEZE PROTECTION BAG.

CITY OF LIVE OAK

STANDARD DETAIL

STANDARD BACKFLOW ASSEMBLY FOR ¾" TO 2" SERVICES

311

DATE	REVISIONS	BY

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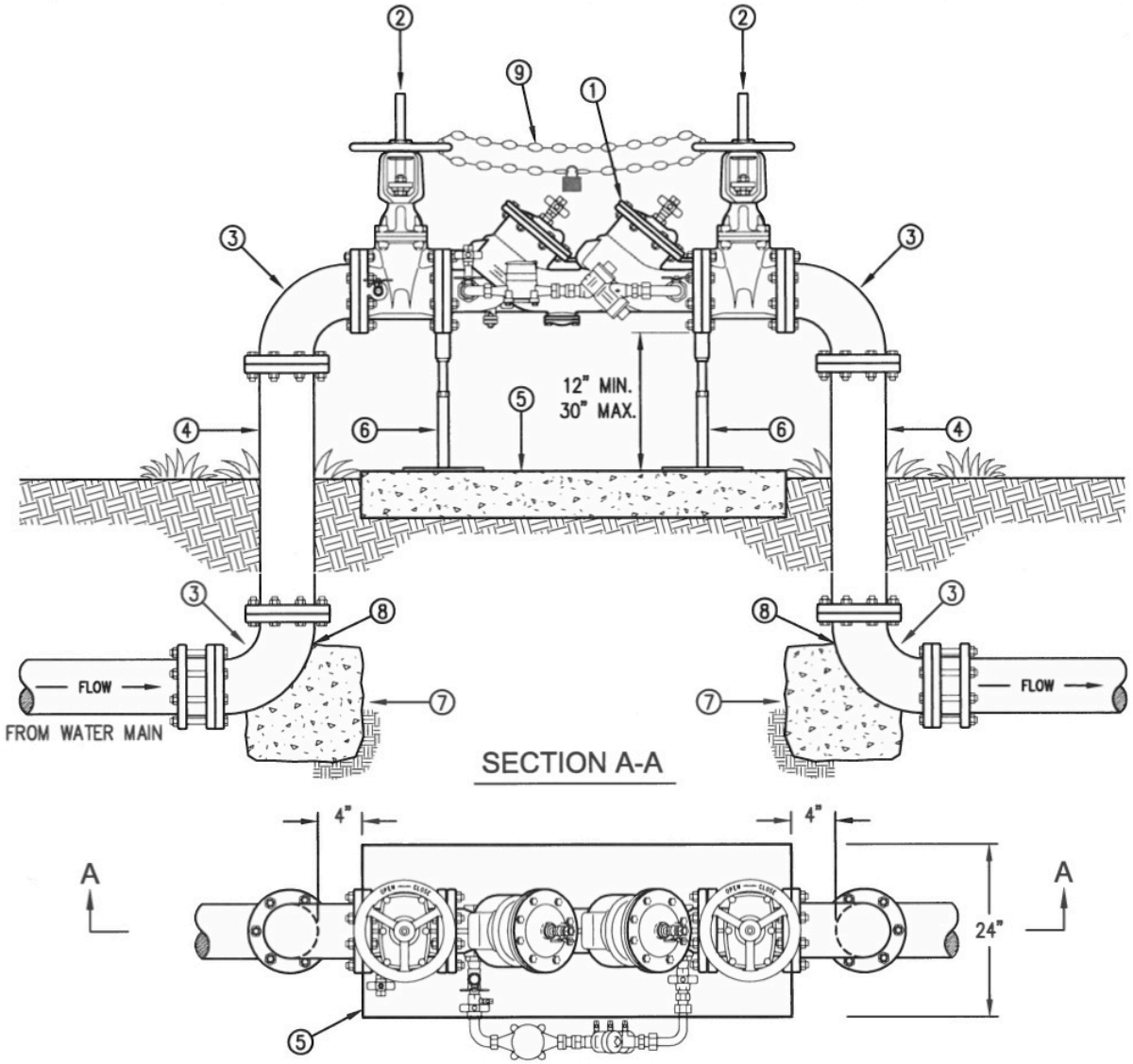

SECTION A-A

PLAN VIEW

CONSTRUCTION MATERIALS AND NOTES

*NOTE: ALL BRASS FITTINGS AND PIPE SECTIONS SHALL BE NSF61 COMPLIANT

① DOUBLE CHECK DETECTOR ASSEMBLY. FEBCO MASTERSERIES 856 WITH ¾" METERED BY-PASS, OR APPROVED EQUAL.
② OS&Y RESILIENT SEAT GATE VALVE.
③ FLANGE x FLANGE DUCTILE IRON 90° ELBOW.
④ FLANGE x FLANGE DUCTILE IRON SPOOL, LENGTH AS REQUIRED.
⑤ 6" THICK CONCRETE SLAB.
⑥ ADJUSTABLE GALVANIZED STEEL PIPE SUPPORT WITH REMOVABLE ANCHOR BOLTS.
⑦ THRUST BLOCK.
⑧ PLACE MINIMUM 4 MILLIMETER PLASTIC BETWEEN FITTING AND CONCRETE THRUST BLOCK.
⑨ INSTALL ⅜" NON CASE HARDENED CHAIN WITH BREAKAWAY LOCK BETWEEN VALVES. LOCK TO BE APPROVED BY BATALLION CHIEF PRIOR TO INSTALLATION. TWO KEYS FOR THE LOCK ARE TO BE PROVIDED TO THE CITY OF LIVE OAK.

*NOTE: THIS ASSEMBLY IS NOT TO BE USED ON FIRE MAINS

DOUBLE CHECK DETECTOR ASSEMBLY FOR SERVICES LARGER THAN 2"

DATE	REVISIONS	BY

CITY OF LIVE OAK

STANDARD DETAIL

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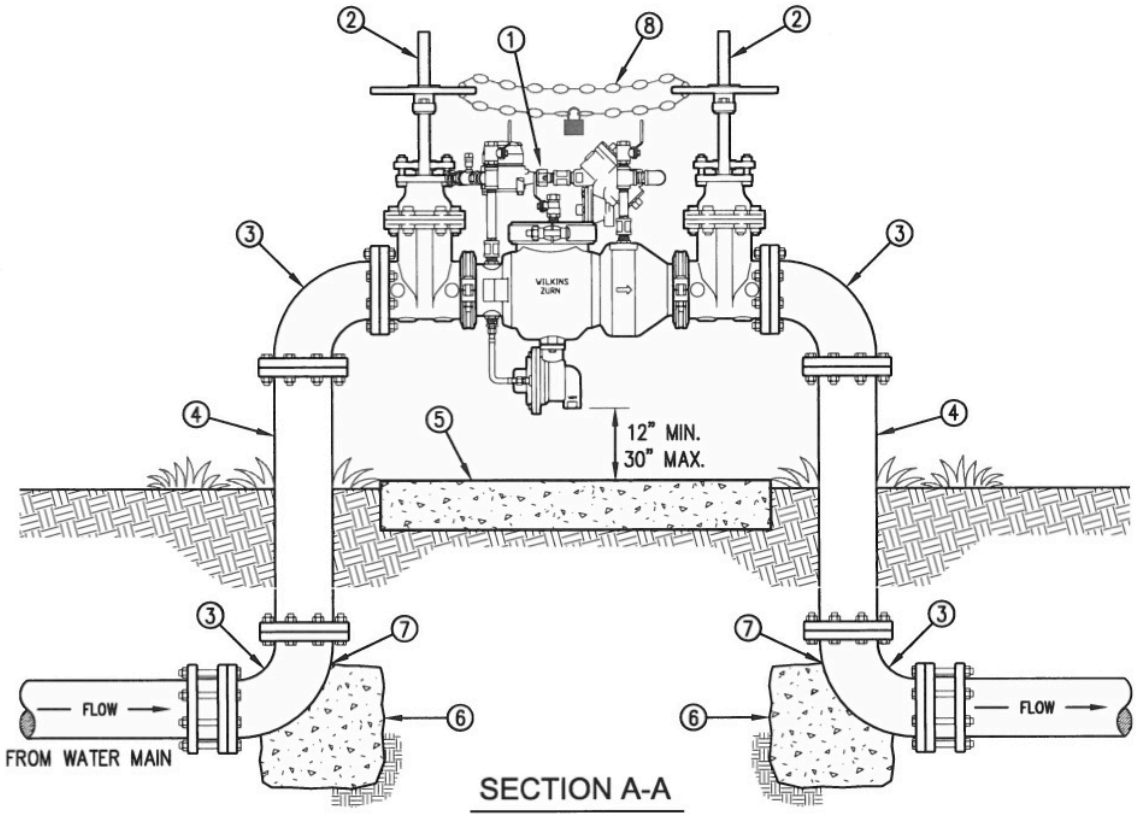
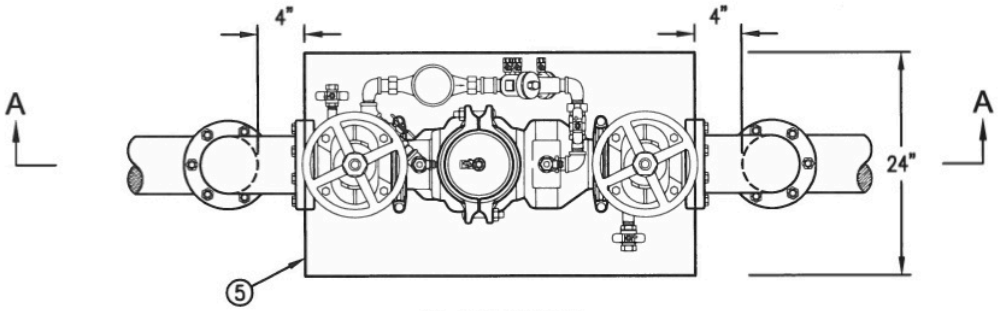
Scott R. Dahle APPROVED 10/7/15 DATE



SECTION A-A



PLAN VIEW

CONSTRUCTION MATERIALS AND NOTES

*NOTE: ALL BRASS FITTINGS AND PIPE SECTIONS SHALL BE NSF61 COMPLIANT

1. REDUCED PRESSURE DETECTOR ASSEMBLY. WILKINS SERIES 375ADA WITH ¾" METERED BY-PASS, OR APPROVED EQUAL
2. OS&Y RESILIENT SEAT GATE VALVE
3. FLANGE x FLANGE DUCTILE IRON 90° ELBOW
4. FLANGE x FLANGE DUCTILE IRON SPOOL, LENGTH AS REQUIRED
5. 6" THICK CONCRETE SLAB
6. THRUST BLOCK
7. PLACE MINIMUM 4 MILLIMETER PLASTIC BETWEEN FITTING AND CONCRETE THRUST BLOCK.
8. INSTALL ⅜" NON CASE HARDENED CHAIN WITH BREAKAWAY LOCK BETWEEN VALVES. LOCK TO BE APPROVED BY BATALLION CHIEF PRIOR TO INSTALLATION. TWO KEYS FOR THE LOCK ARE TO BE PROVIDED TO THE CITY OF LIVE OAK.

NOTE: BACKFLOW ASSEMBLY SHALL BE INSULATED WITH A CITY APPROVED FREEZE PROTECTION BAG.

REDUCED PRESSURE BACKFLOW ASSEMBLY FOR SERVICES LARGER THAN 2"

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CITY OF LIVE OAK

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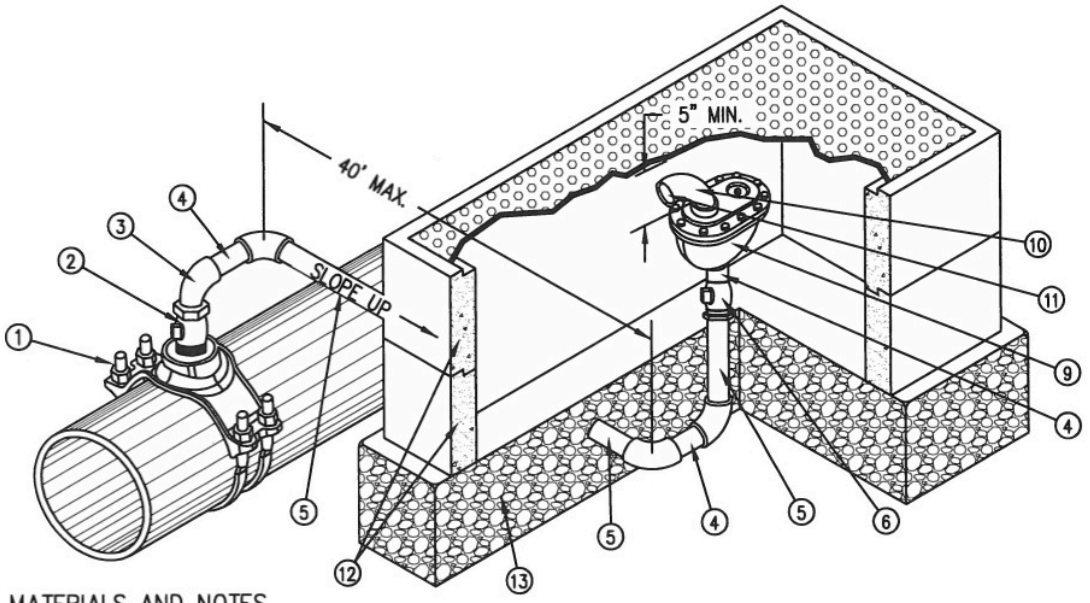
APPROVED 10/7/15 DATE



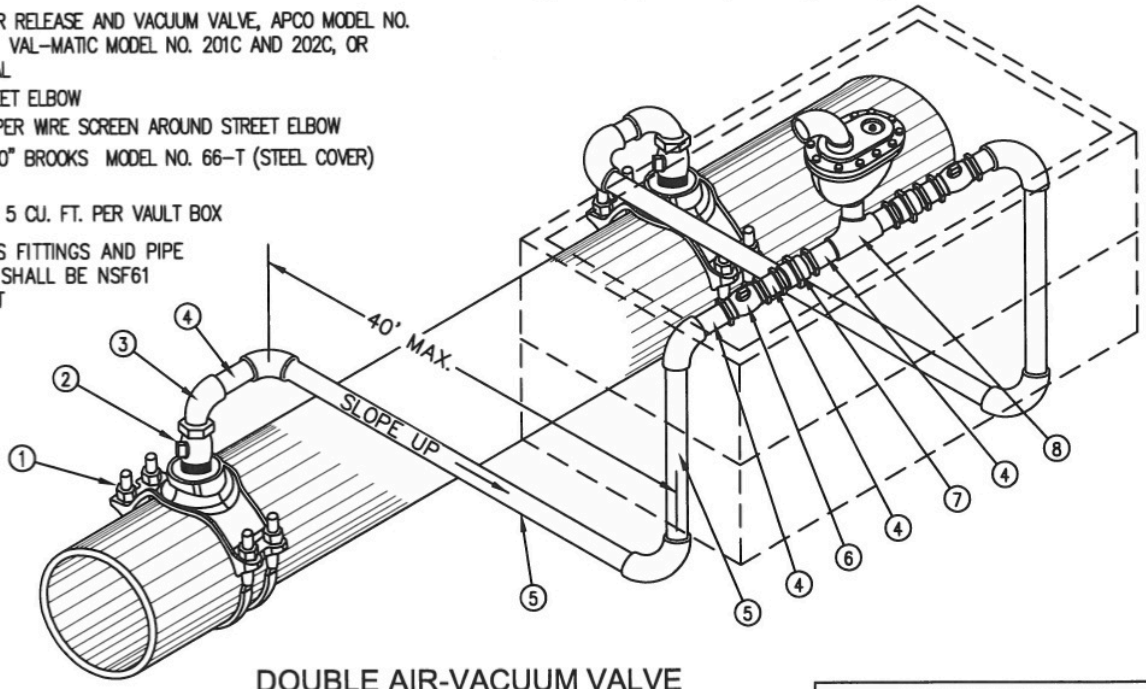
CONSTRUCTION MATERIALS AND NOTES

1. ROMAC TYPE 202U OR 202S DOUBLE STRAP SERVICE SADDLE, OR APPROVED EQUAL
2. FORD MODEL FB 1700 CORPORATION STOP
3. 90° BRASS ELBOW
4. BRASS NIPPLE
5. RIGID BRASS
6. JAMES JONES MODEL J1900 BALL TYPE CURB STOP, OR APPROVED EQUAL
7. BRASS UNION
8. BRASS TEE
9. COMBINATION AIR RELEASE AND VACUUM VALVE, APCO MODEL NO. 143C AND 145C, VAL-MATIC MODEL NO. 201C AND 202C, OR APPROVED EQUAL
10. 90° BRASS STREET ELBOW
11. FINE MESH COPPER WIRE SCREEN AROUND STREET ELBOW
12. VAULT: 17" X 30" BROOKS MODEL NO. 66-T (STEEL COVER) WITH EXTENSION
13. 1" DRAIN ROCK, 5 CU. FT. PER VAULT BOX

NOTE: ALL BRASS FITTINGS AND PIPE SECTIONS SHALL BE NSF61 COMPLIANT

SINGLE AIR-VACUUM VALVE
TYPE "A"

TYPE	AIR-VALVE SIZE	SIZE OF PIPE FITTINGS
A	1"	2"
A	2"	2"
B	1"	1"
B	2"	2"



DOUBLE AIR-VACUUM VALVE
TYPE "B"

CITY OF LIVE OAK

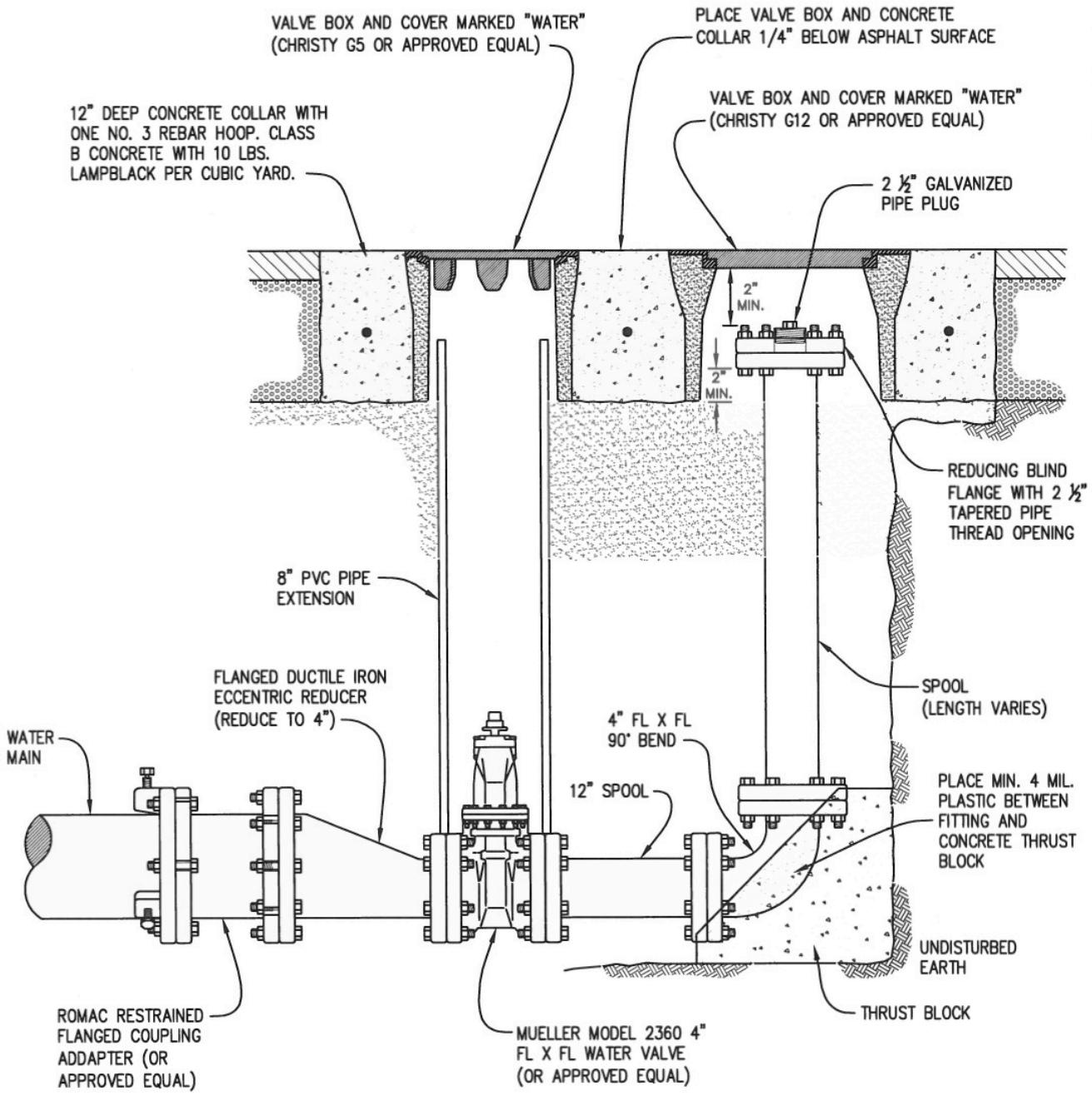
STANDARD DETAIL

AIR-VACUUM VALVES

314

DATE	REVISIONS	BY

APPROVED — DATE: 10/7/15



TYPICAL BLOWOFF AT DEAD ENDS

DEAD-END WATER MAIN

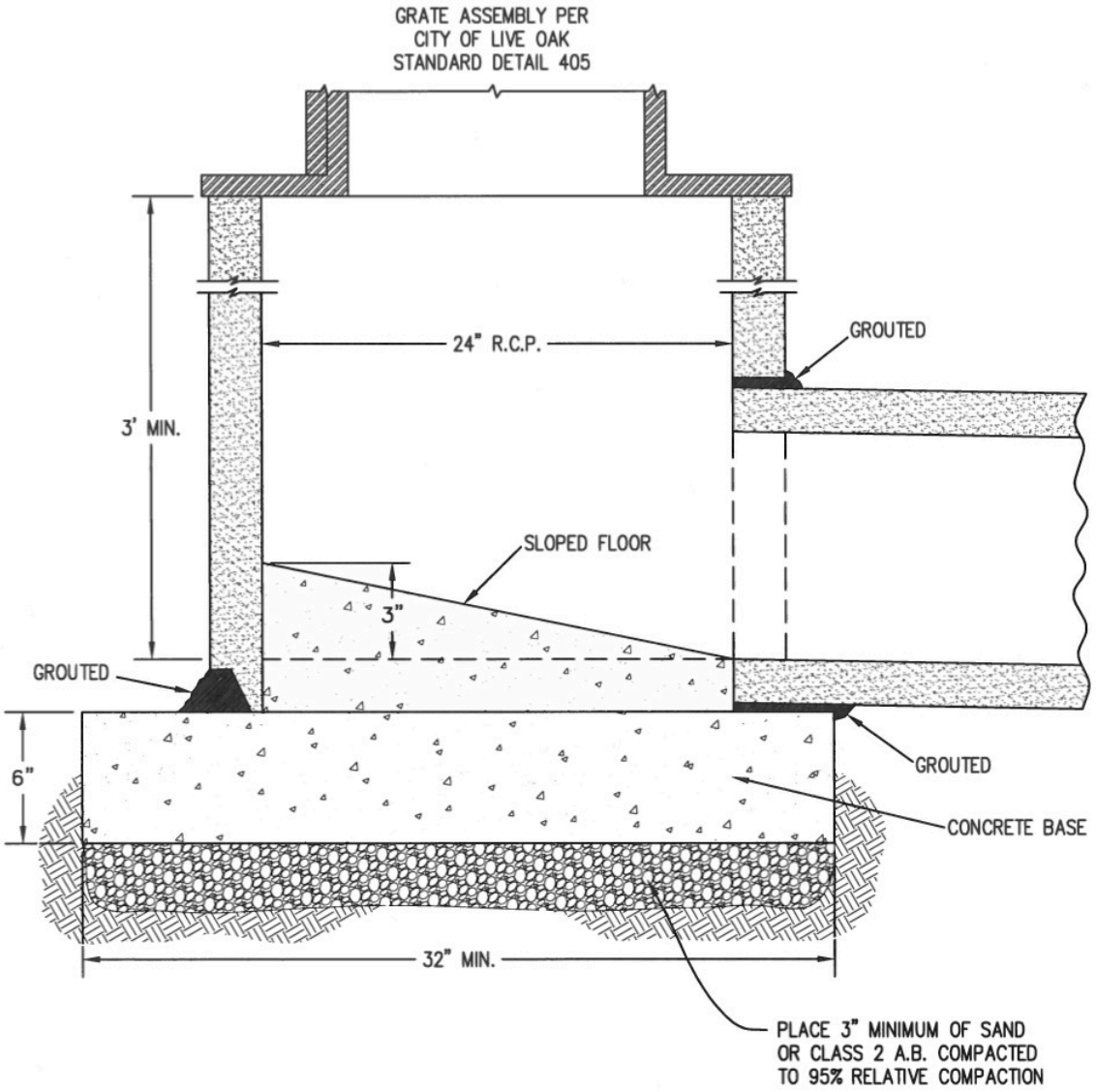
DATE	REVISIONS	BY

CITY OF LIVE OAK

STANDARD DETAIL

315

APPROVED — DATE: 10/7/15



R.C.P.
STORM DRAIN
DROP INLET

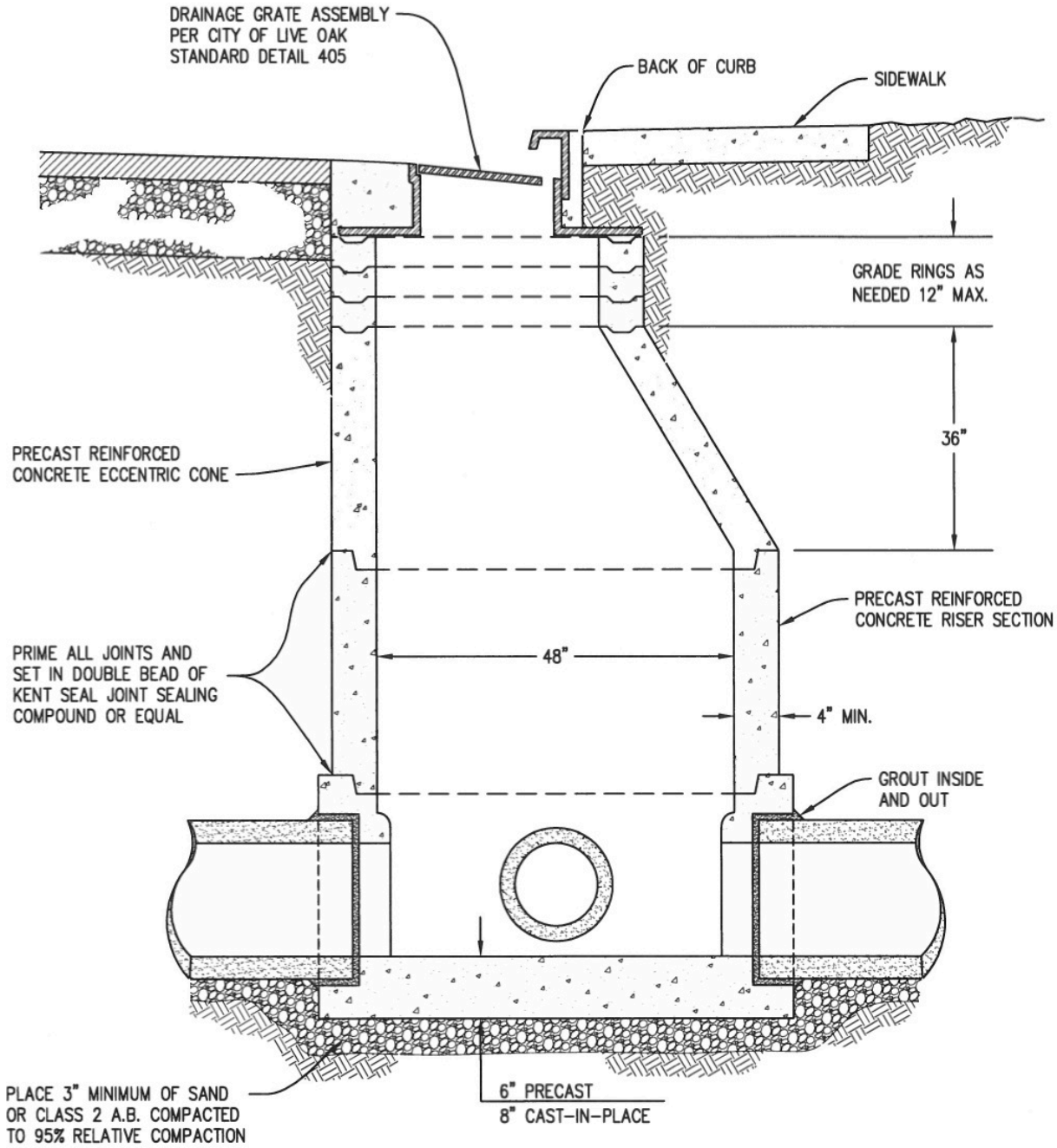
DATE	REVISIONS	BY

CITY OF LIVE OAK

STANDARD DETAIL

401

APPROVED 10/7/15 DATE



JUNCTION D.I. DETAIL

DATE	REVISIONS	BY

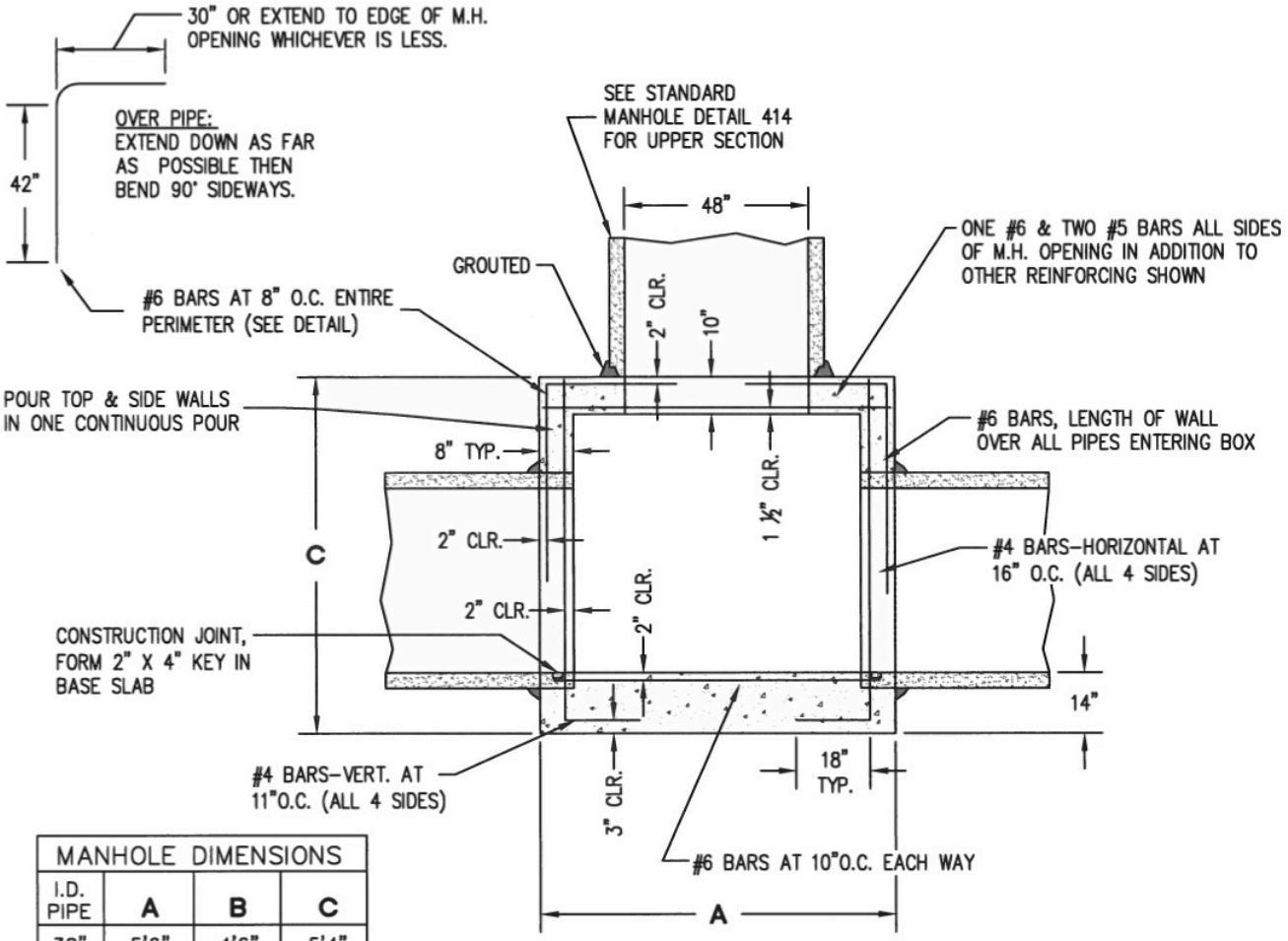
CITY OF LIVE OAK

STANDARD DETAIL

402

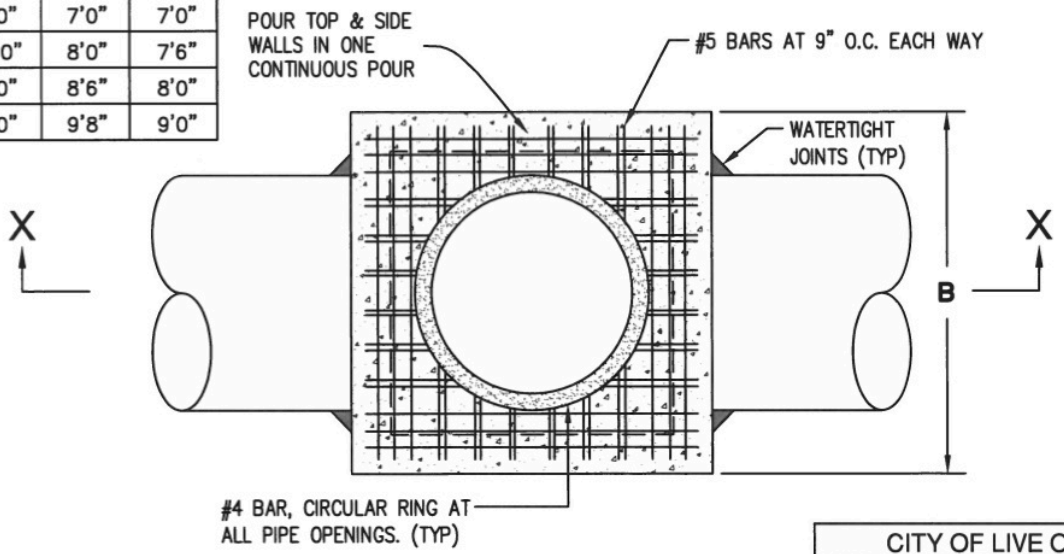
Scott R. Robb — APPROVED

10/7/15 — DATE



SECTION X-X

MANHOLE DIMENSIONS			
I.D. PIPE	A	B	C
30"	5'6"	4'6"	5'4"
36"	6'0"	5'6"	5'10"
42"	6'6"	6'6"	6'4"
48"	7'0"	7'0"	7'0"
54"	7'10"	8'0"	7'6"
60"	8'0"	8'6"	8'0"
72"	9'0"	9'8"	9'0"



JUNCTION BOX FOR PIPES 30" DIAMETER OR GREATER

DATE	REVISIONS	BY

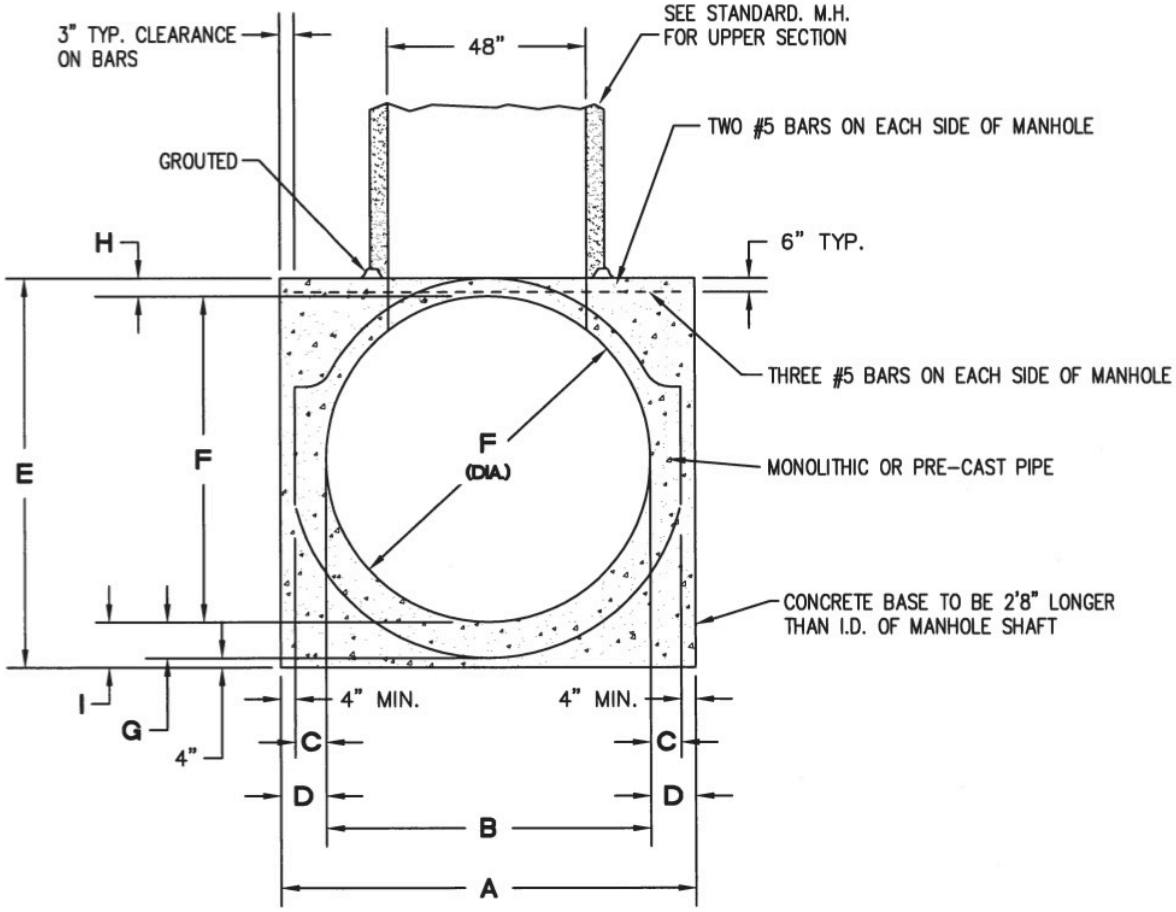
CITY OF LIVE OAK

STANDARD DETAIL

403

APPROVED — DATE 10/7/15

MANHOLE DIMENSIONS									
I.D. PIPE	A	B	C	D	E	F	G	H	I
30"	5'0"	2'6"	4"	1'3"	3'9"	2'6"	3"	8"	7"
36"	5'0"	3'0"	4½"	1'0"	4' 3½"	3'0"	3½"	8"	7½"
42"	5'0"	3'6"	5"	9"	4'10"	3'6"	4"	8"	8"
48"	5'8"	4'0"	6"	10"	5'5"	4'0"	5"	8"	9"
54"	6'3"	4'6"	6½"	10½"	5' 11½"	4'6"	5½"	8"	9½"
60"	6'10"	5'0"	7"	11"	6'6"	5'0"	6"	8"	10"
72"	7'11"	6'0"	7½"	11½"	7' 6½"	6'0"	6½"	8"	10½"
84"	9'0"	7'0"	8"	1'0"	8'7"	7'0"	7"	8"	11"



MANHOLE FOR PIPE 30" DIA. OR GREATER

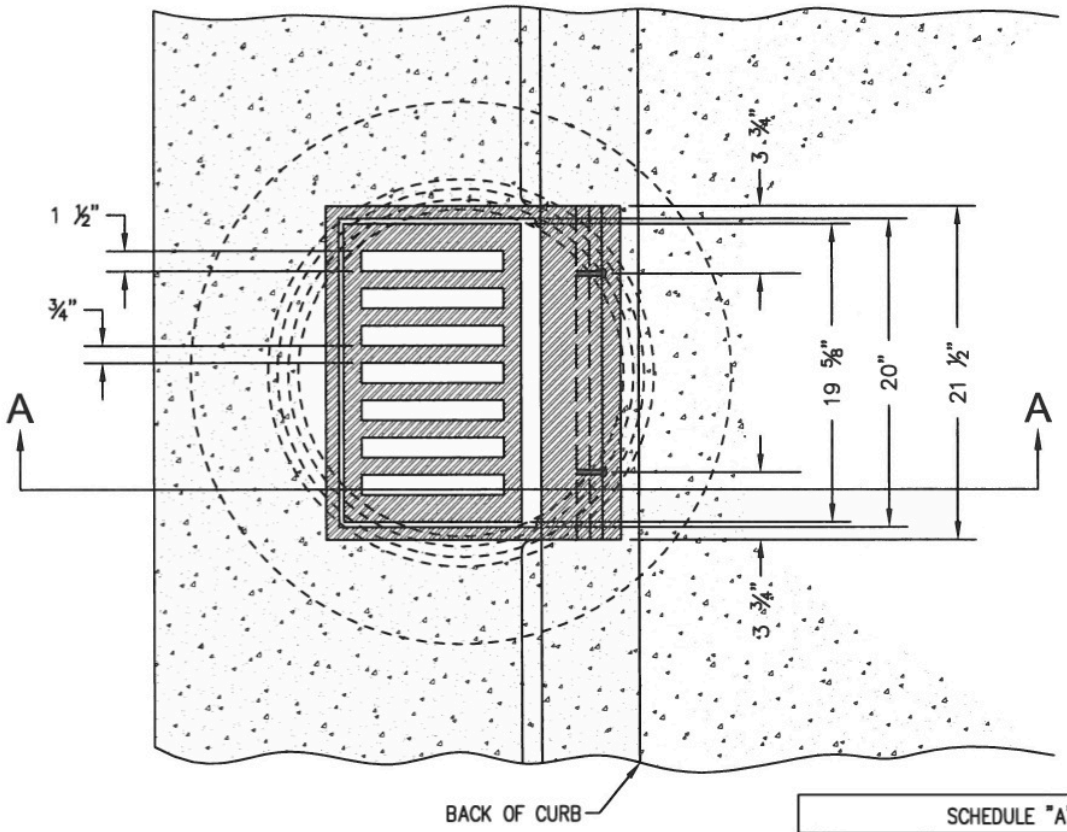
DATE	REVISIONS	BY

CITY OF LIVE OAK

STANDARD DETAIL

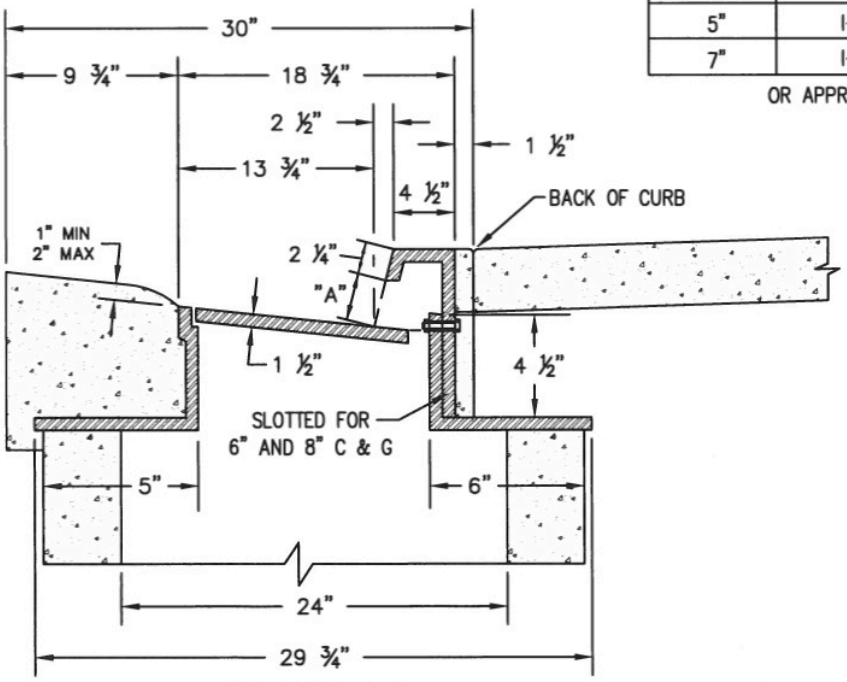
404

APPROVED 10/7/15 DATE



SCHEDULE "A"		
CURB HT.	D & L SUPPLY	"A"
5"	I-4420	3 ¼"
7"	I-4420	5"

OR APPROVED EQUAL



SECTION A-A

DROP INLET DRAINAGE GRATE ASSEMBLY

DATE	REVISIONS	BY

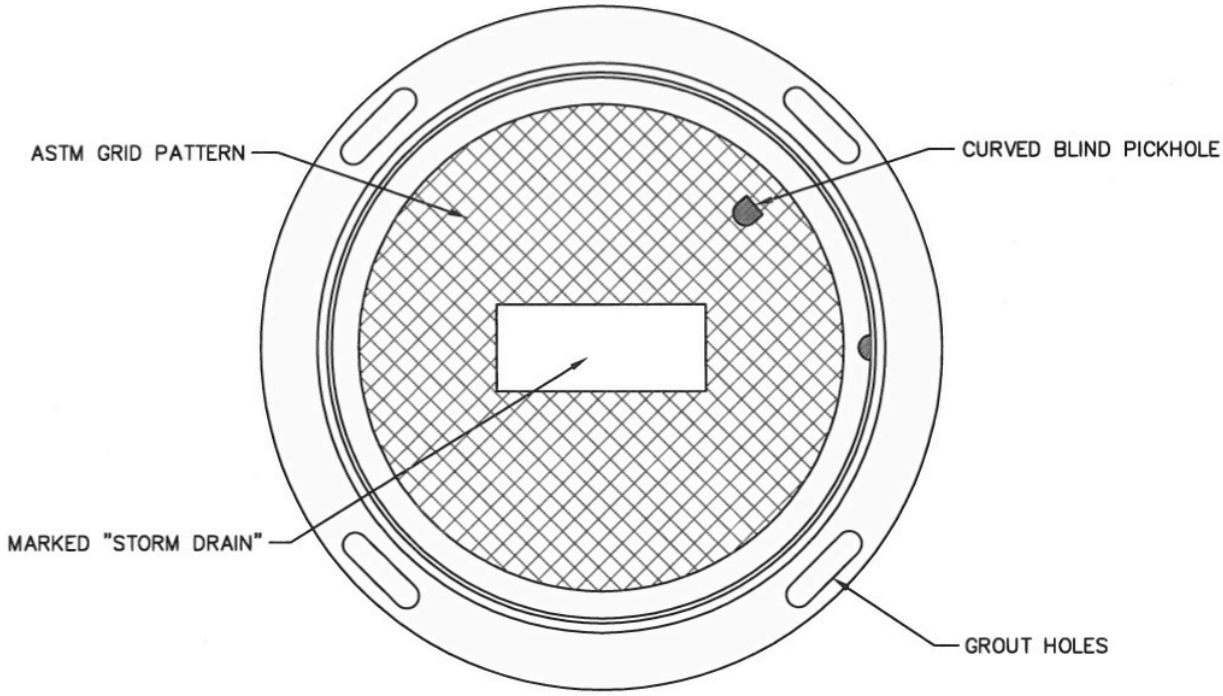
CITY OF LIVE OAK

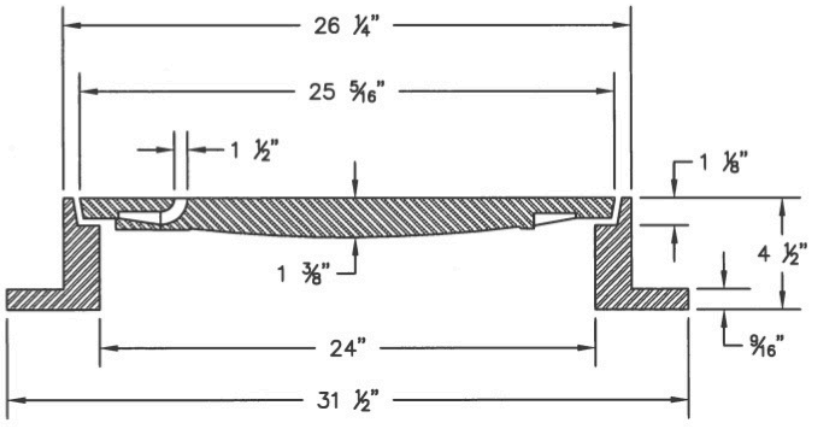
STANDARD DETAIL

405

APPROVED 10/7/15 DATE

NOTE: MANHOLE FRAME & COVER PHOENIX IRON WORKS NO. P-1090 OR APPROVED EQUAL





STORM DRAIN MANHOLE FRAME & COVER

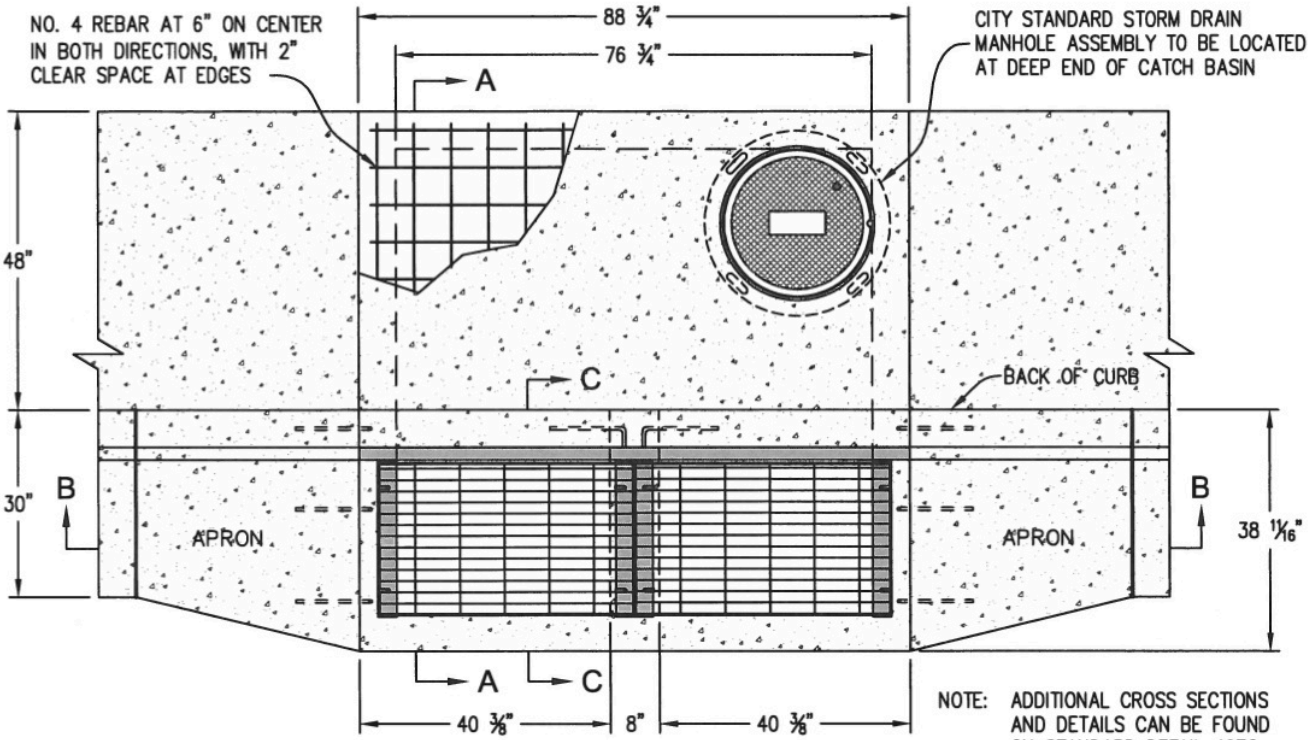
DATE	REVISIONS	BY

CITY OF LIVE OAK

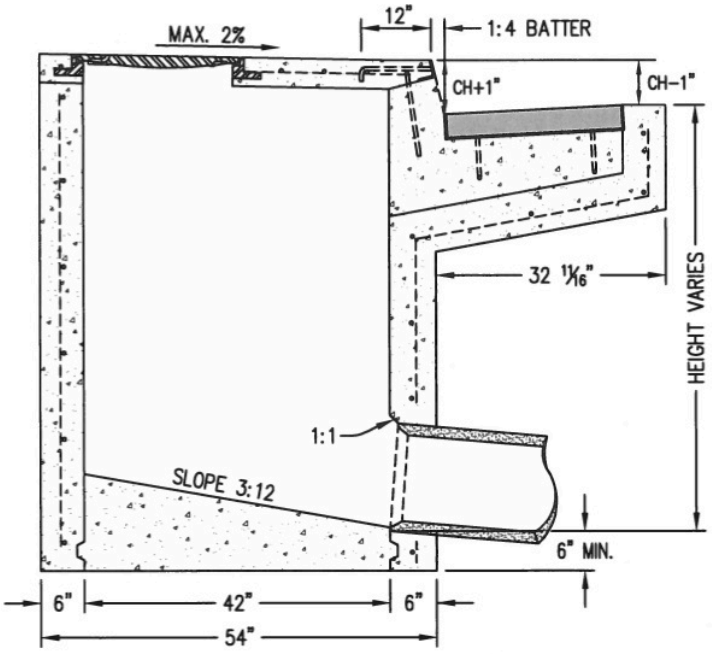
STANDARD DETAIL

406

APPROVED — DATE 10/7/15



PLAN VIEW



SECTION A-A

CONSTRUCTION MATERIALS AND NOTES

1. HEIGHT SHALL NOT EXCEED 8' MAXIMUM.
2. REINFORCING STEEL IN WALLS SHALL BE NUMBER 4 REBAR AT 12"± CENTERS PLACED 2" CLEAR TO INSIDE OF BOX, UNLESS OTHERWISE SHOWN.
3. FRAME AND GRATE SHALL BE CALTRANS TYPE 24–12X GALVANIZED, OR APPROVED EQUAL.
4. PIPE(S) CAN BE PLACED IN ANY WALL.
5. CURB SECTION SHALL MATCH ADJACENT CURB.
6. BASIN FLOORS SHALL HAVE A WOOD TROWEL FINISH AND MINIMUM SLOPE OF 3:12 FROM ALL DIRECTIONS TOWARD THE OUTLET PIPE.
7. ALL HARDWARE SHALL BE HOT DIP GALVANIZED AFTER FABRICATION.
8. WHEN INSTALLED IN EXISTING ROLLED CURB AND GUTTER, WARP TO VERTICAL CURB IN A 10' TRANSITION.
9. WHEN APRON IS CONSTRUCTED WITH DROP INLET, EXTEND NUMBER 4 SIDEWALL REBAR 12" INTO TAPERED GUTTER PAN.
10. DO NOT INSTALL APRON IN AREAS WITHOUT CURB AND GUTTER.
11. CONCRETE SHALL BE CLASS B P.C.C. WITH LAMPBLACK OF APPROVED QUALITY ADDED AT THE RATE OF ONE–HALF POUND PER CUBIC YARD.
12. CH = CURB HEIGHT

NOTE: A PRECAST UNIT MEETING THESE MINIMUM STANDARDS MAY BE SUBSTITUTED UPON PRIOR APPROVAL OF THE CITY ENGINEER.

DOUBLE GRATE DRAINAGE INLET AND BASIN

DATE	REVISIONS	BY

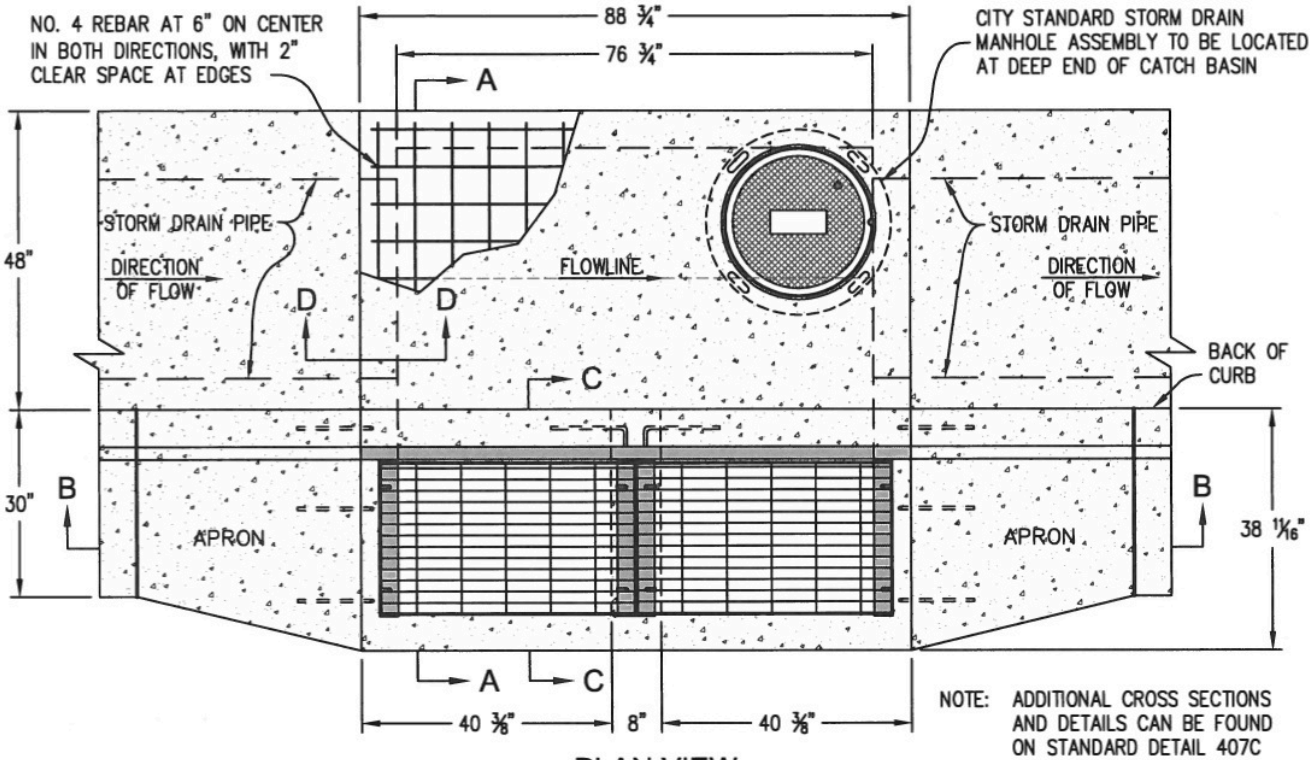
CITY OF LIVE OAK

STANDARD DETAIL

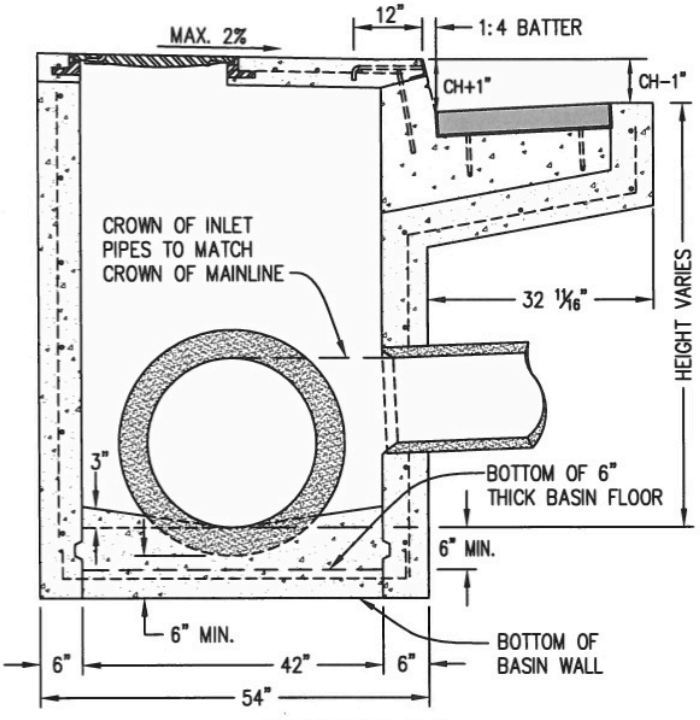
407A

Scott R. Ruble 10/7/15

APPROVED DATE



PLAN VIEW



SECTION A-A

CONSTRUCTION MATERIALS AND NOTES

1. HEIGHT SHALL NOT EXCEED 8' MAXIMUM.
2. REINFORCING STEEL IN WALLS SHALL BE NUMBER 4 REBAR AT 12"± CENTERS PLACED 2" CLEAR TO INSIDE OF BOX, UNLESS OTHERWISE SHOWN.
3. FRAME AND GRATE SHALL BE CALTRANS TYPE 24-12X GALVANIZED, OR APPROVED EQUAL.
4. PIPE(S) CAN BE PLACED IN ANY WALL.
5. CURB SECTION SHALL MATCH ADJACENT CURB.
6. BASIN FLOORS SHALL HAVE A WOOD TROWEL FINISH AND MINIMUM SLOPE OF 1:12 FROM ALL DIRECTIONS TOWARD THE FLOWLINE.
7. ALL HARDWARE SHALL BE HOT DIP GALVANIZED AFTER FABRICATION.
8. WHEN INSTALLED IN EXISTING ROLLED CURB AND GUTTER, WARP TO VERTICAL CURB IN A 10' TRANSITION.
9. WHEN APRON IS CONSTRUCTED WITH DROP INLET, EXTEND NUMBER 4 SIDEWALL REBAR 12" INTO TAPERED GUTTER PAN.
10. DO NOT INSTALL APRON IN AREAS WITHOUT CURB AND GUTTER.
11. CONCRETE SHALL BE CLASS B P.C.C. WITH LAMPBLACK OF APPROVED QUALITY ADDED AT THE RATE OF ONE-HALF POUND PER CUBIC YARD.
12. CH = CURB HEIGHT

NOTE: A PRECAST UNIT MEETING THESE MINIMUM STANDARDS MAY BE SUBSTITUTED UPON PRIOR APPROVAL OF THE CITY ENGINEER.

MODIFIED DOUBLE GRATE DRAINAGE INLET AND BASIN

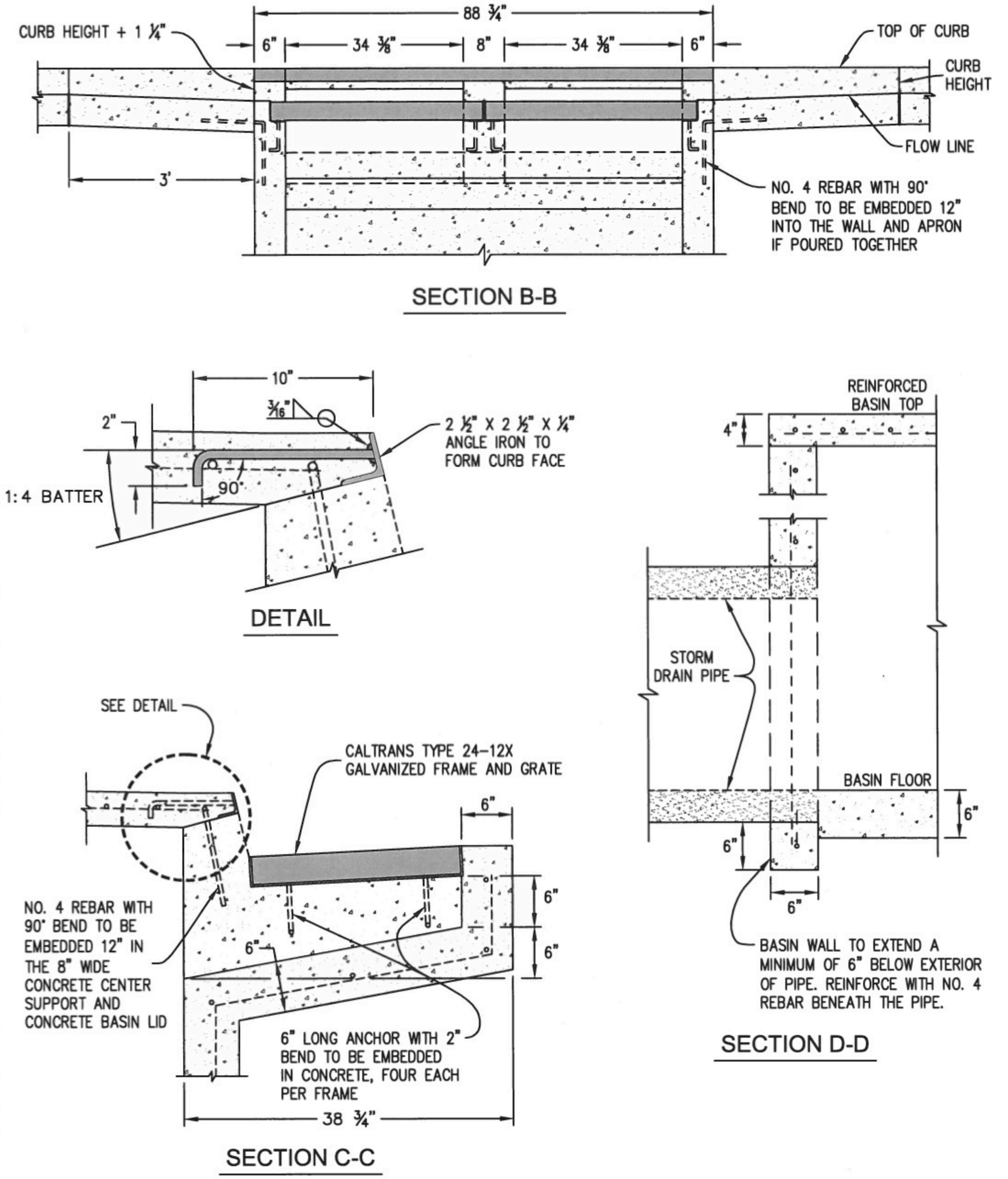
DATE	REVISIONS	BY

CITY OF LIVE OAK

STANDARD DETAIL

407B

APPROVED 10/7/15 DATE



DOUBLE GRATE DRAINAGE INLET AND BASIN CROSS SECTIONS AND DETAILS

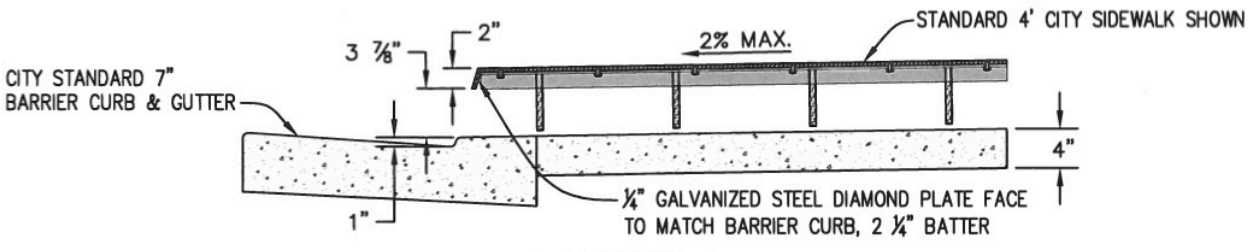
DATE	REVISIONS	BY

CITY OF LIVE OAK

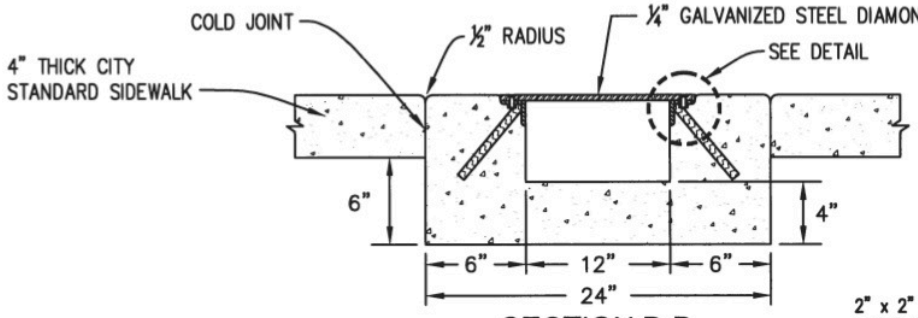
STANDARD DETAIL

407C

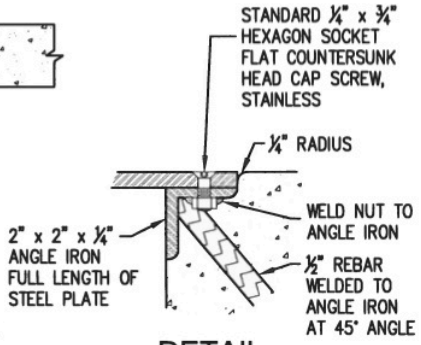
APPROVED 10/7/15 DATE



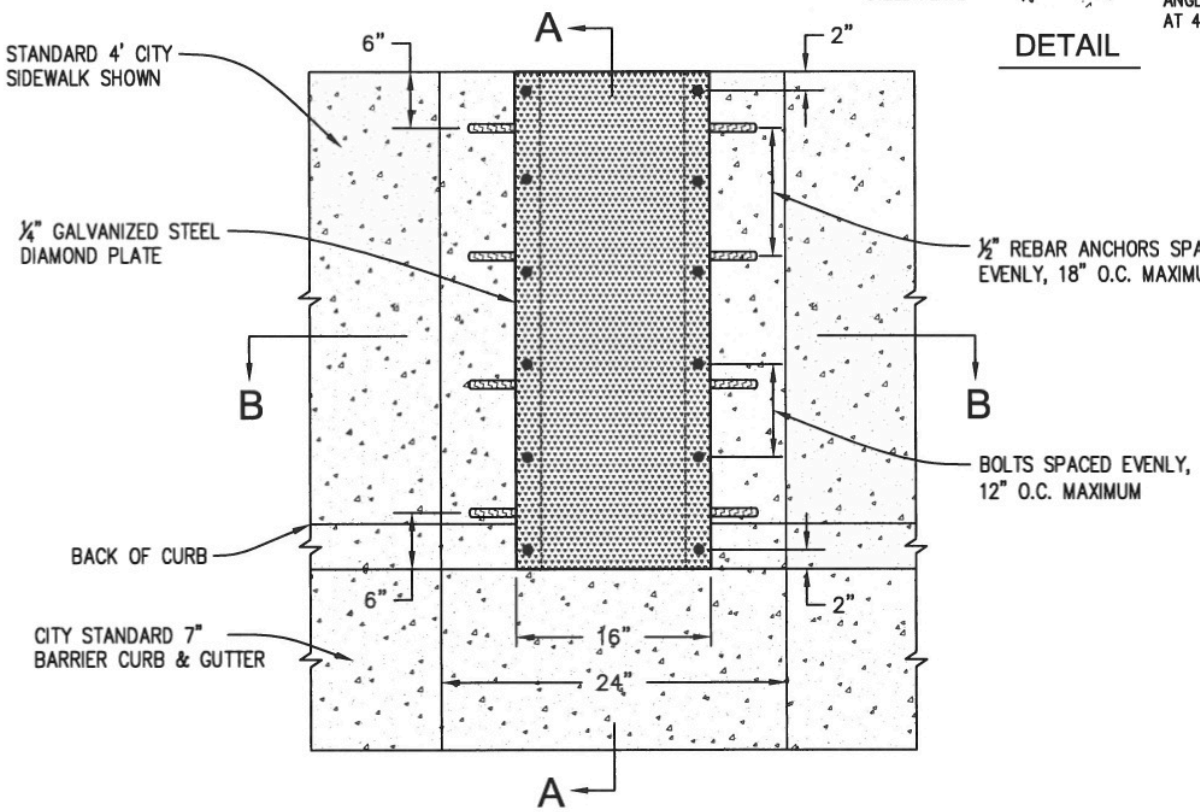
SECTION A-A



SECTION B-B



DETAIL



PLAN VIEW

UNDER SIDEWALK DRAIN FOR 7" BARRIER CURB

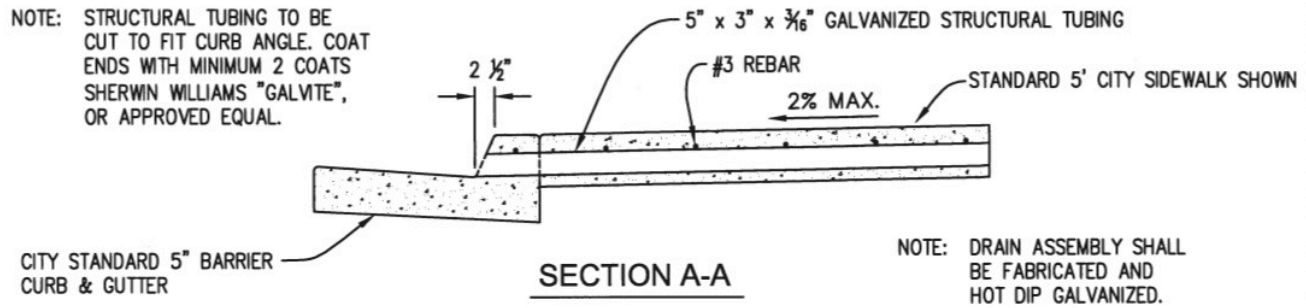
DATE	REVISIONS	BY

CITY OF LIVE OAK

STANDARD DETAIL

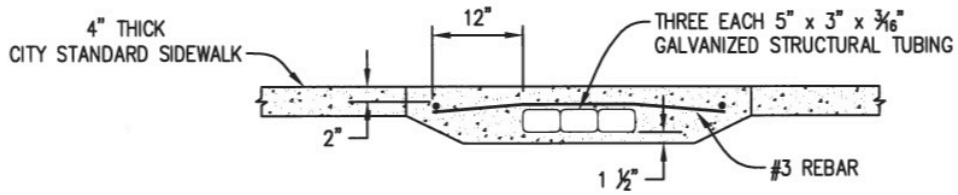
408

Scott R. Robb — APPROVED — 10/7/15 — DATE

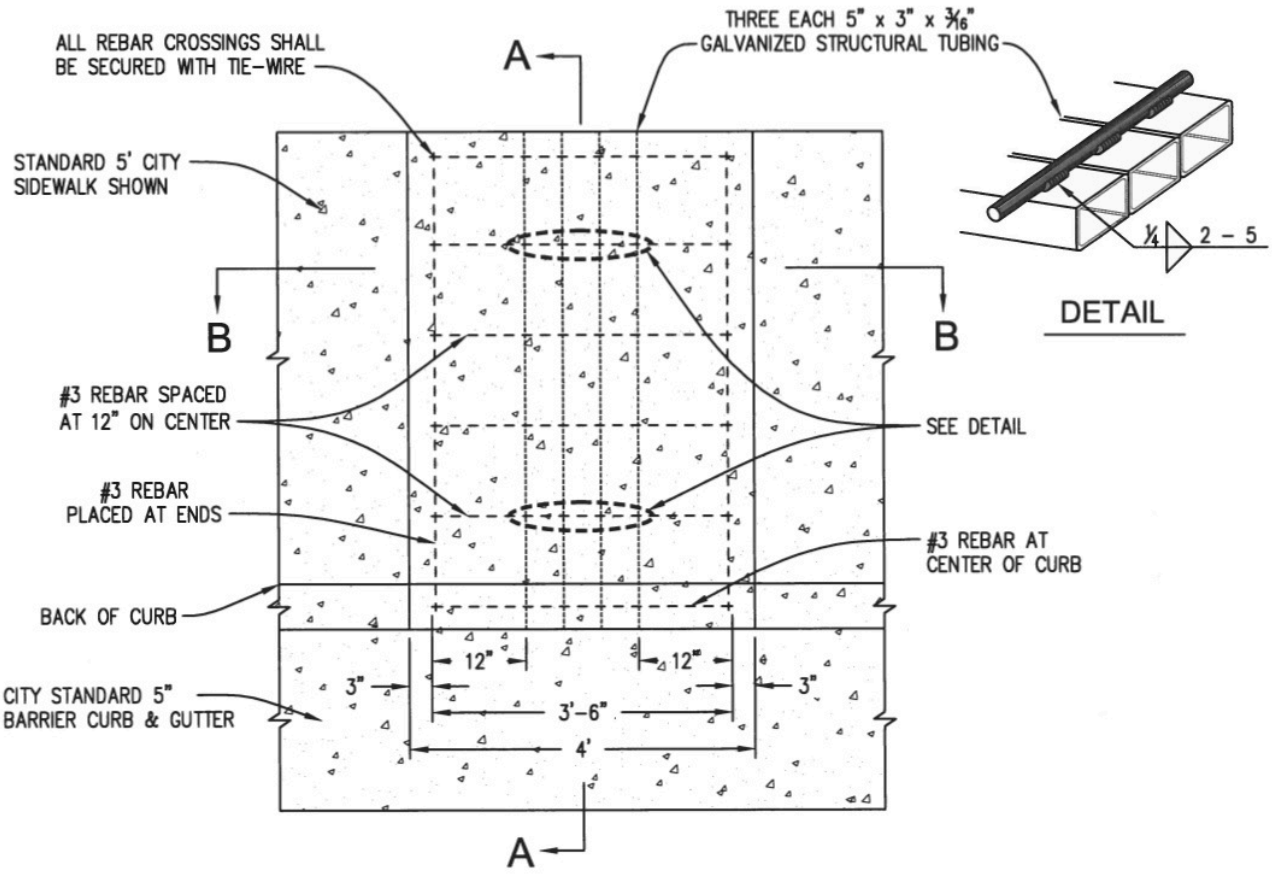


SECTION A-A

NOTE: DRAIN ASSEMBLY SHALL BE FABRICATED AND HOT DIP GALVANIZED.



SECTION B-B



DETAIL

PLAN VIEW

UNDER SIDEWALK DRAIN FOR 5" BARRIER CURB

DATE	REVISIONS	BY

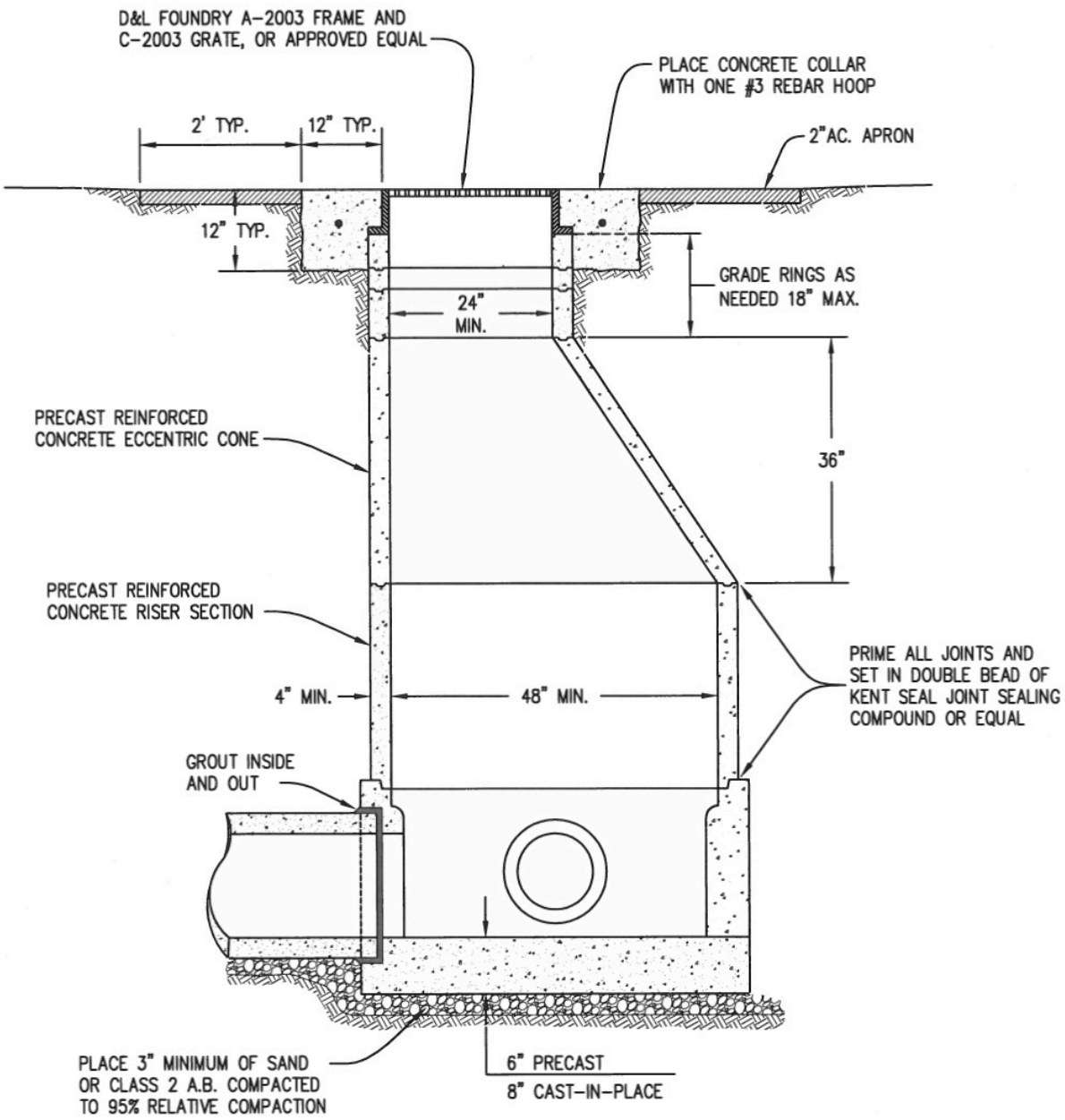
CITY OF LIVE OAK

STANDARD DETAIL

409

Scott R. Robb — APPROVED

10/7/15 — DATE



TYPE "A" FIELD INLET

DATE	REVISIONS	BY

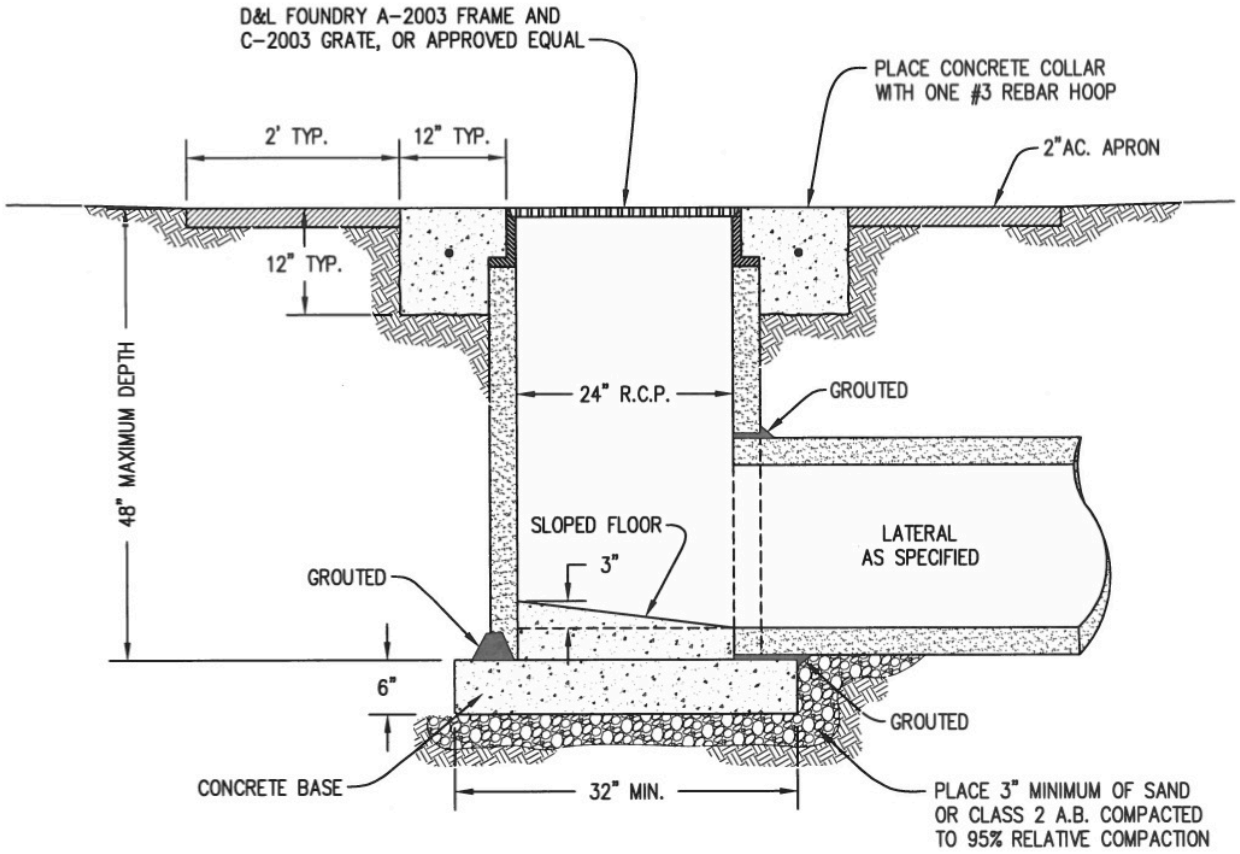
CITY OF LIVE OAK

STANDARD DETAIL

410

Scott R. Robb — APPROVED

10/7/15 — DATE



CONSTRUCTION MATERIALS AND NOTES

1. 2' x 2' PRECAST CATCH BASIN W/ H20 WHEEL LOADING MAY BE SUBSTITUTED WHEN APPROVED BY THE CITY ENGINEER.

TYPE "B" FIELD INLET

DATE	REVISIONS	BY

CITY OF LIVE OAK

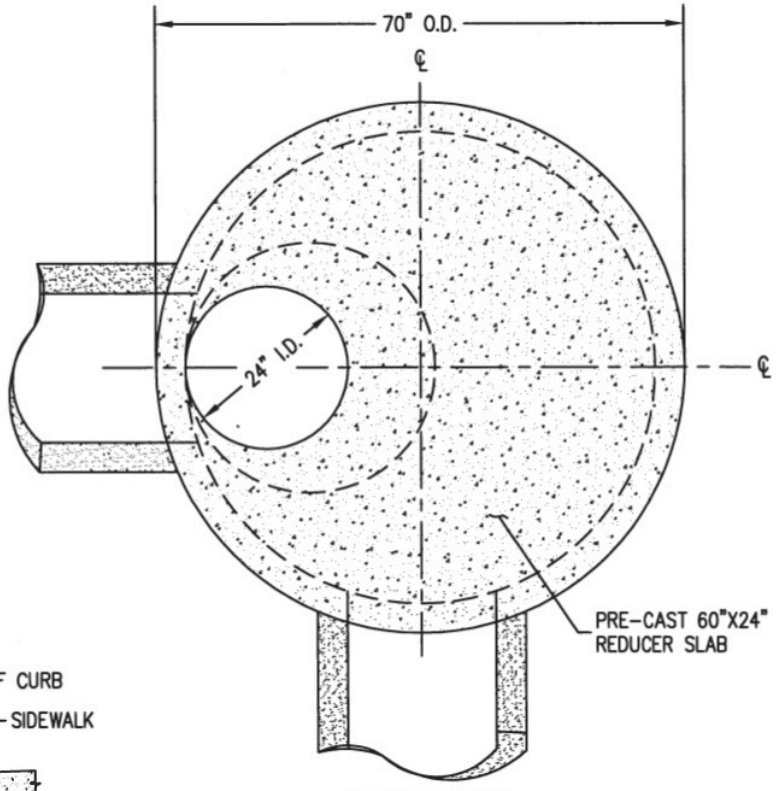
STANDARD DETAIL

411

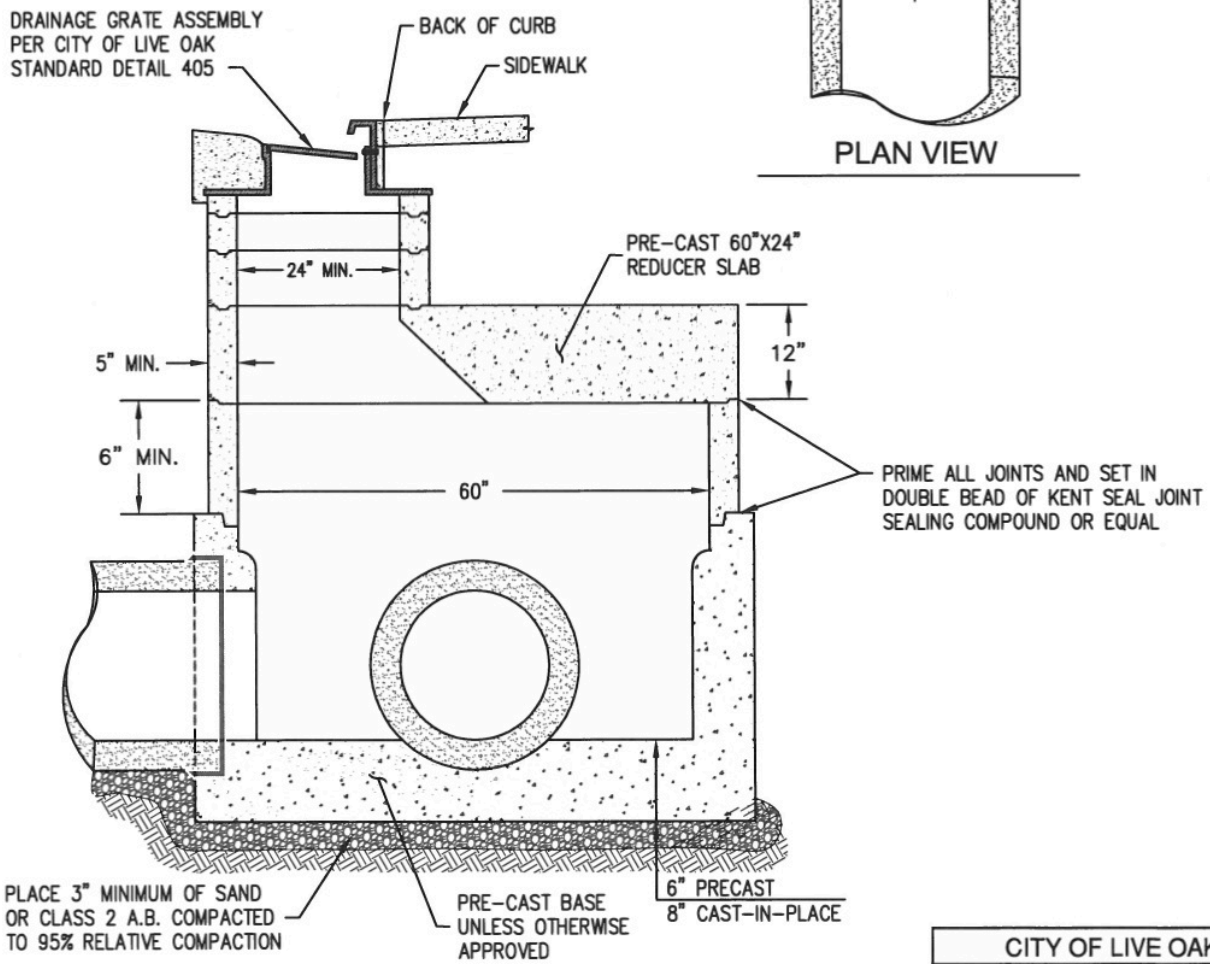
Scott R. Ruble APPROVED 10/7/15 DATE

CONSTRUCTION MATERIALS AND NOTES

1. GALVANIZED STEEL STEPS MAY BE SPECIFIED. STEPS SHALL BE ¾" DIAMETER, SPACED AT 12" O.C. AND 6" FROM JOINTS
2. PRE-CAST REDUCER SLAB SHALL MEET H20 WHEEL LOADING REQUIREMENTS



PLAN VIEW



MODIFIED JUNCTION BOX

DATE	REVISIONS	BY

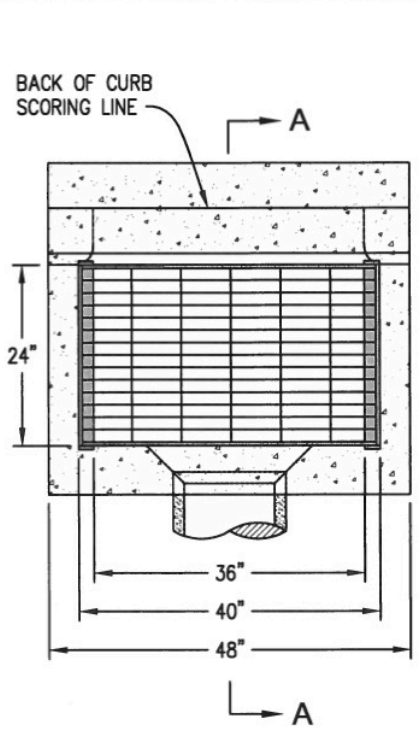
CITY OF LIVE OAK

STANDARD DETAIL

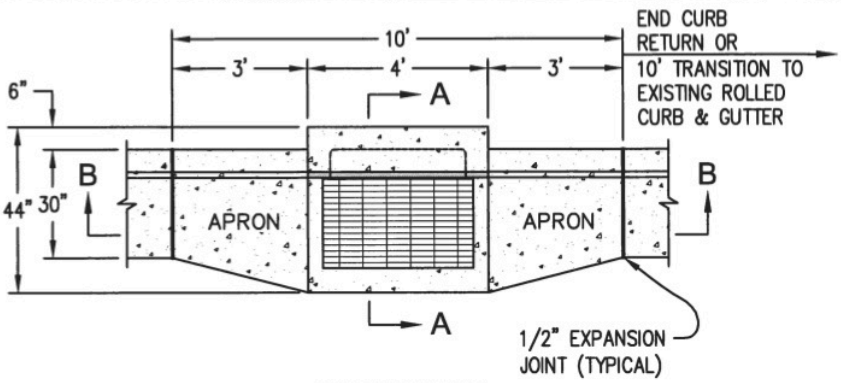
412

Scott R. Rollo 10/7/15

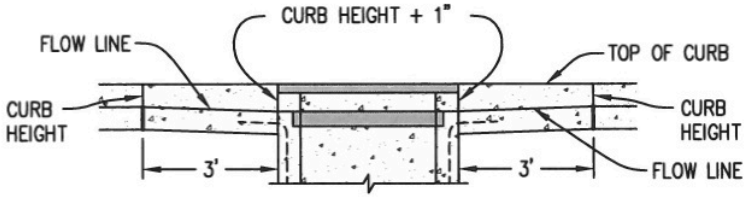
APPROVED DATE



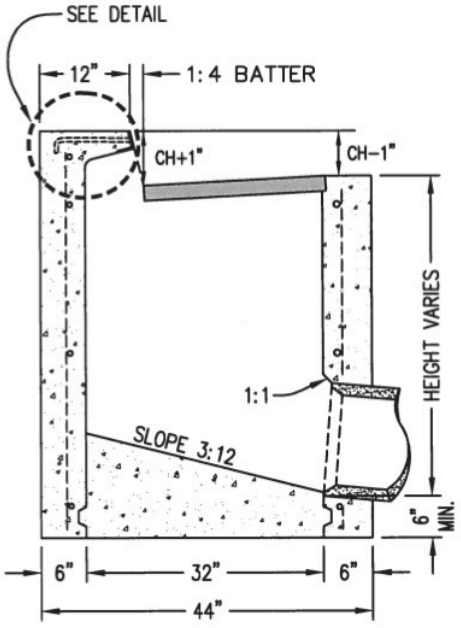
PLAN VIEW



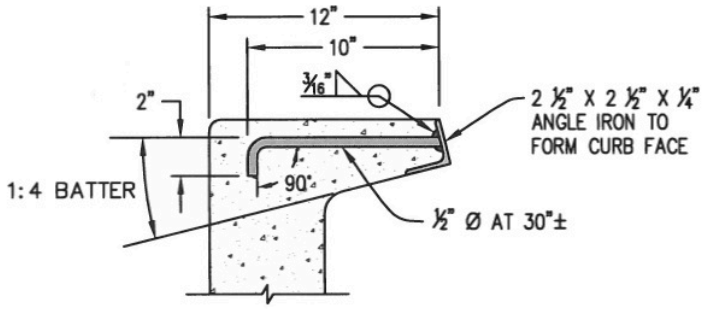
PLAN VIEW



SECTION B-B



SECTION A-A



DETAIL

CONSTRUCTION MATERIALS AND NOTES

1. HEIGHT SHALL NOT EXCEED 8' MAXIMUM.
2. REINFORCING STEEL IN WALLS SHALL BE NUMBER 4 BARS AT 18"± CENTERS PLACED 1 ½" CLEAR TO INSIDE OF BOX, UNLESS OTHERWISE SHOWN.
3. FRAME AND GRATE SHALL BE CALTRANS TYPE 24–12X GALVANIZED, OR APPROVED EQUAL.
4. PIPE(S) CAN BE PLACED IN ANY WALL.
5. CURB SECTION SHALL MATCH ADJACENT CURB.
6. BASIN FLOORS SHALL HAVE A WOOD TROWEL FINISH AND MINIMUM SLOPE OF 3:12 FROM ALL DIRECTIONS TOWARD THE OUTLET PIPE.
7. ALL HARDWARE SHALL BE HOT DIP GALVANIZED AFTER FABRICATION.
8. WHEN INSTALLED IN EXISTING ROLLED CURB AND GUTTER, WARP TO VERTICAL CURB IN A 10' TRANSITION.
9. WHEN APRON IS CONSTRUCTED WITH DROP INLET, EXTEND NUMBER 4 SIDEWALL REBAR 12" INTO TAPERED GUTTER PAN.
10. DO NOT INSTALL APRON IN AREAS WITHOUT CURB AND GUTTER.
11. CONCRETE SHALL BE CLASS B P.C.C. WITH LAMPBLACK OF APPROVED QUALITY ADDED AT THE RATE OF ONE–HALF POUND PER CUBIC YARD.
12. CH = CURB HEIGHT

TYPE "G0" DROP INLET

DATE	REVISIONS	BY

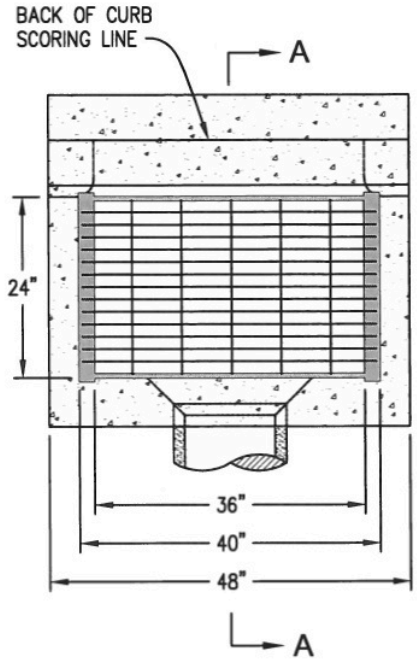
CITY OF LIVE OAK

STANDARD DETAIL

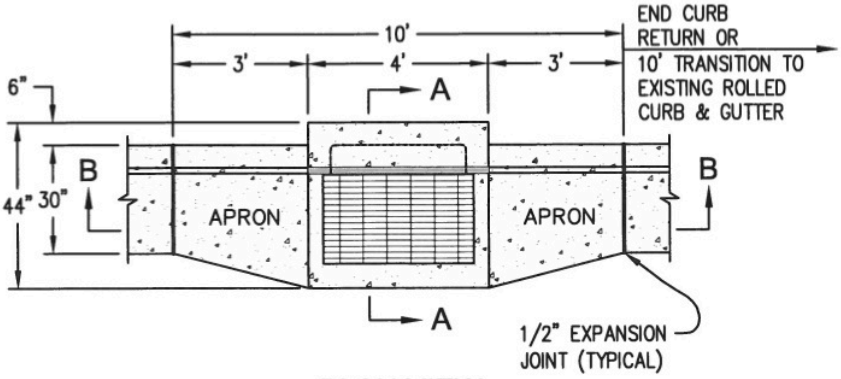
413A

Scott R. Robb — APPROVED

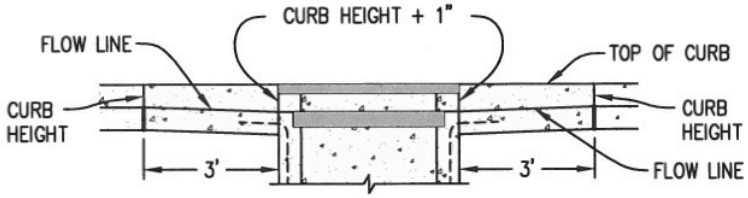
10/7/15 — DATE



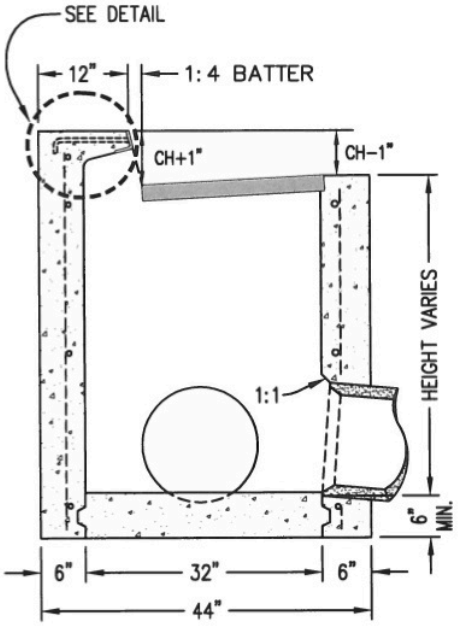
PLAN VIEW



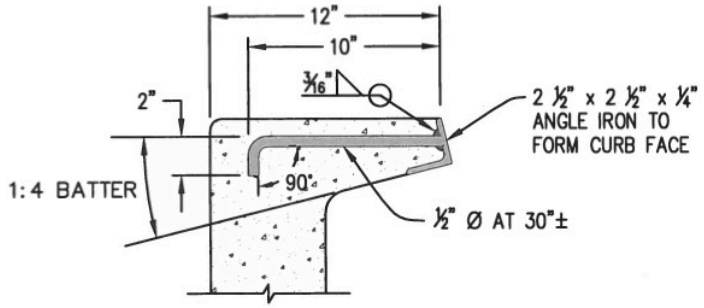
PLAN VIEW



SECTION B-B



SECTION A-A



DETAIL

CONSTRUCTION MATERIALS AND NOTES

1. HEIGHT SHALL NOT EXCEED 8' MAXIMUM.
2. REINFORCING STEEL IN WALLS SHALL BE NUMBER 4 BARS AT 18"± CENTERS PLACED 1 ½" CLEAR TO INSIDE OF BOX, UNLESS OTHERWISE SHOWN.
3. FRAME AND GRATE SHALL BE CALTRANS TYPE 24-12X GALVANIZED, OR APPROVED EQUAL.
4. PIPE(S) CAN BE PLACED IN ANY WALL.
5. CURB SECTION SHALL MATCH ADJACENT CURB.
6. BASIN FLOORS SHALL HAVE A WOOD TROWEL FINISH AND MINIMUM SLOPE OF 3:12 FROM ALL DIRECTIONS TOWARD THE OUTLET PIPE.
7. ALL HARDWARE SHALL BE HOT DIP GALVANIZED AFTER FABRICATION.
8. WHEN INSTALLED IN EXISTING ROLLED CURB AND GUTTER WARP TO VERTICAL CURB IN A 10' TRANSITION.
9. WHEN APRON IS CONSTRUCTED WITH DROP INLET, EXTEND NUMBER 4 SIDEWALL REBAR 12" INTO TAPERED GUTTER PAN.
10. DO NOT INSTALL APRON IN AREAS WITHOUT CURB AND GUTTER.
11. CONCRETE SHALL BE CLASS B P.C.C. WITH LAMPBLACK OF APPROVED QUALITY ADDED AT THE RATE OF ONE-HALF POUND PER CUBIC YARD.
12. CH = CURB HEIGHT

MODIFIED TYPE "G0" DROP INLET

DATE	REVISIONS	BY

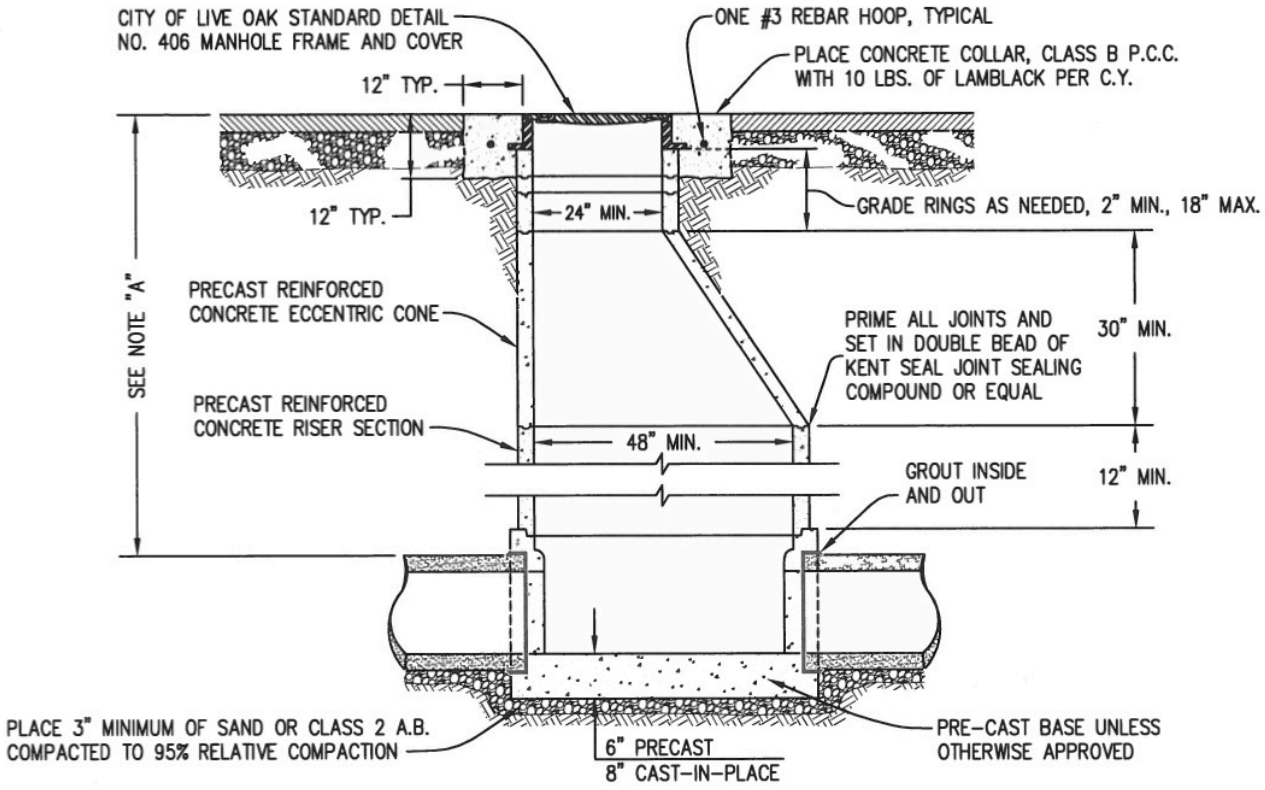
CITY OF LIVE OAK

STANDARD DETAIL

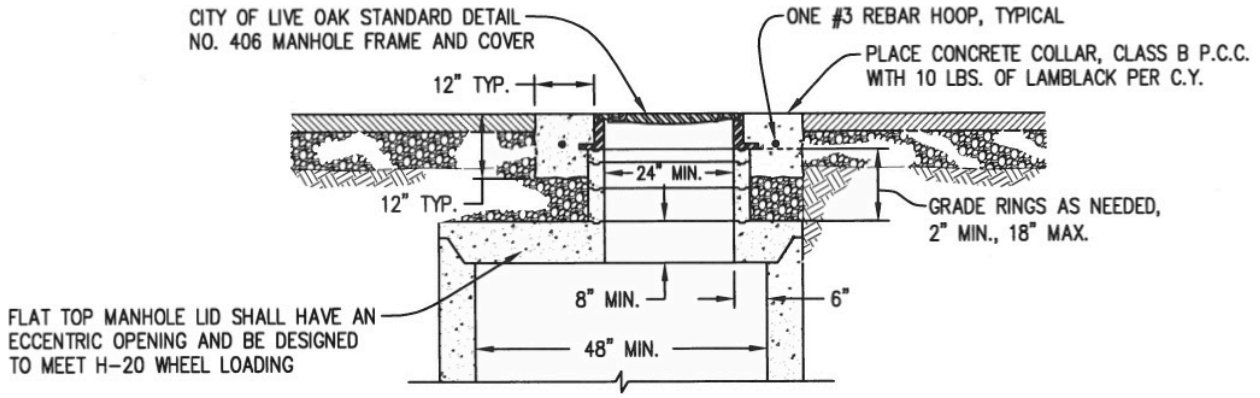
413B

Scott R. Ruller 10/7/15

APPROVED DATE



STANDARD MANHOLE DETAIL



SHALLOW MANHOLE DETAIL

(FOR PIPES WITH LESS THAN 5' OF COVER)

CONSTRUCTION MATERIALS AND NOTES

1. FOR PIPES WITH LESS THAN 5' OF COVER, MEASURED FROM THE THE TOP OF PIPE TO FINISH ASPHALT GRADE, USE SHALLOW MANHOLE DETAIL.
2. WATERSTOPS SHALL BE INSTALLED ON ALL PLASTIC PIPES.
3. MANHOLE FRAME AND CONCRETE COLLAR SHALL BE SET AND FINISHED ⅛" TO ¼" BELOW ASPHALT GRADE IN AREAS WITH NEW ASPHALT PAVING TO ALLOW FOR ASPHALT SHRINKAGE.

STORM DRAIN STANDARD AND SHALLOW MANHOLE

DATE	REVISIONS	BY

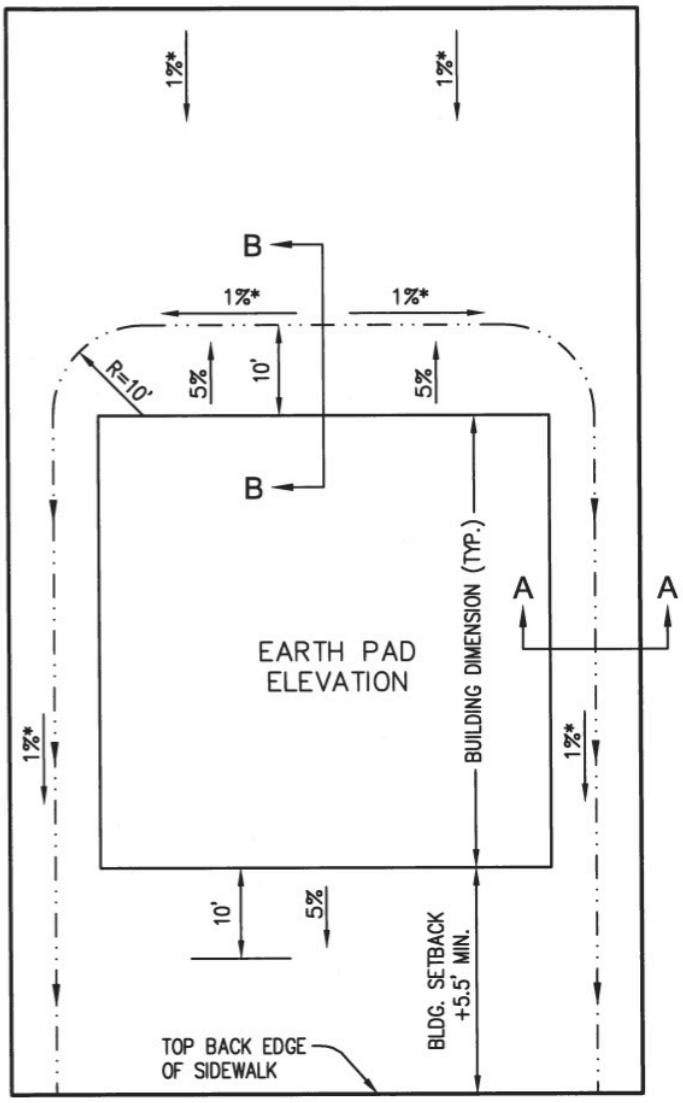
CITY OF LIVE OAK

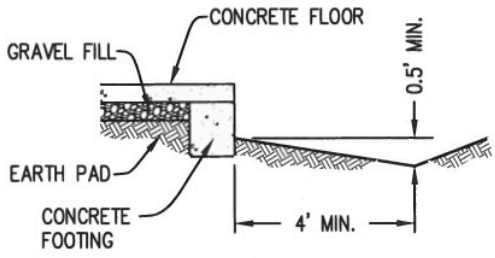
STANDARD DETAIL

414

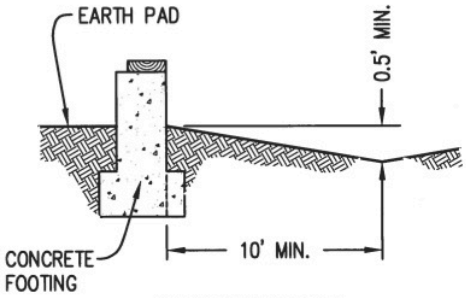
Scott R. Robb — APPROVED

10/7/15 — DATE





SECTION A-A



SECTION B-B

CONSTRUCTION MATERIALS AND NOTES

1. MINIMUM EARTH PAD ELEVATION = MAXIMUM SWALE ELEVATION +0.5'

*2. MINIMUM LOT GRADE MAY BE REDUCED TO NOT LESS THAN 0.5%, PROVIDED:

- PROPERTY ABUTTING THE SUBDIVISION DRAINS ONTO THE SUBDIVISION PROPERTY, AND A 1% LOT GRADE WOULD OBSTRUCT THE NATURAL DRAINAGE.
- THE DRAINAGE FROM THE ABUTTING PROPERTY WILL BE COLLECTED AND ROUTED THROUGH THE SUBDIVISION DRAINAGE FACILITIES.
- THE CITY ENGINEER CONFIRMS THAT LOT GRADES OF NOT LESS THAN 0.5% WILL ACCOMMODATE THE COLLECTION AND ROUTING OF THE SURFACE DRAINAGE.
- BUILDING PADS SHALL NOT BE INUNDATED DURING A 100 YEAR FREQUENCY DESIGN STORM.

MINIMUM RESIDENTIAL LOT GRADES

DATE	REVISIONS	BY

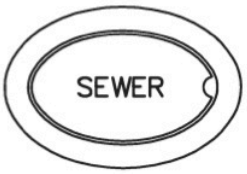
CITY OF LIVE OAK

STANDARD DETAIL

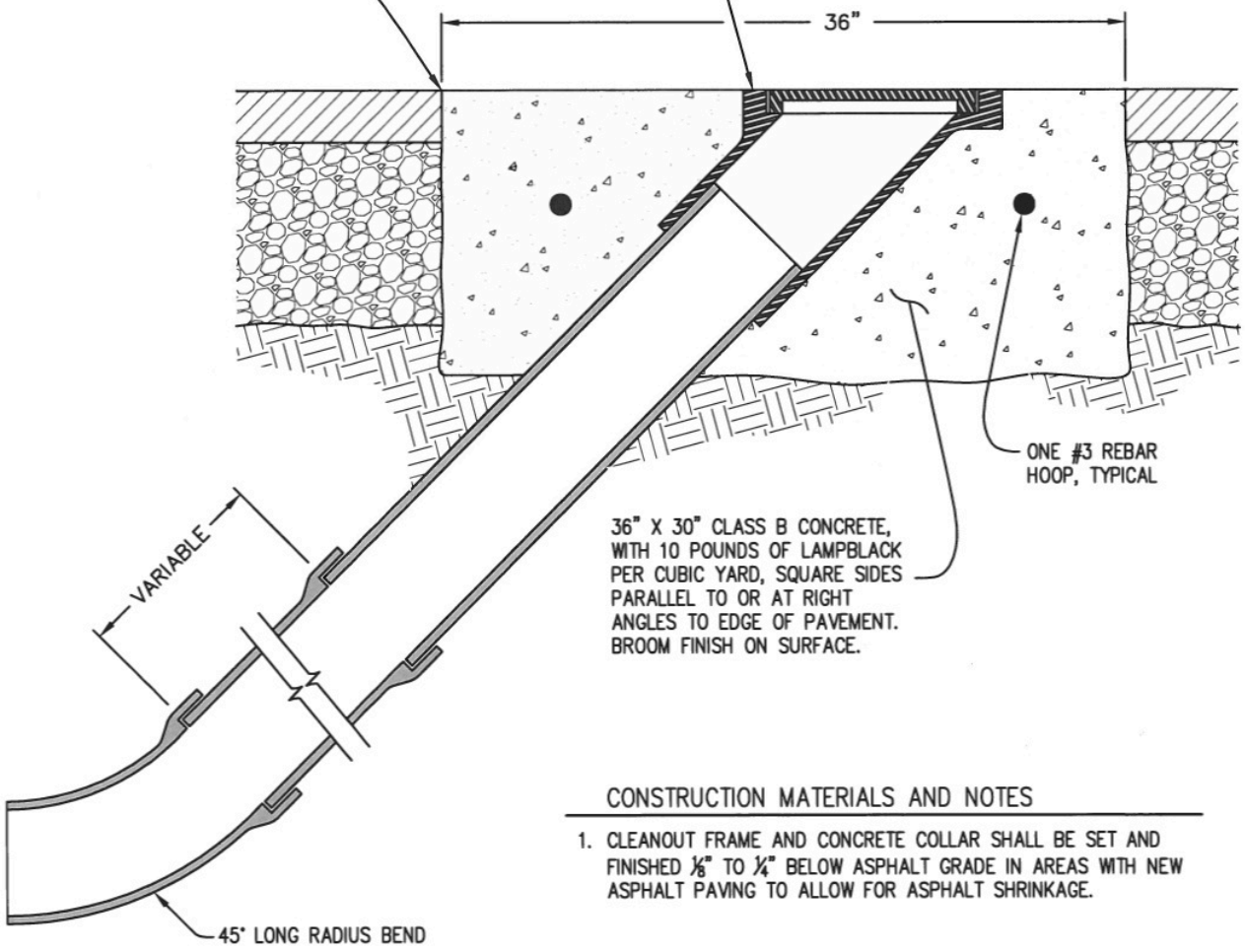
415

Scott R. Ruble APPROVED 10/7/15 DATE

1. FOR 6" SEWER MAIN USE SOUTH BAY FOUNDRY MODEL NO. 1248 VALVE BOX OR APPROVED EQUAL, MARKED "SEWER"
2. FOR 8" SEWER MAINS USE SOUTH BAY FOUNDRY MODEL NO. 1247 VALVE BOX OR APPROVED EQUAL, MARKED "SEWER"



COVER DETAIL



CONSTRUCTION MATERIALS AND NOTES

1. CLEANOUT FRAME AND CONCRETE COLLAR SHALL BE SET AND FINISHED ⅛" TO ¼" BELOW ASPHALT GRADE IN AREAS WITH NEW ASPHALT PAVING TO ALLOW FOR ASPHALT SHRINKAGE.

SANITARY SEWER CLEANOUT

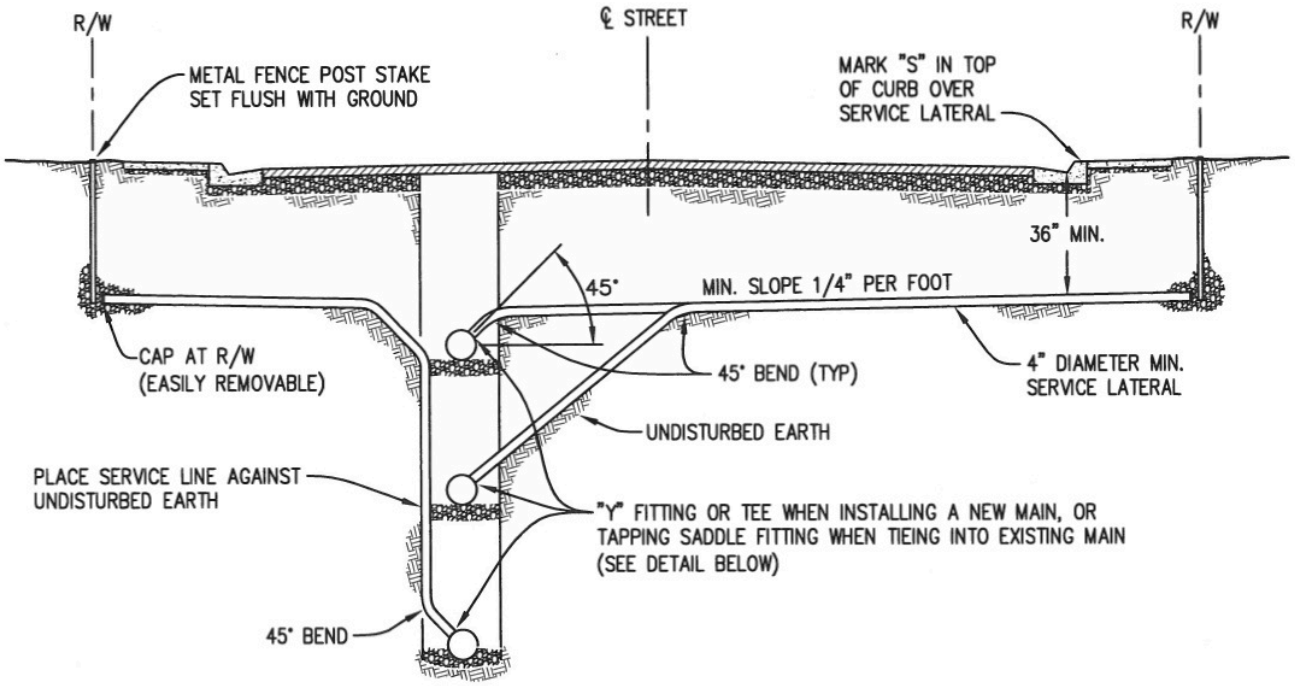
DATE	REVISIONS	BY

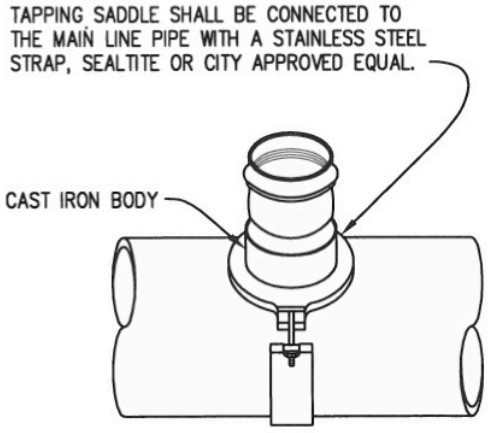
CITY OF LIVE OAK

STANDARD DETAIL

501

Scott R. Ruble APPROVED 10/7/15 DATE





CONSTRUCTION MATERIALS AND NOTES

1. SERVICES SHALL HAVE SAME BEDDING AND BACKFILL AS MAIN SEWER. (SEE CITY OF LIVE OAK STANDARD DETAIL NO. 101)
2. ANY REPAIRS DONE TO SERVICES OR MAINS SHALL BE DONE WITH COMPRESSION COUPLINGS WITH STAINLESS STEEL SHEAR RINGS
3. LATERAL INVERT ELEVATION SHALL BE AT OR ABOVE THE SPRINGLINE OF THE MAIN LINE SEWER
4. 45° BEND IS REQUIRED IN ALL LATERAL INSTALLATIONS EXCEPT WHEN CONNECTING TO A MANHOLE

SANITARY SEWER SERVICE & CONNECTION

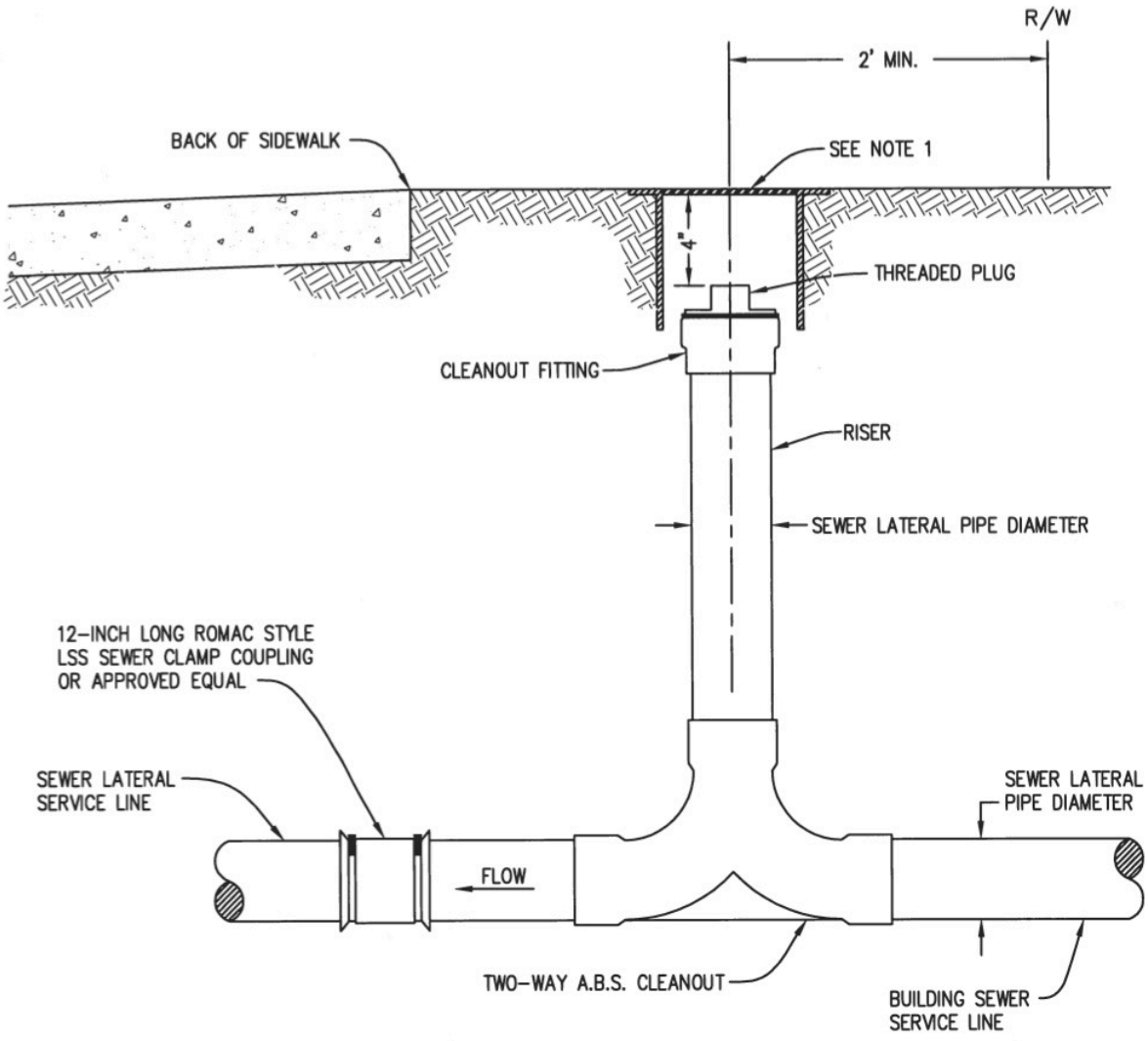
DATE	REVISIONS	BY

CITY OF LIVE OAK

STANDARD DETAIL

502

APPROVED 10/7/15 DATE



CONSTRUCTION MATERIALS AND NOTES

1. WHEN INSTALLED IN SIDEWALK OR DRIVEWAY USE BROOKS 3RT SERIES VALVE BOX, MARKED "SEWER".
2. WHEN INSTALLED IN LAWN OR PLANTER USE BROOKS 1-SP SERIES VALVE BOX MARKED "SEWER".
3. TWO-WAY CLEANOUT REQUIRED ON ALL SERVICES WHEN THE PROPERTY IS NOT SERVED BY CITY WATER.

SANITARY SEWER CITY ACCESS CONTROL

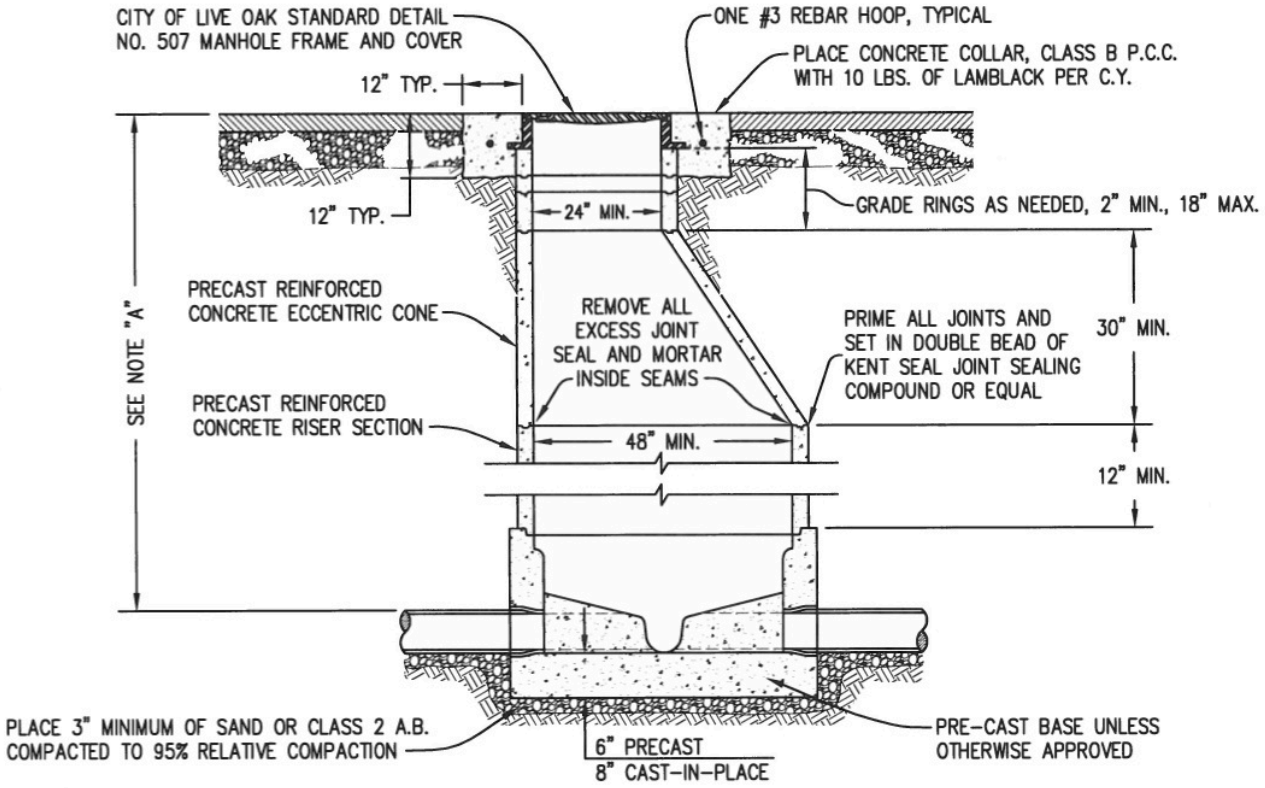
DATE	REVISIONS	BY

CITY OF LIVE OAK

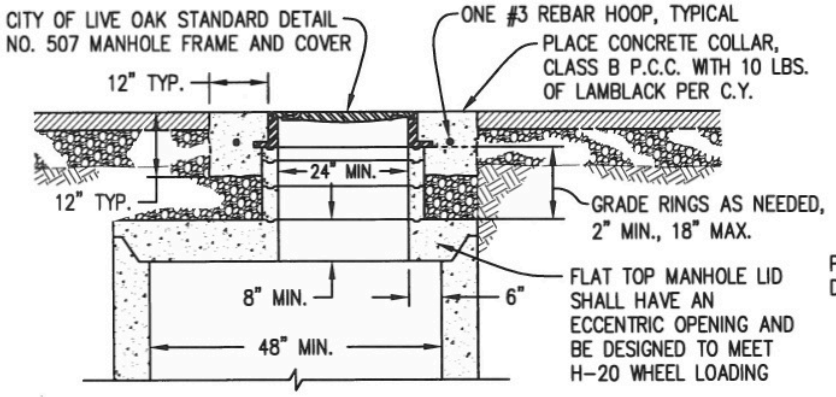
STANDARD DETAIL

503

Scott R. Ruble APPROVED 10/7/15 DATE

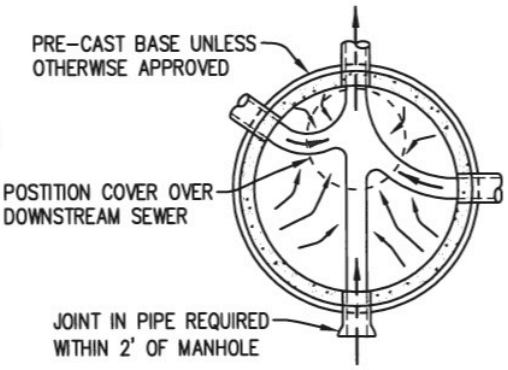


STANDARD MANHOLE DETAIL



SHALLOW MANHOLE DETAIL

(FOR PIPES WITH LESS THAN 5' OF COVER)



CHANNELIZATION FOR SANITARY SEWER MANHOLES

CONSTRUCTION MATERIALS AND NOTES

1. FOR PIPES WITH LESS THAN 5' OF COVER, MEASURED FROM THE THE TOP OF PIPE TO FINISH ASPHALT GRADE, USE SHALLOW MANHOLE DETAIL.
2. PRECAST MANHOLE BASES SHALL HAVE PVC SEWER PIPE WITH WATER STOPS ATTACHED WITH STAINLESS STEEL BANDS, CAST INTO THE BASE. NEOPRENE "BOOTS" ARE NOT ACCEPTABLE FOR CONNECTIONS TO THE MANHOLE BASE.
3. MANHOLE FRAME AND CONCRETE COLLAR SHALL BE SET AND FINISHED ⅛" TO ¼" BELOW ASPHALT GRADE IN AREAS WITH NEW ASPHALT PAVING TO ALLOW FOR ASPHALT SHRINKAGE.

SANITARY SEWER STANDARD AND SHALLOW MANHOLE

DATE	REVISIONS	BY

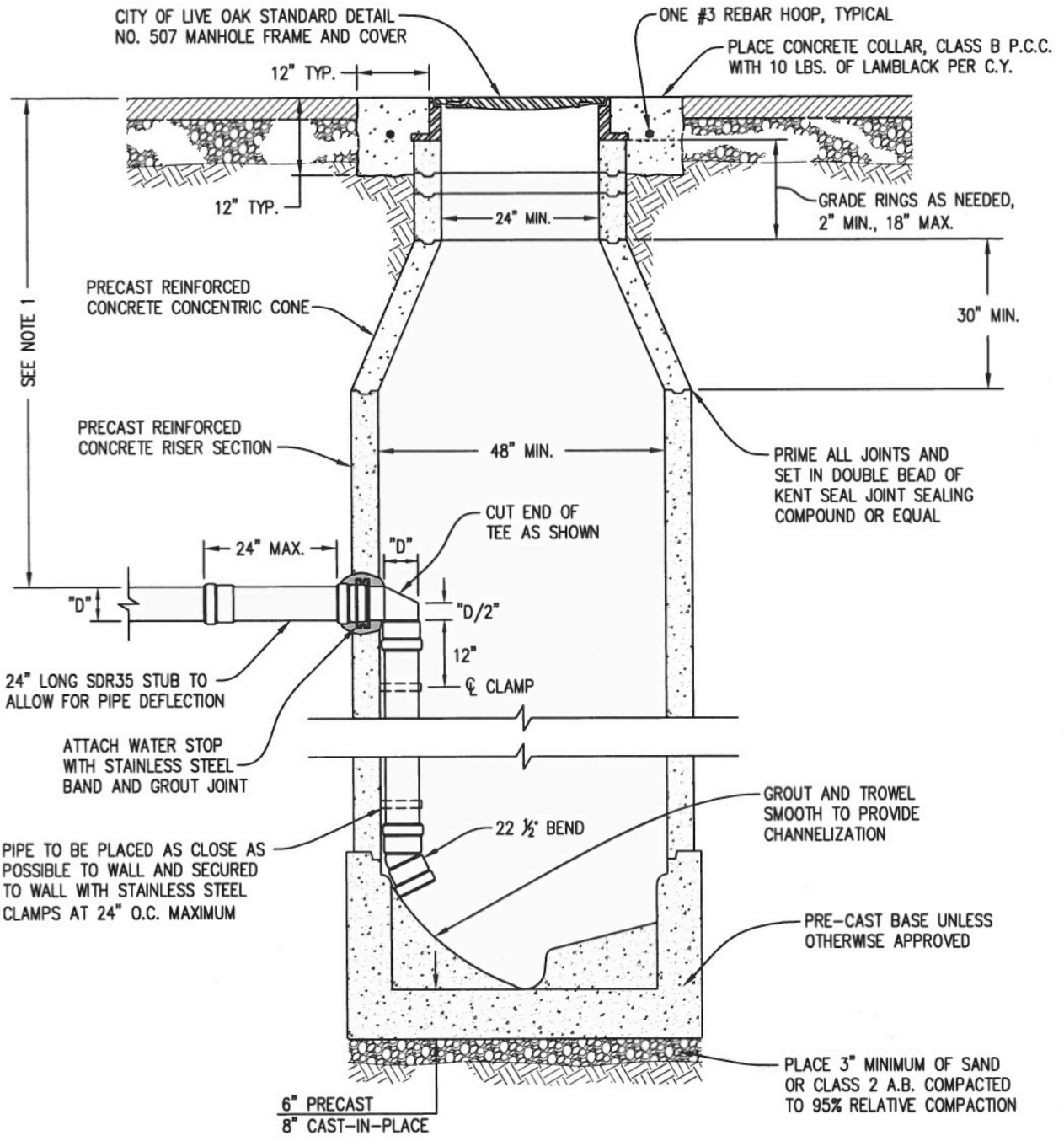
CITY OF LIVE OAK

STANDARD DETAIL

504

Scott R. Robb 10/7/15

APPROVED DATE



CONSTRUCTION MATERIALS AND NOTES

1. FOR PIPES WITH LESS THAN 5' OF COVER, MEASURED FROM THE THE TOP OF PIPE TO FINISH ASPHALT GRADE, USE SHALLOW MANHOLE DETAIL.
2. INSIDE DROPS SHALL ONLY APPLY TO EXISTING SEWER MANHOLES ONLY, AND WILL REQUIRE APPROVAL BY THE CITY ENGINEER.
3. OUTSIDE DROP IS REQUIRED FOR ALL NEW SEWER MANHOLE CONSTRUCTION.
4. MANHOLE FRAME AND CONCRETE COLLAR SHALL BE SET AND FINISHED ⅛" TO ¼" BELOW ASPHALT GRADE IN AREAS WITH NEW ASPHALT PAVING TO ALLOW FOR ASPHALT SHRINKAGE.

SANITARY SEWER INSIDE DROP MANHOLE

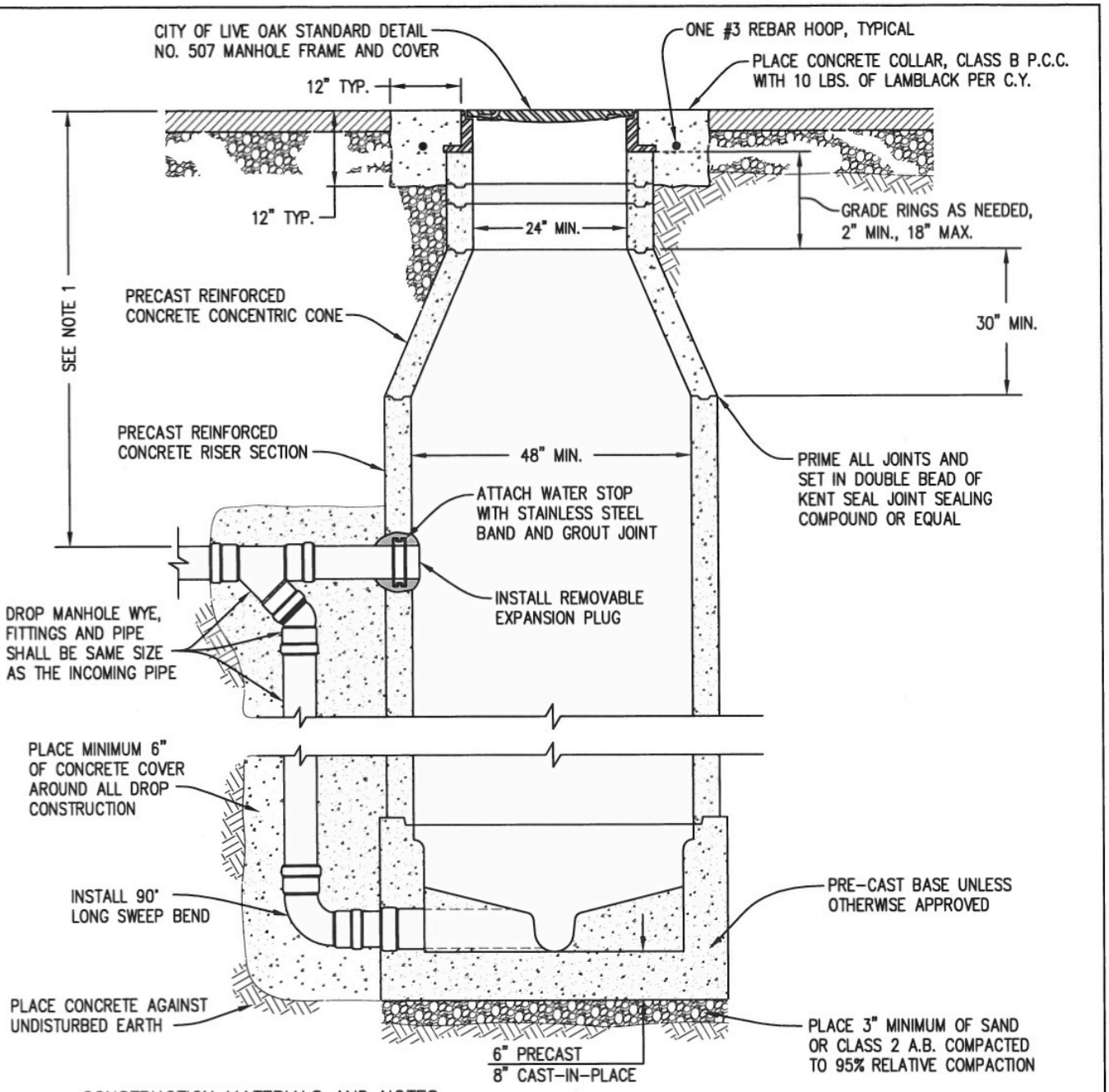
DATE	REVISIONS	BY

CITY OF LIVE OAK

STANDARD DETAIL

505

Scott R. Rollo APPROVED 10/7/15 DATE



CONSTRUCTION MATERIALS AND NOTES

1. FOR PIPES WITH LESS THAN 5' OF COVER, MEASURED FROM THE THE TOP OF PIPE TO FINISH ASPHALT GRADE, USE SHALLOW MANHOLE DETAIL.
2. DROP CONSTRUCTION IS NOT ALLOWED WHEN THE INCOMING SEWER IS TWO FEET OR LESS ABOVE THE MAIN SEWER LINE INVERT. THE CONTRACTOR IS TO VERIFY FITTING DIMENSIONS BEFORE ORDERING MATERIALS.
3. OUTSIDE DROP IS REQUIRED FOR ALL NEW SEWER MANHOLE CONSTRUCTION.
4. PRECAST MANHOLE BASES SHALL HAVE PVC SEWER PIPE WITH WATER STOPS ATTACHED WITH STAINLESS STEEL BANDS, CAST INTO THE BASE. NEOPRENE "BOOTS" ARE NOT ACCEPTABLE FOR CONNECTIONS TO THE MANHOLE BASE.
5. MANHOLE FRAME AND CONCRETE COLLAR SHALL BE SET AND FINISHED ⅛" TO ¼" BELOW ASPHALT GRADE IN AREAS WITH NEW ASPHALT PAVING TO ALLOW FOR ASPHALT SHRINKAGE.

SANITARY SEWER OUTSIDE DROP MANHOLE

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CITY OF LIVE OAK

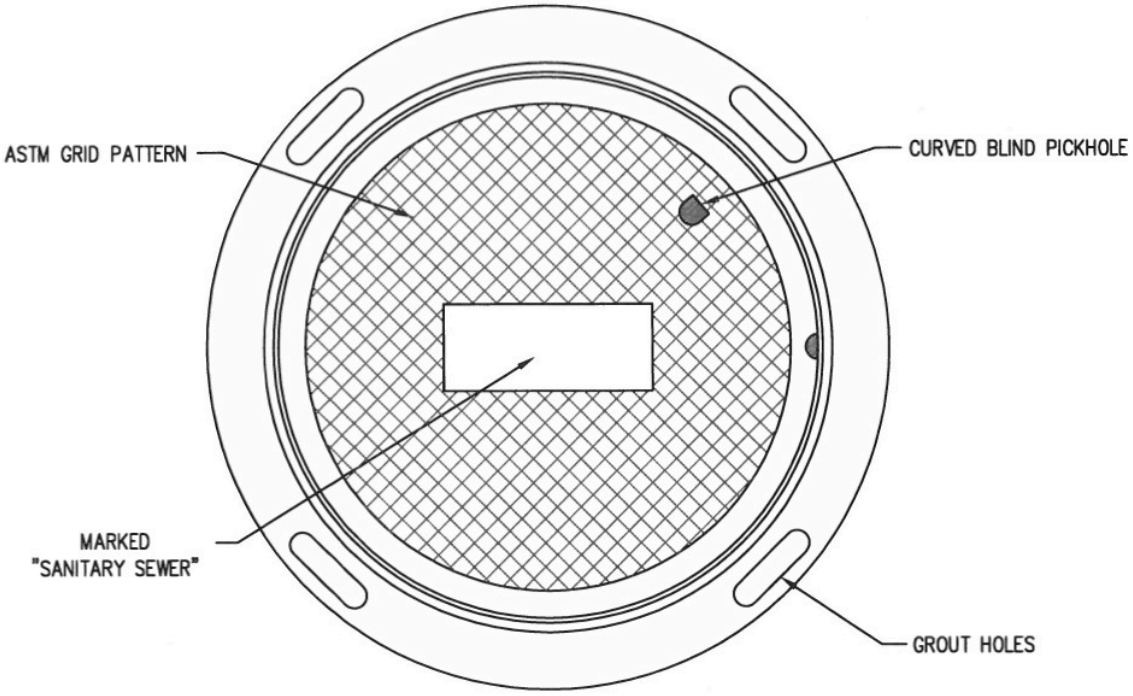
STANDARD DETAIL

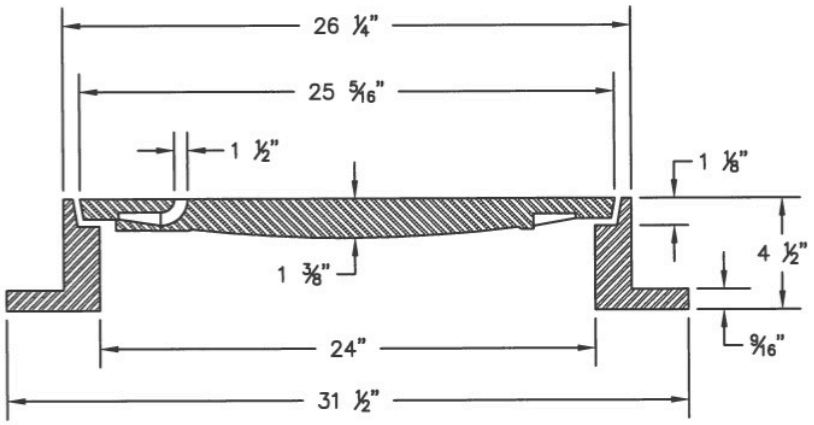
506

Scott R. Rollo 10/7/15

APPROVED DATE

NOTE: MANHOLE FRAME & COVER PHOENIX IRON WORKS NO. P-1090 OR APPROVED EQUAL





SANITARY SEWER MANHOLE FRAME & COVER

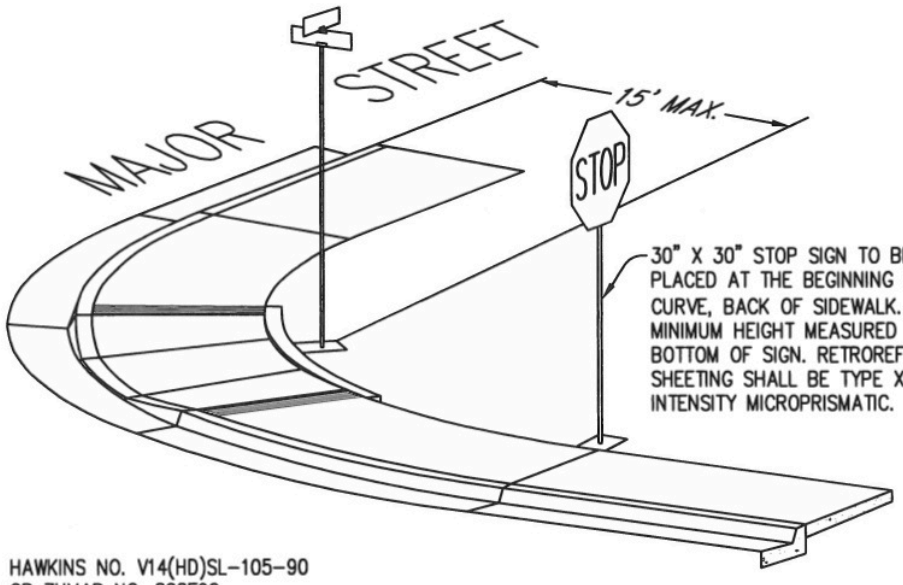
DATE	REVISIONS	BY

CITY OF LIVE OAK

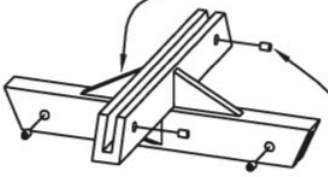
STANDARD DETAIL

507

APPROVED 10/7/15 DATE



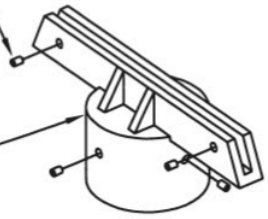
30" X 30" STOP SIGN TO BE PLACED AT THE BEGINNING OF CURVE, BACK OF SIDEWALK. 7' MINIMUM HEIGHT MEASURED TO BOTTOM OF SIGN. RETROREFLECTIVE SHEETING SHALL BE TYPE XI, HIGH INTENSITY MICROPRISMATIC.



HAWKINS NO. V14(HD)SL-105-90
OR ZUMAR NO. 808F90
90° CROSSPIECE

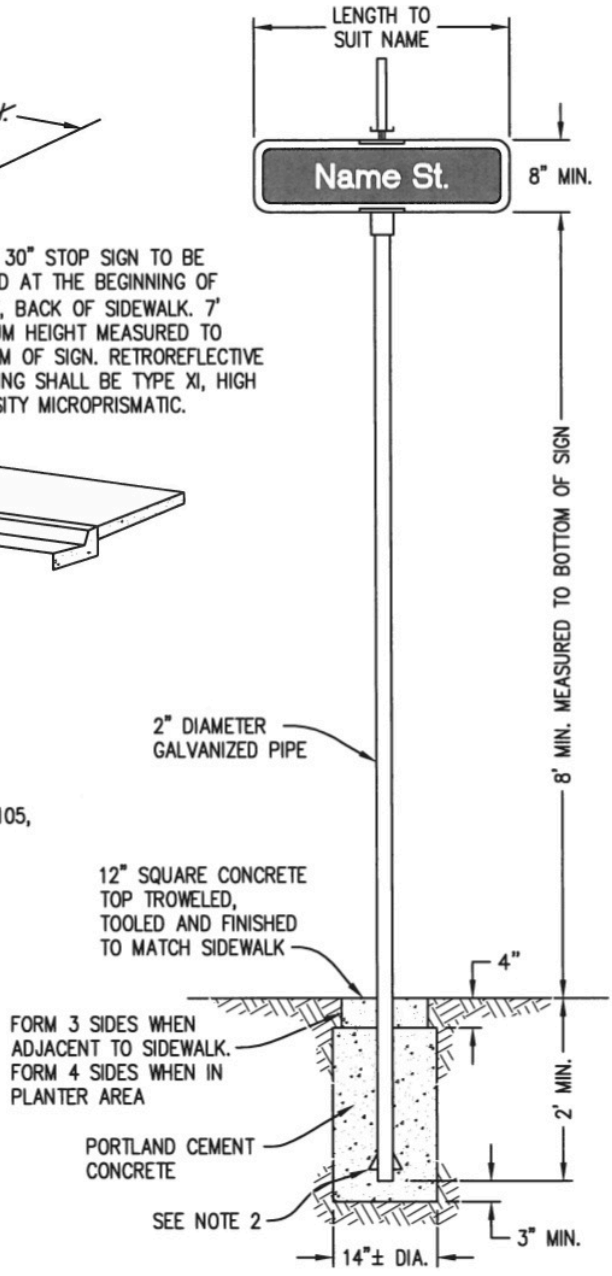
90° CROSSPIECE

CAP & CROSSPIECE SET SCREWS SHALL BE HAWKINS NO. V14(HD)1105, OR APPROVED EQUAL



HAWKINS NO. V14(HD)SL-107.2C
OR ZUMAR NO. 808F
2" DIAMETER CAP

2" CAP



CONSTRUCTION MATERIALS AND NOTES

1. SIGN LOCATION, NAME PLATES, AND MOUNTING ASSEMBLIES TO BE DETERMINED AND APPROVED BY THE CITY ENGINEER.
2. FLARE THE BOTTOM OF THE SIGN POST TO PREVENT TURNING.
3. STREET NAME SIGN SHALL BE 0.080" ALUMINUM PLATE WITH A TYPE XI HIGH INTENSITY MICROPRISMATIC GREEN REFLECTIVE BACKGROUND, OUTLINED BY A TYPE XI HIGH INTENSITY MICROPRISMATIC WHITE BORDER.
4. SIGN LETTERING SHALL BE TYPE XI HIGH INTENSITY MICROPRISMATIC WHITE LETTERING WITH 6" INITIAL UPPER-CASE LETTERS, FOLLOWED BY 4 ½" LOWER-CASE LETTERS.
5. USE HEAVY DUTY SLOTTED, HIGH TENSION ALUMINUM ALLOY DIE CASTINGS FOR CAPS AND CROSS PIECES INSTALLED ON STREET NAME SIGNS. ALL OTHER SIGN POSTS SHALL BE CAPPED WITH A 2" GALVANIZED CAP. MATERIALS SHALL BE HAWKINS, ZUMAR OR APPROVED EQUAL.

STREET SIGNS

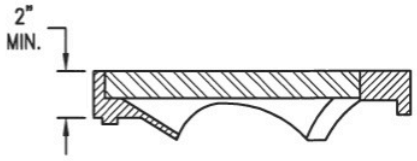
DATE	REVISIONS	BY

CITY OF LIVE OAK

STANDARD DETAIL

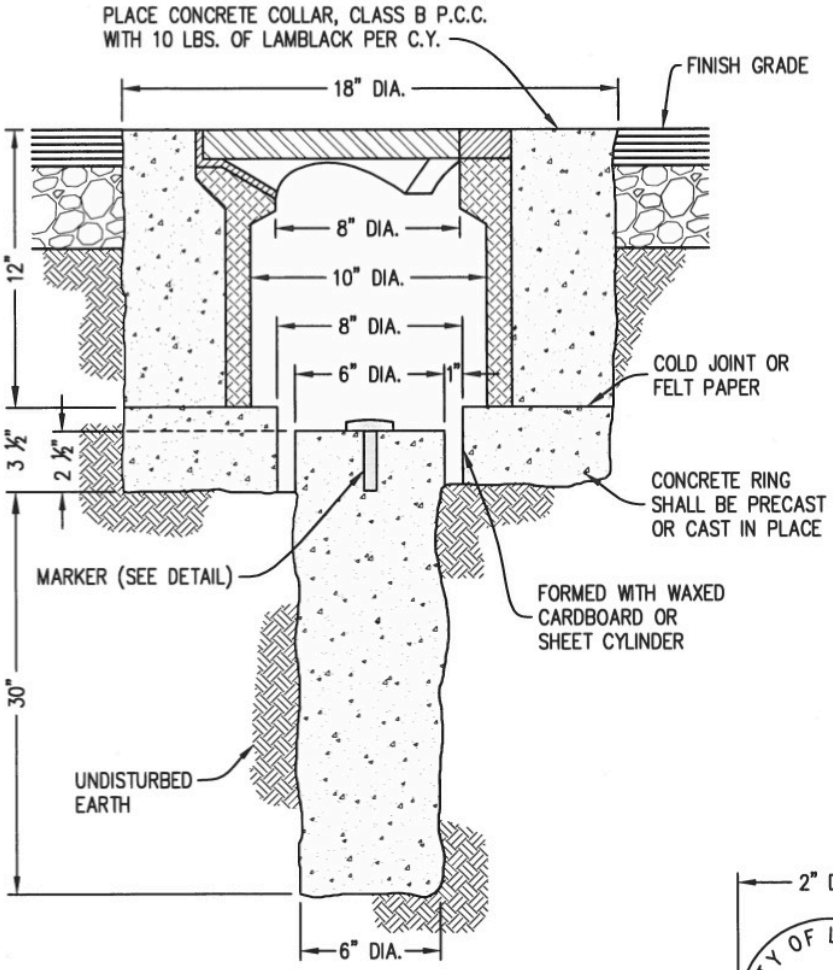
601

Scott R. Robb 10/7/15
APPROVED DATE

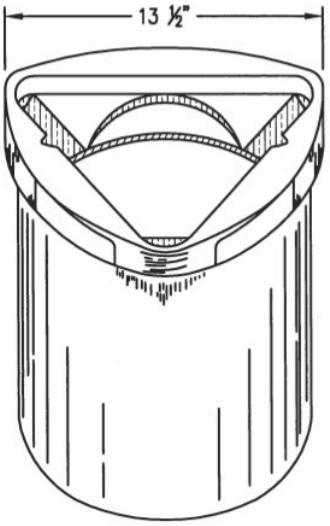


RISER RING

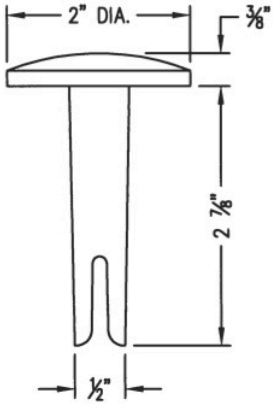
C.I. COVER



MONUMENT SECTION



VALVE BOX



MARKER

CONSTRUCTION MATERIALS AND NOTES

1. WHEN RESURFACING AN EXISTING ROAD, ADD RISER RING BETWEEN EXISTING BOX AND COVER TO MEET NEW ROAD GRADE.
2. MONUMENT VALVE BOX SHALL BE BROOKS NO. 4–TT, CHRISTY CONCRETE PRODUCTS G04, OR APPROVED EQUAL.
3. ALL CONCRETE SHALL BE CLASS B P.C.C.

MONUMENT WELL

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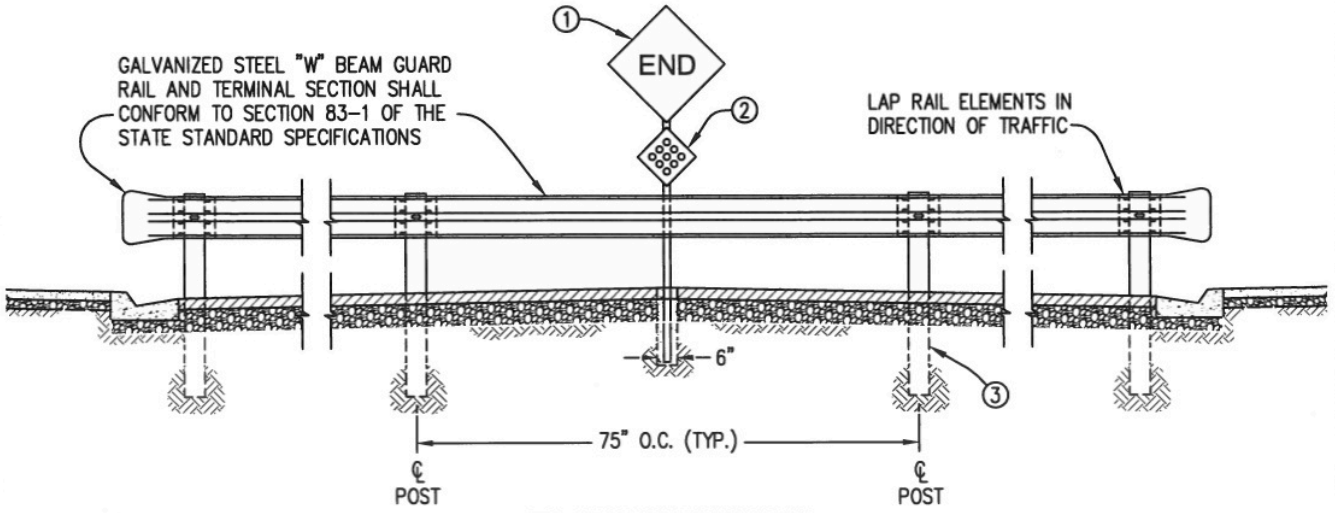
CITY OF LIVE OAK

STANDARD DETAIL

602

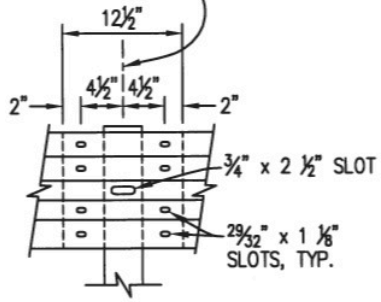
Scott R. Ruble 10/7/15

APPROVED DATE

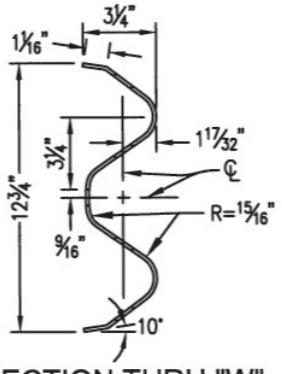


FRONT ELEVATION

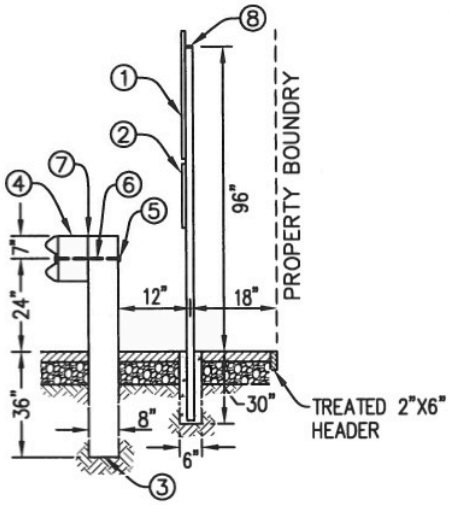
℄ RAIL SPLICE AND SLOT FOR 5/8"ø BUTTON HEAD BOLT WITH HEX NUT. ATTACH RAIL ELEMENT TO WOOD BLOCK AND POST WITH BOLT ON TRAFFIC APPROACH SIDE OF POST WEB. NO WASHER ON RAIL FACE FOR BOLTED CONNECTION TO POST.



RAIL SPLICE DETAIL



SECTION THRU "W" BEAM RAIL ELEMENT



SIDE ELEVATION

CONSTRUCTION MATERIALS AND NOTES

1. M.U.T.C.D. 30"x30" W-31 WARNING SIGN.
2. M.U.T.C.D. OM4-1 OR OM4-2 END-OF-ROADWAY OBJECT MARKER.
3. 6"x8"x64" DOUGLAS FIR OR PRESSURE TREATED POST, TYP.
4. 6"x8"x14" DOUGLAS FIR OR PRESSURE TREATED BLOCK.
5. GALVANIZED CUT STEEL WASHER.
6. 5/8" GALVANIZED CARRIAGE BOLT WITH HEX NUT.
7. TOENAIL WITH 1-16D NAIL ON EACH SIDE OF BLOCK.
8. 2" DIA. GALVANIZED STEEL POST AND CAP.

A. CONNECT THE OVER LAPPED END OF THE RAIL ELEMENTS WITH 5/8"ø x 1 ⅛" BUTTON HEAD OVAL SHOULDER SPLICE BOLTS INSERTED INTO THE 29/32" x 1 ⅛" SLOTS AND BOLTED TOGETHER WITH 5/8"ø RECESSED HEX NUTS. RECESS OF HEX NUT POINTS TOWARD RAIL ELEMENT. A TOTAL OF 8 BOLTS AND NUTS ARE TO BE USED AT EACH RAIL SPLICE CONNECTION.

B. THE ENDS OF THE RAIL ELEMENTS ARE TO BE OVERLAPPED IN THE DIRECTION OF TRAFFIC.

C. WHERE END CAP IS TO BE ATTACHED TO THE END OF A RAIL ELEMENT, A TOTAL OF 4 OF THE ABOVE DESCRIBED SPLICE BOLTS AND NUTS ARE TO BE USED.

D. SIGNS AND MARKERS SHALL BE MOUNTED TO THE STEEL POSTS USING A HAWKINS M2G-S2S "SIGN SADDLE" OR APPROVED EQUAL.

E. END SIGN AND MARKERS SHALL CONFORM TO THE CURRENT EDITION OF THE CALIFORNIA M.U.T.C.D.

BARRICADE

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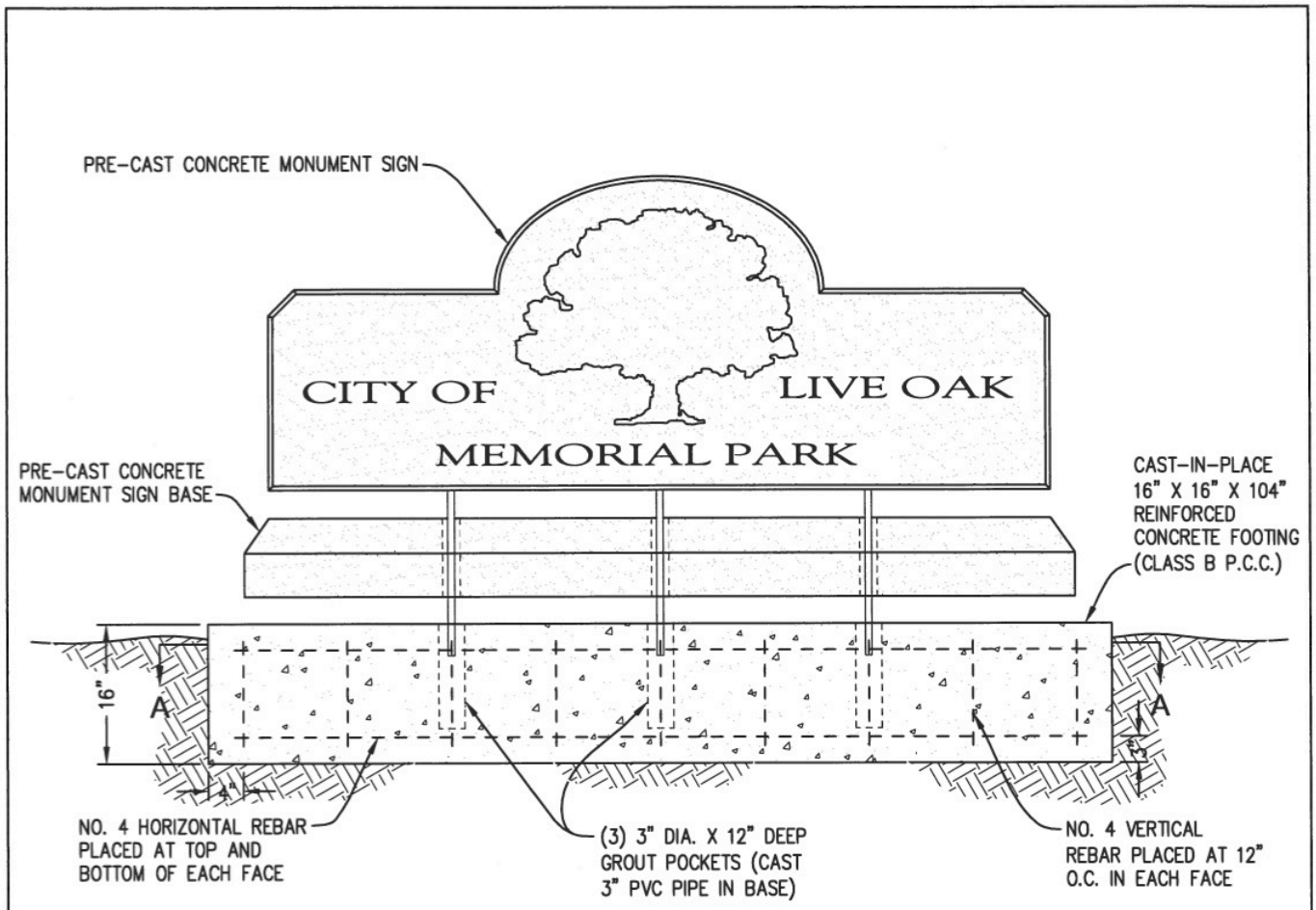
CITY OF LIVE OAK

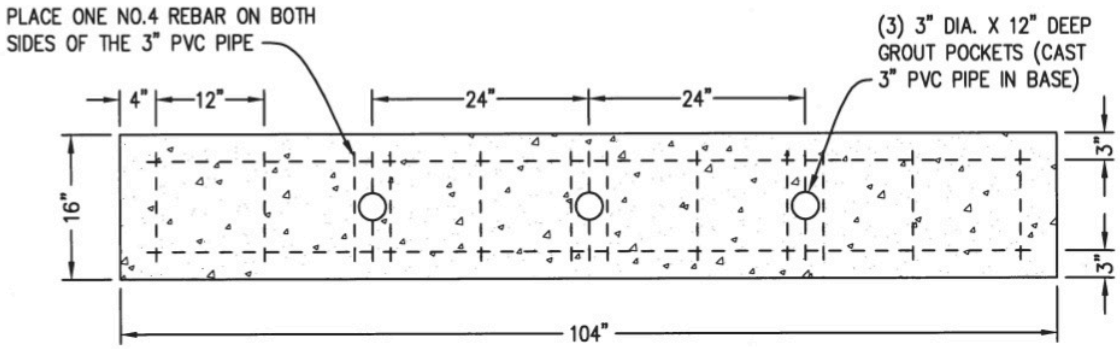
STANDARD DETAIL

603

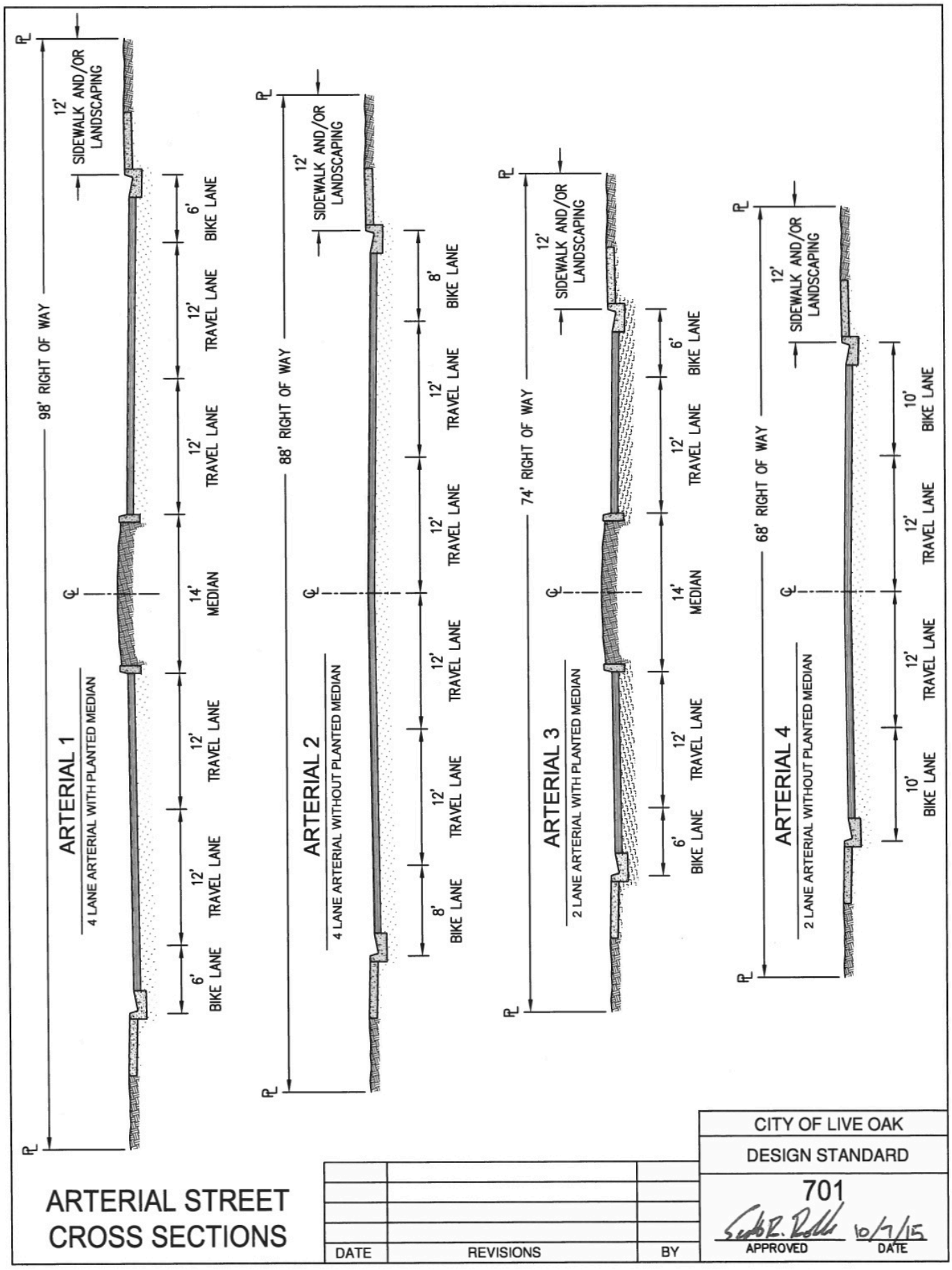
Scott R. Ruble APPROVED 10/7/15 DATE

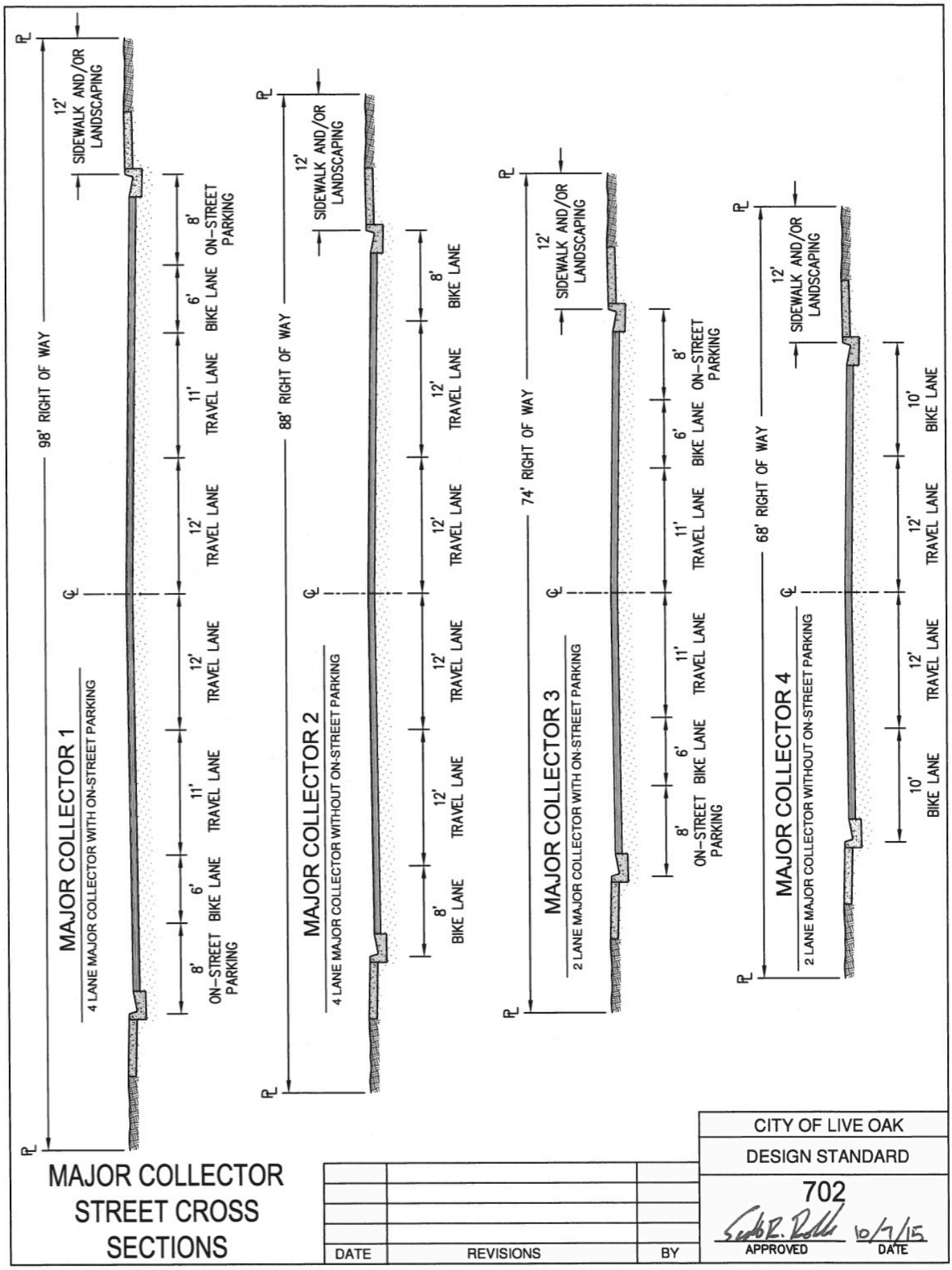


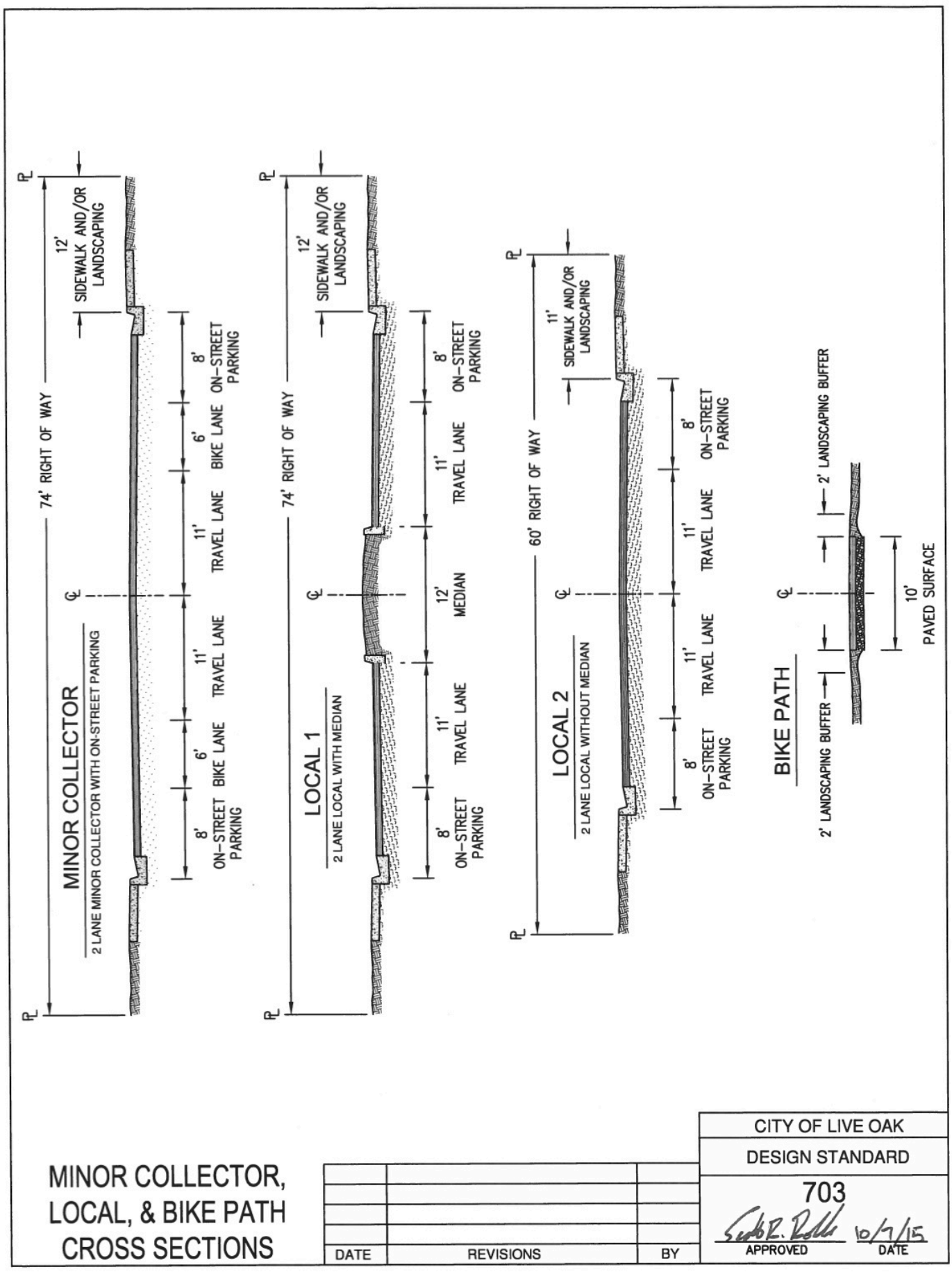
SECTION A-A



			CITY OF LIVE OAK
			STANDARD DETAIL
PRECAST CONCRETE MONUMENT SIGN			604
DATE	REVISIONS	BY	APPROVED 10/7/15 DATE


ARTERIAL 1
4 LANE ARTERIAL WITH PLANTED MEDIAN
98' RIGHT OF WAY
12' SIDEWALK AND/OR LANDSCAPING
6' BIKE LANE
12' TRAVEL LANE
12' TRAVEL LANE
14' MEDIAN
12' TRAVEL LANE
12' TRAVEL LANE
6' BIKE LANE
ARTERIAL 2
4 LANE ARTERIAL WITHOUT PLANTED MEDIAN
88' RIGHT OF WAY
12' SIDEWALK AND/OR LANDSCAPING
8' BIKE LANE
12' TRAVEL LANE
12' TRAVEL LANE
12' TRAVEL LANE
12' TRAVEL LANE
8' BIKE LANE
ARTERIAL 3
2 LANE ARTERIAL WITH PLANTED MEDIAN
74' RIGHT OF WAY
12' SIDEWALK AND/OR LANDSCAPING
6' BIKE LANE
12' TRAVEL LANE
14' MEDIAN
12' TRAVEL LANE
6' BIKE LANE
ARTERIAL 4
2 LANE ARTERIAL WITHOUT PLANTED MEDIAN
68' RIGHT OF WAY
12' SIDEWALK AND/OR LANDSCAPING
10' BIKE LANE
12' TRAVEL LANE
12' TRAVEL LANE
10' BIKE LANE
ARTERIAL STREET CROSS SECTIONS
DATE
REVISIONS
BY
CITY OF LIVE OAK
DESIGN STANDARD
701
APPROVED
10/7/15
DATE


MAJOR COLLECTOR 1
4 LANE MAJOR COLLECTOR WITH ON-STREET PARKING
98' RIGHT OF WAY
12' SIDEWALK AND/OR LANDSCAPING
8' ON-STREET PARKING
6' BIKE LANE
11' TRAVEL LANE
12' TRAVEL LANE
MAJOR COLLECTOR 2
4 LANE MAJOR COLLECTOR WITHOUT ON-STREET PARKING
88' RIGHT OF WAY
8' BIKE LANE
12' TRAVEL LANE
MAJOR COLLECTOR 3
2 LANE MAJOR COLLECTOR WITH ON-STREET PARKING
74' RIGHT OF WAY
MAJOR COLLECTOR 4
2 LANE MAJOR COLLECTOR WITHOUT ON-STREET PARKING
68' RIGHT OF WAY
10' BIKE LANE
MAJOR COLLECTOR STREET CROSS SECTIONS
DATE
REVISIONS
BY
CITY OF LIVE OAK
DESIGN STANDARD
702
APPROVED
10/7/15
DATE



MINOR COLLECTOR, LOCAL, & BIKE PATH CROSS SECTIONS

DATE	REVISIONS	BY

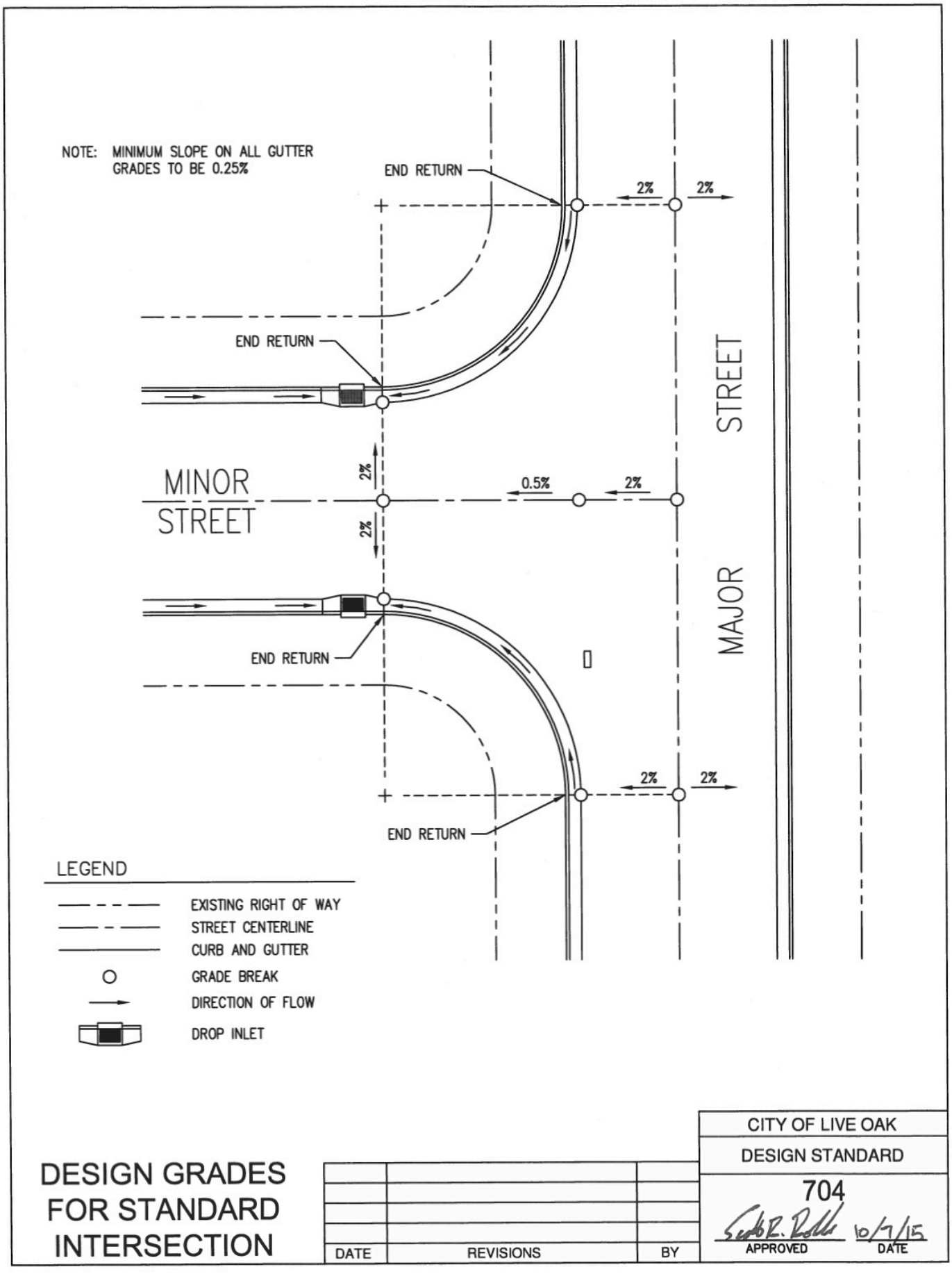
CITY OF LIVE OAK

DESIGN STANDARD

703

APPROVED

10/7/15
DATE



DESIGN GRADES FOR STANDARD INTERSECTION

DATE	REVISIONS	BY

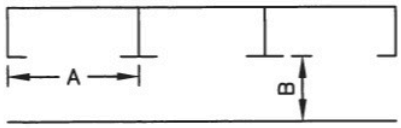
CITY OF LIVE OAK

DESIGN STANDARD

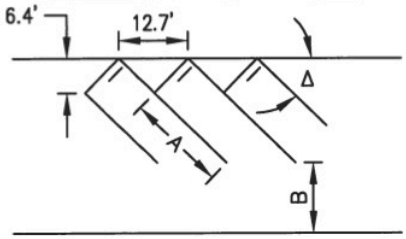
704

Scott R. Reller APPROVED 10/7/15 DATE

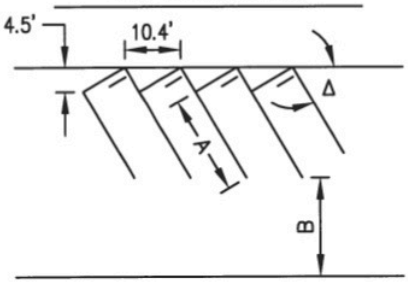
PARALLEL PARKING



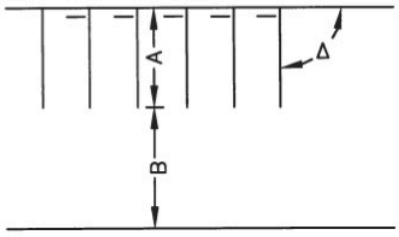
45° PARKING

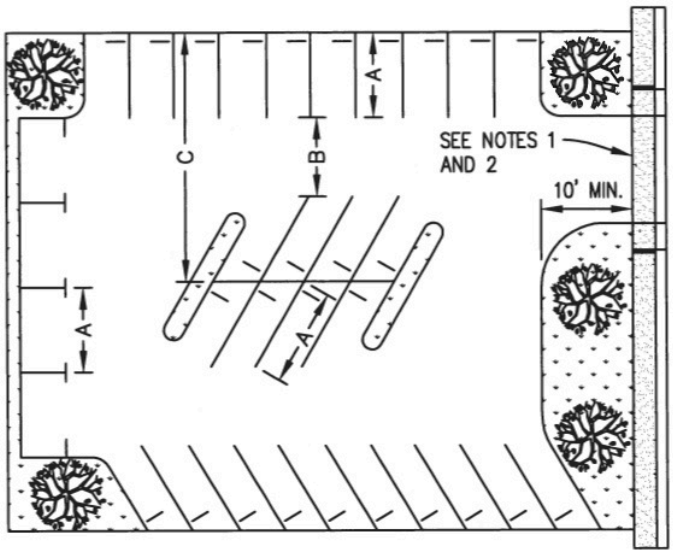


60° PARKING



90° PARKING





CONSTRUCTION MATERIALS AND NOTES

1. SEE ZONING CODE FOR DRIVEWAY WIDTHS WITHIN DEVELOPMENT.
2. SEE STANDARD NO. 205 AND 206 FOR DRIVEWAY REQUIREMENT AT STREET.
3. FOR RESIDENTIAL USES, 90° STALLS SHOULD BE 10' WIDE.
4. NOT MORE THAN 25% OF ALL REQUIRED PARKING SPACES MAY BE REDUCED TO 8 FEET IN WIDTH AND 16 FEET IN LENGTH, AND SUCH SPACES SHALL BE DISPERSED THROUGHOUT THE PARKING LOT AND MARKED AS "COMPACT" CAR PARKING ONLY.
5. REFER TO SECTION 17 OF THE LIVE OAK MUNICIPAL CODE FOR LANDSCAPING REQUIREMENTS.

PARKING DIMENSION TABLE (ALL DIMENSIONS IN FEET)

STANDARD STALL LENGTH = 20' (18' WITH WHEEL STOP) / STANDARD STALL WIDTH = 9'				COMPACT STALL LENGTH = 16' (14' WITH WHEEL STOP) / COMPACT STALL WIDTH = 8'					
PARKING ANGLE (Δ)	1-WAY SINGLE-LOADED			1-WAY DOUBLE-LOADED			2-WAY DOUBLE-LOADED		
	STALL DEPTH (A)[1]	AISLE WIDTH (B)	TOTAL BAY DEPTH (C)	STALL DEPTH (A)[1]	AISLE WIDTH (B)	TOTAL BAY DEPTH (C)	STALL DEPTH (A)[1]	AISLE WIDTH (B)	TOTAL BAY DEPTH (C)
PARALLEL	24	12	21	24	12	30	24	24	42
45°	18	14	33.1	18	14	52.2	18	20	58.2
60°	18	18	38.1	18	18	58.2	18	20	60.2
90°	18	23	41	18	23	59	18	24	60

1. STALL DEPTH WITH WHEEL STOP.

OFF STREET PARKING LAYOUT

DATE	REVISIONS	BY

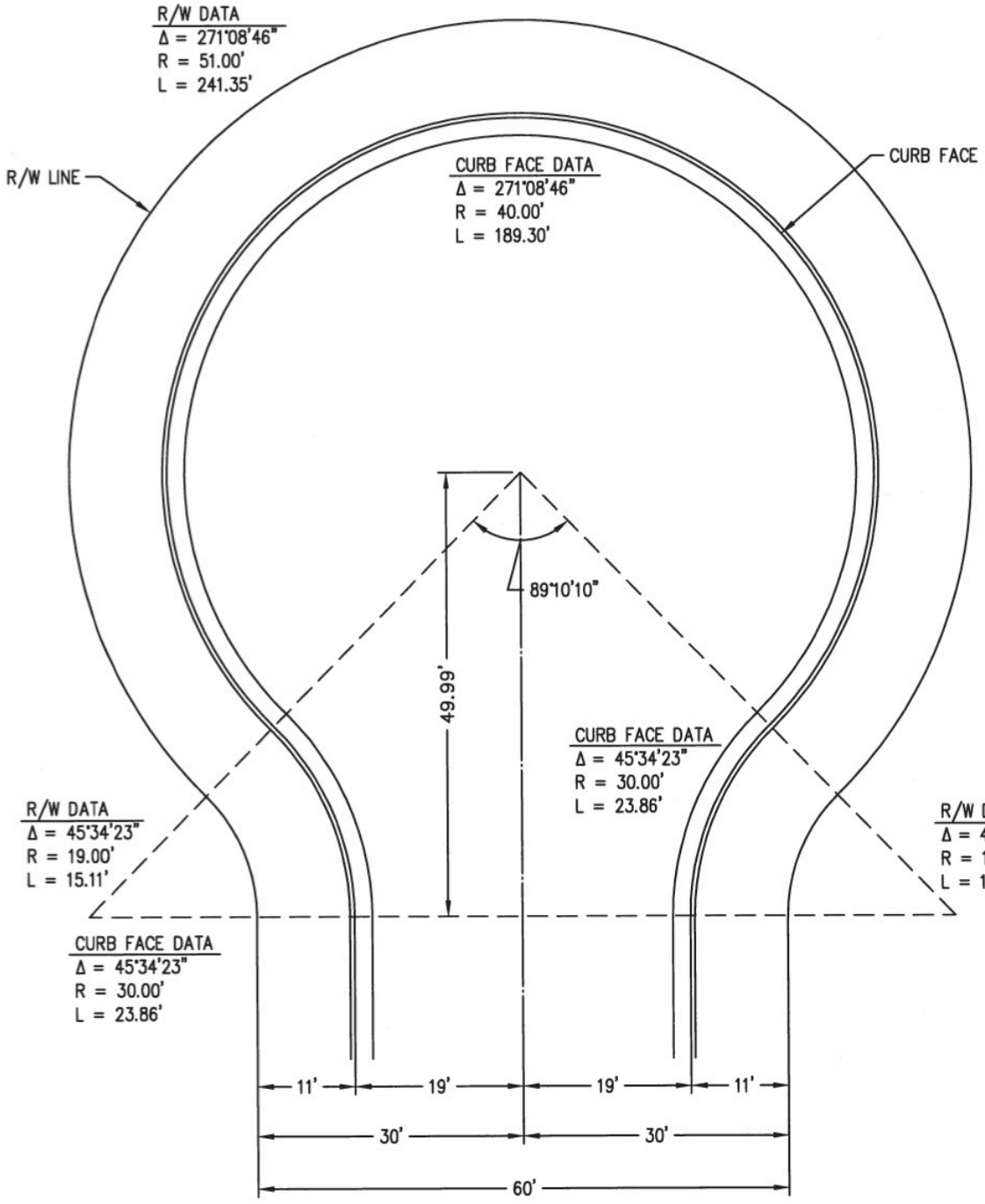
CITY OF LIVE OAK

DESIGN STANDARD

705

Scott R. Robb — APPROVED

10/7/15 — DATE



STANDARD
CUL-DE-SAC

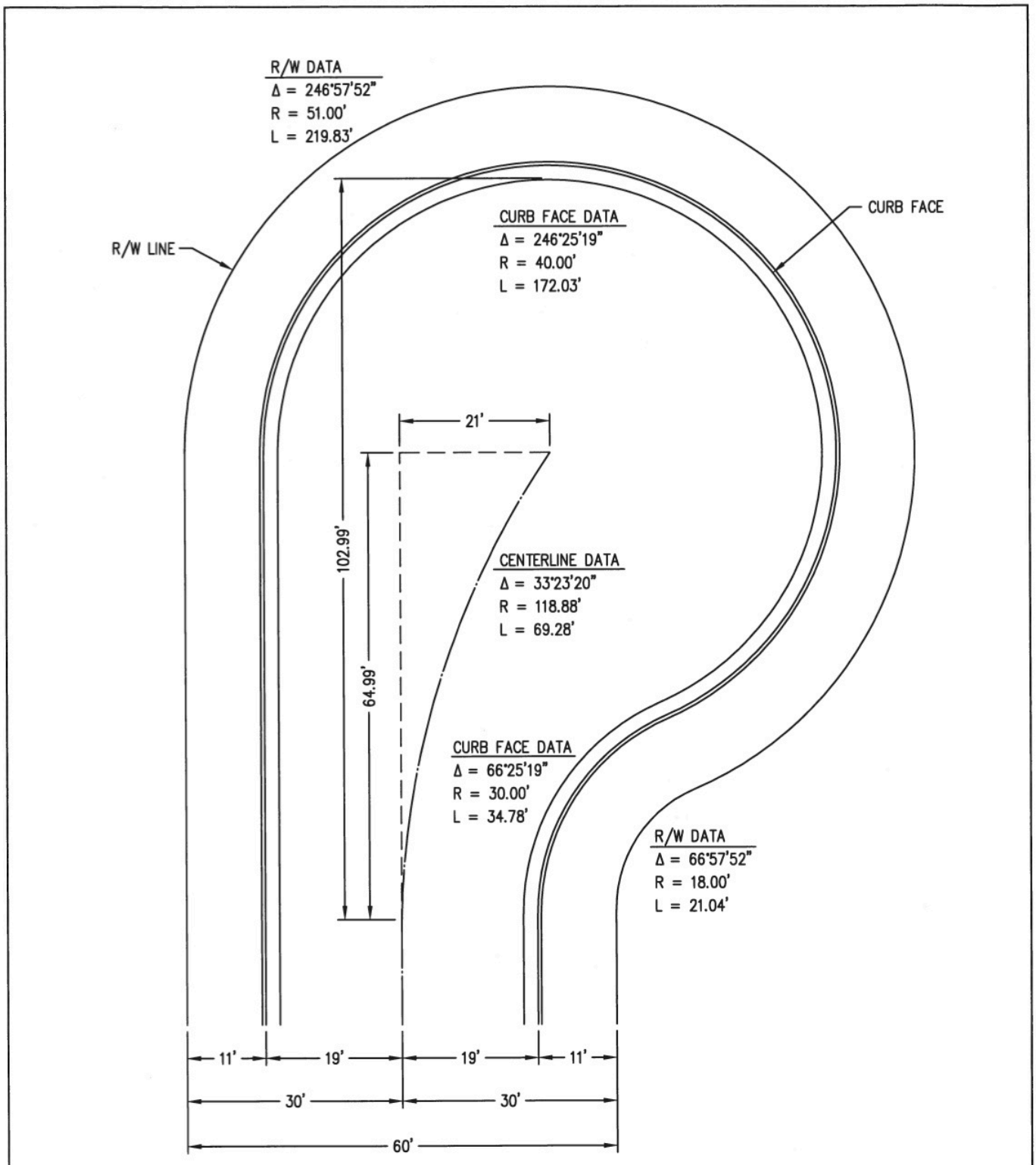
DATE	REVISIONS	BY

CITY OF LIVE OAK

STANDARD DETAIL

706

APPROVED — DATE: 10/7/15



OFFSET
CUL-DE-SAC

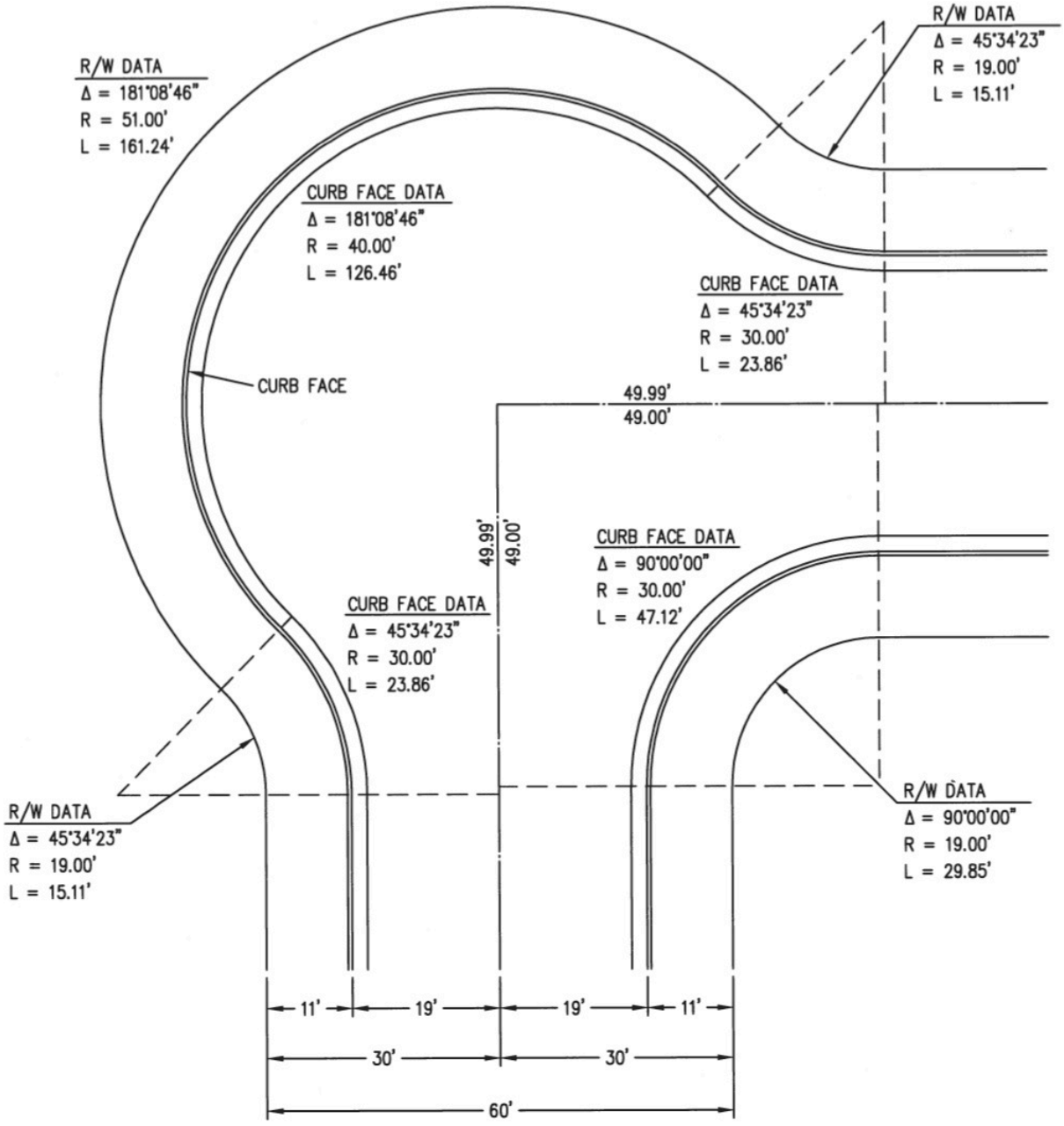
DATE	REVISIONS	BY

CITY OF LIVE OAK

STANDARD DETAIL

707

Scott R. Roller APPROVED 10/7/15 DATE



NOTE: WHEELCHAIR RAMP LOCATIONS TO BE DETERMINED BY THE CITY ENGINEER.

INTERSECTION "KNUCKLE"

DATE	REVISIONS	BY

CITY OF LIVE OAK

STANDARD DETAIL

708

Scott R. Robb — APPROVED

10/7/15 — DATE

APPENDIX C

APPENDIX D

STANDARD TECHNICAL SPECIFICATIONS

APPENDIX D

APPENDIX D

STANDARD TECHNICAL SPECIFICATIONS INDEX

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APPENDIX D

APPENDIX D

TRENCH EXCAVATION AND BACKFILL

A. SCOPE

This section covers trench excavation and backfill for water mains, storm drain pipelines and sanitary sewer pipelines, and excavation and backfill at storm drain and sanitary sewer manholes, water system appurtenances and storm drainage inlets.

B. MATERIALS

IMPORTED BEDDING MATERIAL shall be clean, washed sand or Class 2 aggregate base.

IMPORTED BACKFILL MATERIAL shall be Class 2 aggregate base.

LEAN CONCRETE BACKFILL shall consist of a fluid, workable mixture of the following ingredients:

WEIGHTS PER CUBIC YARD (SATURATED, SURFACE-DRY)

		YIELD, CU. FT.
ASTM C-150 / TYPE II CEMENT, LB	94	0.48
CONCRETE SAND, LB	1,500	8.84
3/8" BY #8 GRAVEL, LB	1,704	10.19
WATER, LB	100	1.60
TOTAL AIR, %	21.8 ± 3.0	5.88
TOTAL		27.00

WATER/CEMENT RATIO, LBS/LB	1.07
CONCRETE UNIT WEIGHT, PCF	125.90

The final mix design and mix consistency shall be subject to the approval of the City Engineer and/or the Caltrans inspector.

SLURRY CEMENT BACKFILL shall consist of a fluid, workable mixture of commercial quality concrete sand, cement and water. Not less than 94 pounds of cement shall be used for each cubic yard of material produced. Cement shall be portland cement conforming to Section 90-1.02 of the State Standard Specifications, except that testing will not be required.

AGGREGATE BASE shall be Class 2, 3/4-inch maximum, conforming to the requirements of Section 26 of the State Standard Specifications.

HOT MIX ASPHALT shall be 1/2-inch maximum size, Type A or Type B, conforming to the requirements of Section 39 of the State Standard Specification and the “Hot Mix Asphalt (HMA)” section of these Technical Specifications. Asphalt binder shall be PG 64-10, conforming to the requirements of Section 92 of the State Standard Specification.

TEMPORARY ASPHALT PAVING shall conform to Sections 39 and 93 of the State Standard Specifications. Aggregate shall be 1/2-inch maximum size, Type B. Bituminous binder shall consist of SC800 liquid asphalt.

APPENDIX D

TRENCH EXCAVATION AND BACKFILL

CONCRETE for concrete collars shall be Class B concrete and concrete for thrust blocks and/or encasing pipe shall be Class C concrete in accordance with Section 90 of the State Standard Specifications. Concrete for concrete collars shall contain a minimum of 10 lbs. of lamp black per cubic yard.

C. EXCAVATION

GENERAL: The Contractor shall excavate whatever substance encountered to the lines and grades shown on the Plans. All material suitable for use as backfill shall be piled in an orderly manner a sufficient distance from the side of the trench to avoid overloading and to prevent sliding into the trench. The Contractor shall do such grading as is necessary to prevent surface water from entering the excavation.

Except with the specific approval of the Engineer, no more than 200 feet of open trench shall be excavated in advance of laying the pipe. Not more than 50 feet of trench excavation shall remain unbackfilled at the end of each day's work. The remainder of the trench shall be backfilled, compacted, and opened to traffic. All operations shall be carried out in an orderly fashion. Backfilling, compacting, and cleanup work shall be accomplished as sections of the pipe installation are approved and traffic through the work shall be impeded or obstructed as little as possible.

Where it is necessary to cross fences, temporary gates or other barriers, or satisfactory obstructions shall be installed by the Contractor as required to keep livestock and/or household pets from entering or leaving the property. All cut fences shall be restored to original condition upon completion of backfilling of the trench.

Where it is necessary to cross irrigation or drainage ditches, the backfill in the bottom and banks of such ditches shall be carefully placed and compacted to avoid settlement. Shape of the banks and bottom shall be restored and left in good condition.

If explosives are used for excavation, the Contractor shall obtain the necessary permits and comply with all local regulations. The utility companies or agencies supplying either sewer service, water, electricity, telephone service, or gas shall be informed if blasting is to be done in the vicinity of their facilities.

WIDTH OF TRENCH: Except where otherwise specifically permitted, banks of trenches shall be vertical, and shall be of uniform width from top to bottom. Trenches shall be a minimum of 12 inches wider than the external diameter of the pipe. The maximum width of the trench, measured at the top of the pipe, shall not exceed the width allowed for various strengths of pipe as may be specified elsewhere in the applicable sections of these Standard Specifications.

If no maximum width is elsewhere specified, the width measured at the top of the pipe shall not exceed the external diameter of the pipe, exclusive of bells and collars, plus 24 inches.

STRIPPING OF TOPSOIL: Where the trench crosses cultivated, residential, or meadow land not in a roadway, the top 12 inches of soil shall be stripped and stockpiled separately from the balance of the excavated material so that later it may be placed in the top of the trench backfill.

APPENDIX D

TRENCH EXCAVATION AND BACKFILL

BRACING OF TRENCHES: Where required to prevent caving of the trench, the Contractor shall furnish and install bracing and sheeting as necessary to protect the excavation and to meet safety regulations. If required by the Engineer, the Contractor shall install sheeting and bracing as required to permit the Engineer safe access to the trench for inspection of the work. However, this requirement does not relieve the Contractor of the responsibility for maintaining the trench to meet safety regulations.

DEPTH OF TRENCH: The bottom of the trench shall be carried to the lines and grades shown on the Plans with proper allowance for the thickness of the pipe and for the type of bedding specified. Any part of the trench excavated below the proper grade shall be corrected with approved bedding material compacted to 95 percent relative density, at the Contractor's expense.

APPURTENANCES: Excavations for valve vaults and other similar structures shall be large enough to provide proper working room. Any over-depth in excavation shall be corrected with concrete or other approved material.

REMOVAL OF WATER: The Contractor shall remove and dispose of all water entering the excavation. Disposal of water shall be done in a manner to prevent damage or nuisance to adjacent properties. Water removed from the excavation shall not be disposed of in storm drainage facilities.

Straw waddles, gravel bags, sediment traps, or other devices shall be provided to prevent silt and sediment from entering storm drainage facilities. Placement and maintenance of devices shall be in accordance with the plans, any Storm Water Pollution Prevention Plan (SWPPP) developed for the project, and as directed by the Engineer.

Sufficient pumping equipment shall be provided to maintain the trench in a dry condition during the bedding and initial backfilling of the pipe.

D. TYPES OF BEDDING

NATIVE BEDDING AND SHADING: Native materials shall not be used as pipe bedding or pipe shading.

IMPORTED BEDDING: Imported bedding material shall be installed in a layer the full width of the trench and of proper thickness to form the bed for the pipe. After the imported bedding has been placed and spread, it shall be compacted to proper grade to not less than 95% relative density.

CONCRETE ENCASEMENT: Shall be installed at the locations and in the manner shown on the Plans. The pipe shall be temporarily supported on masonry blocks. Supports shall be set accurately to grade with a minimum of two supports per joint of pipe. After the pipe has been laid and approved for covering, the pipe shall be bedded and encased in concrete as detailed on the Plans. Great care shall be taken not to float or shift the pipe during the concreting operation.

E. BACKFILLING

GENERAL: No backfilling shall be done until the installation to be covered has been inspected and approved for covering. Backfilling shall be carried out in an orderly fashion and, in general, shall

be done as soon as approval has been given to cover the pipe. Compaction of the backfill shall proceed simultaneously with backfilling operations.

All excess backfill material shall be removed from within the right-of-way and disposed of by the Contractor. The location of the disposal site shall be the responsibility of the Contractor and shall be

subject to approval of the Engineer. Removal of excess material shall be done immediately following backfilling.

Where trenches cross city streets, backfilling shall be completed immediately following excavation. No trenches across streets shall remain open overnight. All crossings shall be backfilled, compacted, and open to traffic at the end of each day's work. Major road crossings
shall be excavated and backfilled in half widths of the traveled way so that at least one-half of the roadway is open to controlled traffic at all times during the work.

BEDDING AND COVERING PIPE: The bed for the pipe shall be final-graded by hand to the line and grade to which the pipe is to be laid, making proper allowance for the thickness of the pipe. The bed shall be hand-raked ahead of the pipe laying operation to remove any stones or lumps which will interfere with smooth and proper bedding. Bell holes shall be hand-dug at the location of the joints and shall be of sufficient size to allow proper making of the joint and to prevent the collar or bell of the pipe from bearing on the bottom of the trench. After the pipe has been laid and approved for covering, backfill shall be placed evenly on both sides of the pipe the full width of the trench. This material shall be placed by hand in layers and each layer shall be compacted to 95% relative compaction by use of approved tampers. For pipe 10 inches in nominal diameter or less, the first layer shall be half the outside diameter in thickness, and shall be tamped by hand. The thickness of the next layer shall be half of the diameter of the pipe plus 12 inches. For pipe 12 inches and larger in nominal diameter, the backfill material shall be placed in layers not more than 8 inches thick. Particular care shall be taken to attain the required compaction in the material supporting the underside of the pipe. Compaction by jetting or ponding shall not be permitted.

TRENCH BACKFILL ABOVE THE PIPE COVER:

BACKFILL WITHIN STATE HIGHWAY 99: Work within the Highway 99 right-of-way shall be in accordance with the Caltrans encroachment permit issued for the work. All backfill above the pipe envelope shall be lean concrete backfill unless otherwise shown on the Plans.

BACKFILL WITHIN PRIVATE DRIVEWAYS, ROADS, AND CITY STREETS: In public roads, backfill and compaction shall be done in accordance with the terms of the City Improvement Standards. The following requirements are minimums and do not relieve the Contractor of the responsibility of complying with any more stringent requirements of the City Standards.

The trench shall be backfilled in layers with suitable imported material which may be placed by machine. Material shall be placed in 8-inch thick layers and compacted by machine.
Prior to commencing backfilling operations, the Contractor shall notify the Engineer of the method of compaction which he intends to use. No method will be approved until the Contractor has demonstrated, under actual field conditions, that such method will produce the degree of compaction required.

The trench backfill shall be compacted to a relative density of not less than 95 percent.

APPENDIX D

TRENCH EXCAVATION AND BACKFILL

SLURRY CEMENT BACKFILL: Where shown on the Plans, and at locations approved by the Engineer, the trench shall be backfilled with slurry cement from the top of the pipe bedding envelope to the bottom of the trench resurfacing structural section.

Immediately after backfilling, all excess material shall be removed and disposed of in an approved disposal area.

F. TESTS

Where a degree of relative compaction is specified, the compaction characteristics of each soil type will be determined in accordance with ASTM D 1557, Procedure C. All field densities shall be expressed as a relative compaction in terms of the maximum density obtained in the laboratory by the foregoing standard procedure.

Field density tests shall be performed in accordance with ASTM D 2922, Direct Transmission Method, using the nuclear gauge, or ASTM D 1556, using the sand cone. The Owner will pay for compaction tests to verify that the Contractor has met all compaction requirements. However, the cost of all failing tests required due to the Contractor's failure to meet the specifications shall be paid for by the Contractor.

G. PROTECTION OF PAVING

During the entire construction period, the Contractor shall protect existing pavement. Track-laying equipment shall be equipped with pavement pads when used on pavement. Any pavement damaged, cracked, or broken by the Contractor's operation shall be removed and replaced to at least the original condition. Damaged pavement shall be restored to the satisfaction of the Engineer.

H. REMOVAL AND REPLACEMENT OF PAVING AND BASE

GENERAL: Only such paving shall be removed as is necessary to excavate the trench and install the pipe. Cuts at valve vaults shall be no larger than necessary to install the structure.

REPLACEMENT OF PAVING: Paving shall be replaced in accordance with the Specifications, the City Improvement Standards, and the details shown on the Plans. Pavement shall be replaced in all streets and highways as soon as possible after completion of backfilling. In no case shall any section of trench in public roads remain unpaved more than one week from the date that the excavation was made. Where trenches cross roadways, pavement shall be replaced the same day the excavation was made.

TEMPORARY PAVEMENT: Where weather conditions or time preclude placing permanent pavement, temporary pavement will be installed. Temporary paving will consist of a one-inch thick layer of premixed asphaltic surfacing material and shall be installed flush with the existing surface. Temporary pavement shall be maintained in a smooth and uniform condition, and shall be removed prior to placing permanent pavement.

APPENDIX D

TRENCH EXCAVATION AND BACKFILL

PLACING AGGREGATE BASE: Where base material is required, the aggregate base shall be placed and compacted in one even layer to the depth shown on the Plans, and extending the full width of the trench. Segregation shall be avoided and extra care shall be taken in compacting the base near the sides of the trench. Relative compaction shall be not less than 95 percent.

PREPARATION FOR HOT MIX ASPHALT PAVING: Edges of existing paving shall be neatly cut along straight lines, and cut edges shall be vertical. All loose pieces or cracked sections of existing paving shall be removed. All vertical edges shall be coated with liquid asphalt-emulsion.

INSTALLING HOT MIX ASPHALT: Hot mix asphalt shall be placed, spread and compacted in conformance with the provisions of Section 39-3, “Method Construction Process”, of the State Standard Specifications, the “Hot Mix Asphalt (HMA)” section of these Technical Specifications, and the following provisions.

Rolling equipment shall consist of power rollers equivalent to tandem rollers weighing not less than 7.5 tons.

The hot mix asphalt shall be spread at a temperature suitable for workability and to a depth that will compact to the required thickness as shown on the Plans. No material shall be spread when the outside temperature is less than 40° Fahrenheit. After spreading, the material shall be thoroughly compacted, smooth, and free of irregularities.

FOG SEAL: Hot mix asphalt shall be sealed with a fog seal coat in accordance with Section 37 of the State Standard Specification and the “Prime Coat, Tack Coat and Fog Seal Coat” section of these Technical Specifications. Fog seal coat shall be applied at a rate such that the original emulsion will be spread with a residual asphalt rate of 0.06 gallons per square yard.

I. CLEAN UP

The Contractor shall clean up and dispose of all trash, debris, and excess material, and shall remove his equipment from the site of the work as completed.

J. GUARANTEE

The Contractor shall guarantee the work against settlement for a period of one year.

APPENDIX D

AGGREGATE SUBBASE

A. SCOPE

This heading covers the furnishing, placement and compaction of aggregate subbase material, complete.

B. MATERIALS

All aggregate subbase material shall be Class 1 or Class 2, conforming to the requirements of Section 25 of the State Standard Specifications.

C. WORKMANSHIP

Aggregate subbase material shall be spread, watered, compacted and finished in accordance with requirements of Section 25 of the State Standard Specifications and these Technical Specifications.

The maximum compacted thickness of any one layer shall not exceed 0.5-foot. The aggregate subbase shall be compacted to at least 95 percent of the maximum density, as determined by ASTM D 1557, Procedure C. Field density tests shall be performed in accordance with ASTM D 2922, Direct Transmission Method, using the nuclear gauge, or ASTM D 1556, using the sand cone.

APPENDIX D

AGGREGATE BASE

A. SCOPE

This heading covers the furnishing, placement and compaction of aggregate base material, complete.

B. MATERIALS

All aggregate base material shall be Class 2, 3/4-inch maximum, conforming to the requirements of Section 26 of the State Standard Specifications.

C. WORKMANSHIP

Aggregate base material shall be spread, watered, compacted and finished in accordance with requirements of Section 26 of the State Standard Specifications and these Technical Specifications.

The maximum compacted thickness of any one layer shall not exceed 0.5-foot. The aggregate base shall be compacted to at least 95 percent of the maximum density, as determined by ASTM D 1557, Procedure C. Field density tests shall be performed in accordance with ASTM D 2922, Direct Transmission Method, using the nuclear gauge, or ASTM D 1556, using the sand cone.

APPENDIX D

PRIME COAT, TACK COAT AND FOG SEAL COAT

A. SCOPE

This heading covers the furnishing and placement of prime coat and paint binder, complete.

B. MATERIALS

PRIME COAT shall be grade SC-70 liquid asphalt conforming to the requirements of Section 93 of the State Standard Specifications.

TACK COAT shall be an asphaltic emulsion, Type and Grade SS1, conforming to the requirements of Section 94 of the State Standard Specifications.

C. WORKMANSHIP

PRIME COAT shall be applied to all aggregate base surfaces to receive hot mix asphalt, unless otherwise indicated on the plans. Application shall be in conformance with the provisions of Section 39-1.22 of the State Standard Specifications (2010 SSP No. 39-1.22) and shall be applied at the rate of not less than 0.20 gallons per square yard. Do not apply more prime coat than can be absorbed completely by the aggregate base in 24 hours.

If you request and if authorized, you may modify prime coat application rates.

Before paving, prime coat must cure for 48 hours.

Close traffic to areas receiving prime coat. Do not track prime coat onto pavement surfaces beyond the job site.

TACK COAT shall be applied to all vertical surfaces of existing pavement, curbs, gutters, construction joints and to pavement to be resurfaced. Application shall be in conformance with the provisions of Section 39-1.09C of the State Standard Specifications and shall be applied at the following residual asphalt rates:

New Hot Mix Asphalt (Between Layers) .....0.02 gal/sq yd

PCC and Existing HMA Surfaces .....0.03 gal/sq yd

Planed PCC and HMA Surfaces .....0.05 gal/sq yd

Tack coat may be omitted between layers of new hot mix asphalt during the same work shift if no dust, dirt, or extraneous material is present and the surface temperature is at least 140 degrees F.

FOG SEAL COAT shall be applied to the finished surface of hot mix asphalt. Tack coat, SS1, shall be applied to the surface of the pavement in conformance with the provisions of Section 37 of the State Standard Specifications. The application rate (residual asphalt) shall be 0.06 gallons per square yard.

APPENDIX D

PRIME COAT, TACK COAT AND FOG SEAL COAT

Provisions shall be made by the Contractor, to keep traffic from tracking the fresh fog seal until it has cured.

APPENDIX D

HOT MIX ASPHALT (HMA)

A. SCOPE

This heading covers the furnishing, placement and compaction of hot mix asphalt (HMA) paving material, complete.

B. MATERIALS

HOT MIX ASPHALT (HMA) shall be 1/2-inch maximum size, medium grading, Type B, conforming to the requirements of Section 39 of the State Standard Specifications.

ASPHALT BINDER shall be PG 64-10 conforming to the requirements of Section 92 of the State Standard Specifications.

C. WORKMANSHIP

Hot mix asphalt shall be placed, spread and compacted in conformance with the provisions of Section 39-3, “Method Construction Process”, of the State Standard Specifications. Hot mix asphalt shall be spread in one operation with a self-propelled spreader ready for compaction without further shaping. Hot mix asphalt shall be placed in maximum 0.25-foot thick compacted layers.

Compaction shall be performed with 3 self-propelled, reversible rollers, each with a separate operator, as follows:

1. One vibratory roller specifically designed to compact HMA. The roller must be capable of at least 2,500 vibrations per minute and must be equipped with amplitude and frequency controls. The roller's gross static weight must be at least 7.5 tons.

2. One oscillating type pneumatic-tired roller at least 4 feet wide. Pneumatic tires must be of equal size, diameter, type, and ply. The tires must be inflated to 60 psi minimum and maintained so that the air pressure does not vary more than 5 psi.

3. One steel-tired, 2-axle tandem roller. The roller's gross static weight must be at least 7.5 tons.

First coverage of breakdown compaction shall be completed before the surface temperature drops below 250 degrees F. Breakdown and intermediate compaction shall be completed before the surface temperature drops below 200 degrees F. Finish compaction shall be completed before the surface temperature drops below 150 degrees F.

HMA compaction coverage is the number of passes needed to cover the paving width. A pass is 1 roller's movement parallel to the paving in either direction. Overlapping passes are part of the coverage being made and are not a subsequent coverage. Do not start a coverage until completing the prior coverage.

Start rolling at the lower edge and progress toward the highest part.

Perform breakdown compaction of each layer of HMA with 3 coverages using a vibratory roller. The speed of the vibratory roller in miles per hour must not exceed the vibrations per minute divided by

1,000. If the thickness of the HMA layer is less than 0.08 foot, turn the vibrator off. The Engineer may order fewer coverages if the thickness of the HMA layer is less than 0.15 foot.

Perform intermediate compaction of each layer of HMA with 3 coverages using a pneumatic-tired roller at a speed not exceeding 5 mph.

Perform finish compaction of HMA with 1 coverage using a steel-tired roller.

Hot mix asphalt shall be finished level with, or not more than 0.02-foot above, existing gutters. In no case shall the finished hot mix asphalt be lower than the edge of the gutter.

At lines of conformance to existing paving the finish course shall be feather-edged to provide a smooth transition to existing paving.

A fog seal coat shall be applied to the finished surface of the hot mix asphalt. Paint binder, SS1, shall be applied to the surface of the pavement in conformance with the provisions of Section 37 of the State Standard Specifications. The application rate (residual asphalt) shall be 0.06 gallons per square yard. Provisions shall be made by the Contractor, to keep traffic from tracking the fresh fog seal until it has cured.

APPENDIX D

CONCRETE WORK

A. SCOPE

This heading covers concrete work, complete.

B. MATERIALS

PORTLAND CEMENT shall be Type II and conform to ASTM Specification C150. All cement shall be protected from moisture until used.

CONCRETE AGGREGATES:

GENERAL: Concrete aggregate shall conform to ASTM Specification C33. The sieves used in Sieve Analysis shall be square mesh wire cloth. Both coarse and fine aggregate shall be tested for soundness by ASTM Method C88 when in the judgment of the Engineer such tests are necessary to determine the quality of the materials.

FINE AGGREGATE shall consist of natural sand having hard, strong and durable particles. It shall not contain more than 2 percent by weight of clay, shale, schist, alkali, or other deleterious substances. The grading of fine aggregate shall range uniformly from coarse to fine.

COARSE AGGREGATE shall consist of clean, hard, sound crushed rock or washed gravel. It shall not contain more than 2 percent by weight of clay, shale, schist, alkali, or other deleterious substances. The grading of coarse aggregate shall range uniformly from coarse to fine.

STORAGE: Fine and coarse aggregate shall be stored and measured separately. Aggregate shall be stored on the job so that various sizes do not become intermixed. They shall be protected from contamination with dust, dirt, or other foreign materials.

MOISTURE CONTENT of aggregate shall be such that no visible separation of moisture and aggregate will take place during transportation from the proportioning plant to the point of mixing. Aggregate containing excess moisture shall be stockpiled prior to use and sufficiently dried.

VARIATIONS in moisture content shall not exceed one percent of the weight of the aggregate in a saturated surface dry condition. Variations in specific gravity of any group of sizes shall not exceed one percent. Variations in grading of separate groups of sizes of aggregate shall not exceed 5 percent. Variations exceeding these maximums shall constitute cause for delaying the use of the materials until batch weights and mixing water can be adjusted.

AGGREGATE SIZE: The primary size of aggregate specified and used on any project shall be the maximum consistent with the dimensions and form of the section being placed, the location and spacing of the reinforcing bars, and with the method of compaction, but shall not be less than 3/4-inch.

WATER shall be clean and free of oil, acid, alkali, organic matter or other deleterious substances.

APPENDIX D

CONCRETE WORK

REINFORCING STEEL:

BARS shall be of intermediate grade steel and shall conform to ASTM Specification A615. All bars shall be deformed and deformations shall conform to ASTM Specification A615.

WELDED WIRE FABRIC OR MESH shall conform to ASTM Specification A185.

ADMIXTURES shall be used only where specifically required or where written approval has been granted by the Engineer. Concrete for curbs, gutters and sidewalks shall contain 0.5 pound of lampblack per cubic yard.

EXPANSION JOINT FILLER shall be of the preformed nonextruding type and shall conform to ASTM Specification D544, Type V, bituminous fibre, and shall be the full depth of the abutting concrete.

C. WORKMANSHIP

REINFORCING STEEL:

PLACEMENT: Unless an exception is made in writing by the Engineer, the Contractor shall submit for approval detailed drawings showing bending and placing of all reinforcing steel and shall not begin work until the drawings have been approved by the Engineer.

Steel reinforcement shall be accurately placed and positively secured and supported by concrete blocks, metal chairs, spacers, or by metal hangers. The clear spacing between parallel bars shall not be less than 1.50 times the nominal diameter for round bars, but in no case shall the clear distance be less than 1.50 inches nor less than 1.33 times the maximum size aggregate. Reinforcing steel shall be in position before concreting is begun.

Steel shall not be bent nor straightened in a manner that will injure the materials. Kinked bars shall not be used. Heating of steel for bending shall not be permitted.

All steel dowels must be placed and securely anchored before concrete is poured.

Reinforcing shall not be placed in slabs and beams until after the concrete in the walls and columns has been placed, unless specifically indicated on drawings.

SPLICING: In slabs, beams, and girders, splices at the points of maximum stress shall be avoided. Bars in horizontal members shall have a maximum lap at splices sufficient to develop the strength of the bars. Wherever possible, splices of adjacent bars shall be staggered. Unless stress governs, the splice of wire fabric shall be at least one mesh wide.
Spliced bars in walls may be either separated or wired together. Deformed bars shall be lapped 24 bar diameters.

CLEANING REINFORCEMENT: Steel shall be cleaned of any oil, grease, rust, concrete or other deleterious substances before it is placed in the forms. Any deleterious substances that get on the steel after placing shall be removed before pouring concrete.

APPENDIX D

CONCRETE WORK

CONCRETE PROPORTIONING AND MIXING:

PROPORTIONS: Amounts of cement and water and strength requirements shall be as follows:

(1) Class of Concrete	Class A	Class B	Class C
(2) Minimum Cement per cubic yard concrete	6 Sks.	5 Sks.	4.2 Sks.
(3) Maximum total water per sack of cement including free moisture	54 Lbs.	62 Lbs.	
(4) Minimum compressive strength at 28 days	3000 psi	2500 psi	2000 psi

The class of concrete used shall be specified on the drawings. However, if no class is shown, Class A concrete shall be used.

Concrete to be used for curbs, gutters and sidewalks shall contain 0.5 pound of lampblack per cubic yard of concrete.

Cement shall be measured in the sack or weighed; broken sacks will not be allowed unless cement is batched by weight. Aggregate shall be proportioned by weight.

Proportions of fine and coarse aggregate shall be furnished by the Engineer or by an approved testing laboratory, and may be varied from time to time by the Engineer to produce a smooth, dense, workable mixture that will work readily into corners and angles without excessive spading or vibrating.

AMOUNT OF WATER AND SLUMP TEST: The amount of water required for the proper consistency of concrete shall be determined by means of the slump test, made in accordance with ASTM Method C143.

The amount of water given in the above table is a maximum. The maximum allowable slump shall be as follows:

(1)	Thin sections and columns	Not more than 5"
(2)	Heavy sections, footings & slabs	Not more than 3"
(3)	Concrete placed under water	Not more than 8" Not less than 6"

The amount of water may be varied in accordance with the dampness of the materials and the requirements of the workability of the aggregate within the limits of the slump tests given above.

MEASURING WATER: The equipment for measuring and supplying the water to the mixer shall be so constructed and arranged that the amount of water to be added to the mixture can be measured positively and that the predetermined quantity of water required can be discharged rapidly in one

operation into the mixing drum. The equipment shall be designed so that water from the source of supply cannot enter the measuring tank while the water is being discharged from the measuring tank into the mixer. Tanks or other equipment for measuring and discharging water into the mixer shall be sufficiently accurate that the amount of water delivered to the mixer for any batch shall not vary more than one percent from the required quantity of water for any position of the mixer. The tanks or other equipment shall be arranged to permit checking the amount of water delivered by discharging into measured containers.

JOB MIXING: The capacity of the mixer shall be adequate to handle one or more full sack batches. No split sack batches will be permitted, unless all materials are weighed. At no time shall the mixer be loaded beyond its capacity. The capacity of the mixer shall be considered to be the rated capacity as given in the manufacturer's catalog, provided that a quantity equal to the rated capacity can be thoroughly mixed in the prescribed time period and that there is no loss of ingredients during the mixing. Each batch shall be mixed not less than 1.50 minutes after all ingredients are in the mixer and until the mixture is uniform and homogeneous. It shall be completely discharged. The peripheral speed of concrete mixing drums shall be approximately 200 feet per minute. The mixer shall be equipped with an automatic time lock on the discharge control arranged to start the time cycle on the stroke of the material skip or on the closing of the hopper gate.

TRANSIT MIXING: Transit-mixed concrete shall be in accordance with ASTM C94 and be of not less than 10 minutes at a peripheral drum speed of approximately 200 feet per minute. Mixing shall be continued until discharge is complete. At least three minutes of the mixing period shall be at the job site. The transit mixer shall be equipped with water measuring devices consisting of either accurately calibrated water tanks or water meters. Transit-mixed concrete will be rejected if not placed within 1.50 hours after water is first added to the batch.

Should the Contractor elect to utilize transit mixing equipment he shall make advance arrangements to prevent delays in delivery and placing of the concrete. An interval of more than 45 minutes between any two consecutive batches or loads, or a delivery and placing rate of less than 8 cubic yards of concrete per hour, shall constitute cause for shutting down the work for the remainder of the day, and if so ordered by the Engineer, the Contractor shall make, at his own expense, a construction joint at the location and of the type directed by the Engineer in the concrete already placed.

FORMS shall conform to the shape, lines and dimensions called for on the Plans and shall be substantial and mortar tight. All vertical surfaces shall be formed, except where specifically authorized to the contrary. Temporary openings at the bottom of the wall forms and temporary openings at the base of all columns and piers shall be provided as required for cleaning and to facilitate inspection.

Drip beads, feature grooves and other concrete details shall be carefully formed with surfaced material which shall be thoroughly coated with oil or other approved products before concrete is poured. Method of forming shall be selected for ease of stripping without damage to details. All exterior corners shall be chamfered 3/4-inch unless otherwise specifically shown.

Bolts or form clamps shall be of sufficient strength and number to prevent spreading of forms. They shall be of a type which can be entirely removed or cut back one inch below the finished surface of the concrete. All forms for outside surfaces shall be constructed with stiff wales at right angles to the studs and all form clamps shall extend through and fasten to such wales. Forms shall be so constructed that side forms where surface finishing is required can be removed without disturbing supporting forms.

APPENDIX D

CONCRETE WORK

Where woodwork comes into contact with concrete, proper anchors shall be provided. End studs of frame walls shall be bolted and dovetailed nailing blocks shall be provided for trim and other woodwork. Anchors in jambs of openings shall be spaced not more than two feet on centers.

Anchor bolts shall be positively positioned and anchored in the forms with templates and checked by the Engineer before concrete is poured.

If there is any question regarding the strength of forms, the recommendations of the manufacturer of the form ties shall be followed.

Non-supporting forms may be removed in 48 hours and supporting forms in not less than 21 days unless approval for earlier removal is granted by the Engineer. Forms shall be carefully removed so as not to endanger the structure or damage the surface.

CONCRETE CONVEYING AND DEPOSITING: Concrete shall be conveyed from the mixer to the place of final deposit by methods which will prevent segregation or loss of material. Concrete shall not be deposited in a manner which shows segregation to occur, and shall be deposited as nearly as practicable in its final position to avoid segregation during rehandling.

No concrete which has partially hardened or been contaminated by foreign material shall be deposited on the work, nor shall retempered concrete be used. When concreting is started it shall be carried on as a continuous operation until the section is completed, maintaining the top surface level.

All concrete shall be compacted with mechanical vibrators in a manner satisfactory to the Engineer. At least two satisfactory vibrators shall be on the job during every pour and more if required by the Engineer. If it is deemed necessary by the Engineer, surfaces that are to be exposed shall be spaded and hammered to obtain a good surface. Concrete shall not be permitted to fall from a height greater than 6 feet without the use of adjustable length pipes or "elephant trunks." The use of chutes in conveying and depositing concrete will be allowed only at the discretion of the Engineer, and wherever they are used, they shall be laid at an inclination that will permit the flow of concrete of the required consistency. Where necessary to prevent separation, chutes shall be provided with baffle boards or a reversed section at the outlets. Columns shall be poured through pipes of adjustable length and not less than 6 inches in diameter. The use of additional water in mixing the concrete to promote free flow in chutes of low inclination will not be allowed.

For columns and walls, concrete shall be allowed to set at least 4 hours before caps, girders, floor slabs, or other connecting members are poured so that the column may obtain its shrinkage before the superstructure is placed.

Where it is necessary to deposit concrete under water, concrete shall be placed by use of a tremie tube. Care shall be exercised to see that the lower end of the tremie tube does not rise above the surface of the concrete during the pour, to avoid contamination with water. Depositing of concrete under water shall be permitted only with the approval of the Engineer, where it is not possible to de-water.

COLD WEATHER WORK: Concrete shall not be mixed nor placed while the atmospheric temperature is at or below 35° Fahrenheit unless means are employed to heat the aggregate and water, and satisfactory provisions have been made for protecting the work. All concrete shall be

effectively protected from frost action for a period of five days after placing and will not be accepted before the expiration of a thirty day period during which the temperature of the concrete does not fall below 40° Fahrenheit.

The concrete shall be maintained at a temperature of at least 50° Fahrenheit for not less than 72 hours after placing or until it has thoroughly hardened.

The temperature of the concrete as it leaves the mixer shall not be less than 50° Fahrenheit, nor more than 120° Fahrenheit. Upon written notice from the Engineer, all concrete which may have become damaged by frost action shall be replaced by the Contractor at his own expense.

CONSTRUCTION JOINTS AND EXPANSION JOINTS: Construction joints in structural concrete shall be level or vertical and shall be of the type and location as the Engineer directs or as shown on the Plans. Joints not indicated on the Plans shall be so made and located as to least impair the strength of the structure and shall conform to the typical details.

The horizontal surface of all construction joints shall be cleaned and roughened by removing the entire surface and exposing clean aggregate solidly embedded in mortar matrix in accordance with the following procedure. The contact surface must be thoroughly cleaned by chipping or sand blasting the entire surface not earlier than 5 days after initial pour or by an approved method that will assure equal bond such as a thorough hose washing of the surface not less than 2 nor more than 4 hours after the concrete is placed (depending on setting time). All wash and chalklike material shall be entirely cleaned from the surface.

In the event that the contact surface becomes coated with earth, sawdust, etc., after being cleaned, the entire surface so coated shall be recleaned.

All construction joints shall be slushed with neat cement grout immediately ahead of the pour.

Water stops shall be installed in construction joints where shown on the Plans. Where no construction joint is shown on the Plans, but is permitted by the Engineer, water stops shall be installed as directed by the Engineer.
Unreinforced slabs, walks, curbs, etc., shall have construction joints at not to exceed 15-foot centers and expansion joints at not to exceed 30-foot centers. Reinforced slabs, walks, curbs, etc., shall have construction joints at not to exceed 20-foot centers and expansion joints at 40-foot centers. Expansion joint material shall be placed along all walls and around each column and projection.

CONCRETE FINISHING:

STRUCTURES: Forms shall be removed as soon as permissible and, immediately thereafter, tie rod holes, rock pockets, and other defects shall be chipped to expose sound aggregate and mortar and then shall be dashed with neat cement paste and dry packed with moistened 1 to 2 cement sand mortar thoroughly tamped in.

After patches have thoroughly hardened, surfaces that are to be exposed or painted in the finished structures shall be rubbed mechanically or by hand with carborundum stones to eliminate traces of forms and patch work. A brush coat of thin cement mortar consisting of one part cement and one part sand that will pass a No. 16 screen or at the option of the Engineer a neat cement wash shall be

applied if necessary to give a uniform appearance. In either case, five percent calcium chloride shall be used. When the cement film has set sufficiently so that the sand particles and cement will not draw out of surface pin holes, but before final set has taken place, the entire surface shall be rubbed with fine carborundum stones (No. 25 to No. 30) until a smooth, even surface of even texture, color and appearance is obtained. No greater amount of mortar shall be applied in advance of rubbing than can be completely rubbed before final setting takes place. Immediately following the rubbing process, the finished surface shall be thoroughly washed with water.

SLABS, WALKS, STEPS, CURBS and GUTTERS: After concrete for slabs or sidewalks has been placed between the side forms, a strikeoff guided by the side forms shall be used to bring the surface to the proper section to be compacted. After screeding off, the surface shall be tamped with a heavy tamper consisting of a grid of metal bars until a layer of mortar not less than 3/8-inch thick has been brought to the surface.

The surface shall be rescreeded to a true surface, worked with a wood float as settling progresses and troweled with a steel trowel a sufficient number of times to produce a smooth, hard finish. After troweling, the surface shall be broomed if required. Care shall be taken to obtain a true surface on slabs, especially at walls and joints. Slab surfaces shall not vary more than 1/4-inch at any point from an 8-foot straight edge. The use of topping or dusting with dry cement and sand shall not be permitted unless it is desired to apply an integral color. No more slabs shall be poured in one day than can be finished to a satisfactory surface.

If colored slabs are called for in the Plans, the finish shall be as specified except that the coloring shall be applied in the finished process in strict accordance with the Manufacturer's directions.

Treads of steps and stairs shall be worked with a wood float to an even surface, troweled to a smooth surface with a steel trowel and given a light brush finish. Use of topping or dry cement and sand will not be permitted. Edges and corners shall be rounded and the tread shall be scored with not less than four grooves the length of all treads near the edge. Forms on risers and other exposed vertical surfaces shall be removed not more than six hours after concrete has been placed. Risers and vertical surfaces shall be brushed with grout and troweled smooth or finished as directed by the Engineer.

Curbs and gutters shall be carefully constructed to the design lines and grades. The extremely flat grades necessary in the City of Live Oak requires particularly careful construction to maintain flowline and lip of gutter grades within 0.02-feet of design grades at all locations.

Curbs and gutters shall be screeded to true cross section and grade. The screed shall be operated parallel to the line of the curb. The surface shall then be worked with a wood float as setting progresses, troweled smooth and given a fine brush finish parallel to the line of the curb. Corners shall be rounded. The forms on the face of the curb shall be removed not more than 6 hours after concrete has been placed. The face shall be brushed with grout, troweled smooth and brushed to match the rest of the curb. The face of the finished curb shall be true and straight and the top surface of the curb and gutter shall be of uniform height and free from irregularities. Tops of curbs and lips of gutters shall be straight and uniform and shall not vary more than 1/8-inch from the edge of a 10-foot straight edge except at grade changes and curves.

The stringent alignment and grade control necessary for minimum grades requires extreme care in the use of extruding machines to construct curb and gutter, and control shall be carefully checked for alignment and grade immediately before pouring.

Any curb and gutter which fails to meet these alignment and grade requirements shall be removed and replaced at no cost to the City.

CURING: All concrete shall be protected from injury and shall be kept continuously wet for a period of ten days after pouring. The use of curing compounds will not be permitted without the approval of the Engineer.

Concrete slabs and walks shall be covered with "Sisal-Kraft" paper, sand, or sawdust as soon as they are hard enough to walk on and shall be kept continuously wet for ten days after pouring. Care shall be taken to prevent exposed slabs from becoming stained.

D. TESTS

During progress of the work, compression tests shall be made at the discretion of the Engineer of samples of the concrete using the molded cylinder method. Materials for the samples will be furnished at the expense of the Contractor. Testing will be done by the Owner or authorized laboratory at the expense of the Owner.

APPENDIX D

STORM DRAIN PIPE AND APPURTENANCES

A. SCOPE

This section covers pipe and fittings for storm drains, complete.

B. MATERIALS

REINFORCED CONCRETE PIPE shall be integral bell and spigot pipe conforming to ASTM Specification C 76, Class III, "A" Wall design, with rubber gasket joints conforming to ASTM Specification C 443.

Fittings and accessories shall be as manufactured and furnished by the pipe supplier, or approved equal, and have bell and/or spigot configurations compatible with that of the pipe.

CORRUGATED HIGH DENSITY POLYETHYLENE PIPE shall be integral bell and spigot, smooth interior wall pipe conforming to ASTM Specifications F 405 and F 667, and Section 64 of the State Standard Specifications, with rubber gasket joints conforming to ASTM Specification F 477.

Fittings and accessories shall be as manufactured and furnished by the pipe supplier, or approved equal, and have bell and/or spigot configurations compatible with that of the pipe.

Minimum "pipe stiffness" at 5% deflection shall be in accordance with Section 64 of the State Standard Specifications for all sizes when tested in accordance with ASTM D 2412.

Maximum pipe deflection shall not exceed 5% of the nominal manufacturer's average inside pipe diameter, and shall be determined as specified in Subsection D of this specification entitled, "Pipe Deflection Testing".

DUCTILE IRON PIPE: Pipe shall be Class 50, minimum, ductile iron pipe conforming to AWWA Specification C151. Pipe shall be bell and spigot with "push-on" rubber gasket joints conforming to AWWA Specification C111, unless otherwise specified. Pipe shall be cement-mortar lined in conformance with AWWA Specification C104 and bituminous coated.

Fittings shall comply with AWWA Specification C110, and shall be cement-mortar lined and bituminous coated as specified above. Fittings shall be supplied with bell and/or spigot configurations compatible with that of the pipe.

C. WORKMANSHIP

PREPARATION OF THE TRENCH: The trench shall be prepared to receive the pipe as specified in the “Trench Excavation and Backfill” section of these Technical Specifications. The excavation and preparation of the trench shall be completed a sufficient distance in advance of the pipe laying to prevent dislodged material from entering the pipe.

INSTALLATION OF THE PIPE: Before lowering into the trench, the pipe shall be inspected for defects, and all cracked or broken pipe shall be discarded. The ends and interior of the pipe shall be clean. Handling of the pipe shall be accomplished in a manner that will not damage the pipe.

APPENDIX D

STORM DRAIN PIPE AND APPURTENANCES

At manholes, pipe shall be installed so that there is a joint at or not more than two feet from the manhole wall.

After lowering the pipe into the trench, the bell or coupling end and spigot shall be cleaned of any foreign matter and a suitable lubricant applied to the joint. The joint shall be made in the manner recommended by the manufacturer. Care shall be taken not to buckle or disturb previously laid pipe.

Each joint shall be inspected to insure that it is properly made before backfilling. Care shall be taken to prevent any dirt or foreign matter from entering the open end of the pipe. Where it is necessary to cut pipe, such cuts shall be neatly made. **The laid pipe shall be true to line and grade and, when complete, shall have a smooth and uniform invert, within ±0.02 foot vertically and ±0.05 foot horizontally of the Plan alignment and grade.**

BACKFILLING THE TRENCH: After the laid pipe has been inspected and approved by the Engineer, the trench shall be backfilled as required under the “Trench Excavation and Backfill” section of these Technical Specifications.

CLEANING STORM DRAINS: The Contractor shall furnish an inflatable rubber ball of a size that will inflate to fit snugly into the pipe. The ball may, at the option of the Contractor, be used without a tag line; or a rope or cord may be fastened to the ball to enable the Contractor to know and control its position at all times. The ball shall be placed in the last inlet or manhole on the pipe to be cleaned, and water shall be introduced behind it. The ball shall pass through the pipe with only the force of the water impelling it. All debris flushed out ahead of the ball shall be removed at the first inlet or manhole where its presence is noted. In the event cemented or wedged debris, or a damaged pipe shall stop the ball, the Contractor shall remove the obstruction.

Final cleaning shall occur after permanent paving is applied and all manhole covers have been raised to grade.

D. PIPE DEFLECTION TESTING

If flexible pipe material is used, the pipe installation shall be tested for excessive deflection after all backfill and resurfacing materials have been placed and the line has been cleaned.

A mandrel having an outside diameter of 95% of the average manufactured internal diameter shall be pulled through the pipeline. If the mandrel does not pass freely through the pipe, the pipe shall be re-excavated, bedded and backfilled to adequately support the pipe and reduce the pipe deflection to 5% or less. The pipeline shall then be retested for deflection.

E. TELEVISION INSPECTION

After pipe deflection testing has been completed, storm drain pipes shall be cleaned and televised (at contractor’s expense) before permanent paving is applied. Any deficiencies in materials or workmanship identified through this inspection shall be corrected and the failed pipes shall be retested for deflection and televised again.

APPENDIX D

STORM DRAIN MANHOLES AND DRAINAGE INLETS

A. SCOPE

This section covers the construction of storm drain manholes and drainage inlets, complete.

Excavation and backfill at manholes and drainage inlets shall conform to the requirements of the "Trench Excavation and Backfill" section of these Technical Specifications.

B. MATERIALS

CAST-IN-PLACE CONCRETE: All materials used in cast-in-place concrete shall be Class B concrete in accordance with the applicable portions of Sections 51 and 90 of the State Standard Specifications and the "Concrete Work" section of these Technical Specifications.

PRECAST CONCRETE MANHOLE SECTIONS: All precast sections, including riser sections, cones, grade rings, and flat slab tops, shall conform to ASTM Specification C 478, and the dimensions shown on the Standard Details. Cones shall be eccentric. Grade rings shall be a standard product, manufactured particularly for use in manhole construction, sized to fit the cones on which they are to be placed, and the wall thickness shall not be less than that of the cones. Grade rings shall be not less than 2 inches, nor more than 6 inches high. All precast components shall have tongue and groove ends.

All manhole construction materials shall be approved in advance by the City Engineer. Precast manhole bases, including connection details, will require specific advance approval. Neoprene "boots" are not acceptable for connections to the manhole bases.

MANHOLE FRAMES AND COVERS: Principal dimensions shall be as shown on the Standard Details. Iron castings shall conform to ASTM Specification A 48, Class 30. Each cover shall have the words "STORM DRAIN" cast into the top with 2-inch high letters. Castings shall be of consistently high quality, and shall be free of material and manufacturing defects. Following cleanup and final machining, an asphaltic paint or similar protective coating shall be applied.

Covers shall have at least one blind pick hole or recessed lifting lug. Horizontal bearing surfaces shall be machined to smooth, plane surfaces providing for full contact between the frame and cover.

The minimum weight of the frame shall be 135 pounds.

HEAVY DUTY COVERS: Unless otherwise indicated on the Plans, covers shall be designed for heavy traffic duty and conform to the following minimum requirements:

Cover weight shall be not less than 130 pounds. Strength of the cover shall be verified by load tests. Load testing of covers shall be done by a recognized independent testing laboratory. The cover shall support a minimum load of 40,000 pounds applied at the center of the cover over a maximum bearing area of 50 square inches. During testing, the cover shall be supported in the same way as it would be under normal service conditions.

LIGHT DUTY COVERS: Light duty covers shall be bolt-down, pressure manhole type, and shall be used only where specifically called for on the Plans. Covers shall be fastened to the frame with

a minimum of four stainless steel bolts and shall be gasketed for a watertight seal. Cover weight shall not be less than 125 pounds.

JOINT SEALING COMPOUND COMPONENTS shall be RAM-NEK primer and joint sealing compound, KENT-SEAL primer and joint sealant, or approved equal.

MANHOLE WATER STOPS shall be installed on PVC storm drain pipe with stainless steel bands to make a watertight seal between the pipe wall and the concrete manhole base.

PRECAST CONCRETE DRAINAGE INLETS: All precast sections, including drainage inlet boxes and tops, shall conform to ASTM Specification C 913, and the dimensions shown on the Standard Details. All precast components shall have tongue and groove ends.

DRAINAGE INLET FRAMES AND GRATES: Principal dimensions shall be as shown on the Standard Details. Frames for Type G0 drainage inlets shall be galvanized, welded structural steel conforming to ASTM Specifications A 36 or A 576, Grades 1021, 1022, 1026, 1029, or 1030. Frames shall be Type 24, as shown on Caltrans Standard Plan D77A.

Grates for Type G0 drainage inlets shall be bicycle proof, galvanized, welded structural steel conforming to ASTM Specifications A 36 or A 576, Grades 1021, 1022, 1026, 1029, or 1030. Grates shall be Type 24-12X, as shown on Caltrans Standard Plan D77B.

MORTAR shall be proportioned with one part portland cement to two parts clean, well-graded sand which will pass a 1/8-inch screen. Admixtures may be used not exceeding the following percentages of weight of cement: Hydrated lime, 10 percent; diatomaceous earth or other inert materials, 5 percent. Consistency of mortar shall be such that it will readily adhere to the surfaces. Mortar mixed for longer than 30 minutes shall not be used.

C. WORKMANSHIP

CAST-IN-PLACE CONCRETE: Concrete work shall conform to the Standard Details, the applicable portions of Sections 51 and 90 of the State Standard Specifications and, “Concrete Work”, of these Technical Specifications.

GENERAL CONSTRUCTION: Manholes shall be constructed only when the temperature is above 32° Fahrenheit. All work shall be protected against freezing. Water shall be removed from the excavation and the excavation maintained "dry" during construction of the manhole and during the time required for the concrete or mortar to develop sufficient strength to resist rupture by groundwater pressure. All pipes connected to manholes shall have a joint within 2 feet of the manhole wall.

The subgrade for the manhole base shall be carefully prepared to provide a firm support for the manhole, and prevent future settlement of the manhole. Particular care shall be taken with deep manholes and manholes located in wet locations.

Manhole inverts shall be formed as shown on the Standard Details, either by laying pipe through and cutting out the top portion before completion of the base of the manhole, or by forming a "U" shaped channel in the concrete base slab. Cut edges of pipe laid through the manhole shall be fully covered by

concrete when the manhole invert is complete. The finished invert shall be smooth and true to grade. No mortar or broken pieces of pipe shall be allowed to enter the pipe.

A groove shaped to match the tongue of the first precast concrete riser section of the manhole shall be formed in the base slab. A circular metal form suited to the particular precast manhole manufacturer's joint shall be used to form the groove.

Except as specified herein, all precast manhole sections shall be set in joint sealing compound. Joint sealing compound components shall be applied in the field. One brush coat of primer shall be applied to the tongue and groove surfaces to be sealed, then the preformed strip of sealing compound shall be pressed firmly to the dry, clean, primed joint surface (groove portion). Precast sections shall be set evenly in a full bed of sealing compound. After the precast sections have been placed, the interior joint surface shall be trimmed smooth with a trowel or sharp tool to remove any excess joint compound projecting into the manhole.

Grade rings may be set with mortar if necessary for adjustment of the final cover elevation. Mortar joints shall not be more than 3/4-inch thick. Excess mortar shall be trimmed flush. The outside of each mortar joint shall be sealed with an approved bituminous sealing compound.

MANHOLE LEAKAGE TESTING: All manholes shall be tested for leakage by filling with water. Leakage shall not be greater than 0.15 gallons per day per square foot of interior surface area. All visible leaks shall be repaired.

INSTALLATION OF FRAMES AND COVERS NOT IN ROADWAYS: Frames and covers shall be joined to the top of the manhole or structure so that the cover, when placed, will be at the proper elevation and so that no ground or surface water may enter the manhole or structure. The finish grade at the tops of manholes will be established after the excavation has been backfilled and compacted to true subgrade.

INSTALLATION OF FRAMES AND COVERS IN ROADWAYS: Roadways are defined as the paved part of all roads, driveways, and parking areas, public or private, and in addition, the unpaved shoulders of public roads. Concrete collars shall be installed around frames of manholes in roadways. Installation shall be as shown on the Standard Details.

After completion of the manhole, all plugs shall be completely removed from the pipes and all loose material shall be removed from the manhole.

PIPE STUBS for future connections shall be not more than 2 feet long and shall be plugged with standard gasketed plugs.

APPENDIX D

GRAVITY SEWER PIPE AND FITTINGS

A. SCOPE

This section covers pipe and fittings for sanitary sewers, complete.

B. MATERIALS

PVC GRAVITY SEWER PIPE shall be integral bell and spigot pipe conforming to ASTM Specification D 3034, having a maximum dimensional ratio (DR) of 35, with rubber gasket joints conforming to ASTM Specifications F 477 and D 3212.

Fittings and accessories shall be as manufactured and furnished by the pipe supplier, or approved equal, and have bell and/or spigot configurations compatible with that of the pipe.

Minimum "pipe stiffness" at 5% deflection shall be 46 psi for all sizes when tested in accordance with ASTM D 2412.

Maximum pipe deflection shall not exceed 5% of the nominal manufacturer's average inside pipe diameter, and shall be determined as specified in Subsection E of this specification entitled, "Pipe Deflection Testing".

CONNECTIONS: Connections to pipe stubs of a different pipe material, if any, shall be made with a suitable connector. Connectors shall be equivalent to full-circle stainless steel repair clamps with appropriate adaptors, similar and equal to Romac Industries, Inc., SS1 Transition Clamp Coupling for Sewer, and must be approved by the Engineer prior to installation.

C. WORKMANSHIP

PREPARATION OF THE TRENCH: The trench shall be prepared to receive the pipe as specified in the "Trench Excavation and Backfill" section of these Technical Specifications. The excavation and preparation of the trench shall be completed a sufficient distance in advance of the pipe laying to prevent dislodged material from entering the pipe.

INSTALLATION OF THE PIPE: Before lowering into the trench, the pipe shall be inspected for defects, and all cracked or broken pipe shall be discarded. The ends and interior of the pipe shall be clean. Belled ends shall be laid upgrade. Handling of the pipe shall be accomplished in a manner that will not damage the pipe.

At manholes, pipe shall be installed so that there is a joint at or not more than two feet from the manhole wall.

After lowering the pipe into the trench, the bell or coupling end and spigot shall be cleaned of any foreign matter and a suitable lubricant applied to the joint. The joint shall be made in the manner recommended by the manufacturer. Care shall be taken not to buckle or disturb previously laid pipe.

APPENDIX D

GRAVITY SEWER PIPE AND FITTINGS

Each joint shall be inspected to insure that it is properly made before backfilling. Care shall be taken to prevent any dirt or foreign matter from entering the open end of the pipe. Where it is necessary to cut pipe, such cuts shall be neatly made. **The laid pipe shall be true to line and grade and, when complete, the sewer shall have a smooth and uniform invert, within ±0.02 foot vertically and ±0.05 foot horizontally of the Plan alignment and grade.**

Connections to pipe stubs of a different pipe material, if any, shall be made with a suitable connector. Connectors shall be equivalent to full-circle stainless steel repair clamps with appropriate adaptors, and must be approved by the Engineer prior to installation.

WYES AND LATERALS: The exact location of new laterals, if any, will be set in the field by the Engineer. Wye branches shall be fully supported by firm material. Pipe and bends shall be installed to the same standards as specified above. Plugs shall be installed at the ends of all laterals, and be adequately braced to withstand the watertightness tests without being dislodged or leaking. Lateral locations shall be marked with a redwood stake as shown on the Plans.

PLUGGING EXISTING SEWER: Existing sewers which are shown on the plans as “PLUG END OF EXISTING SEWER PIPE”, shall be cut to a neat straight perpendicular end and be plugged watertight with concrete and must be approved by the Engineer prior to installation and backfilling and be subject to all requirements of these specifications.

BACKFILLING THE TRENCH: After the laid pipe has been inspected and approved by the Engineer, the trench shall be backfilled as required under the “Trench Excavation and Backfill” section of these Technical Specifications.

CLEANING SEWERS: The pipe shall be cleaned in the following manner:

The Contractor shall furnish an inflatable rubber ball of a size that will inflate to fit snugly into the pipe. The ball may, at the option of the Contractor, be used without a tag line; or a rope or cord may be fastened to the ball to enable the Contractor to know and control its position at all times. The ball shall be placed in the last cleanout or manhole on the pipe to be cleaned, and water shall be introduced behind it. The ball shall pass through the pipe with only the force of the water impelling it. All debris flushed out ahead of the ball shall be removed at the first manhole where its presence is noted. In the event cemented or wedged debris, or a damaged pipe shall stop the ball, the Contractor shall remove the obstruction.

Final cleaning shall occur after permanent paving is applied and all manhole covers and cleanouts have been raised to grade.

D. WATERTIGHTNESS TEST

GENERAL: Tests for watertightness shall be made by the Contractor in the presence of the Engineer. The Contractor shall furnish all labor, tools, materials, and equipment required to make the tests. No testing for final acceptance of pipe will be done until the trench has been fully backfilled and acceptably compacted to finish grade, or if the sewer is under pavement, to the pavement subgrade.

APPENDIX D

GRAVITY SEWER PIPE AND FITTINGS

All sections of pipe shall be tested, and tests shall be made from manhole to manhole. The sewer shall be complete with laterals installed, lateral plugs adequately braced, and trenches backfilled prior to testing.

Where leakage is in excess of the specified rate, the sewer shall immediately be uncovered and the amount of leakage reduced by the Contractor to a quantity within the specified rate before the sewer is accepted. In addition, the Contractor shall repair all visible leaks.

The Engineer will determine whether the test is to be by exfiltration or by infiltration. In most instances an exfiltration test will be required. Exfiltration tests shall be made with air except where the use of water is approved by the Engineer.

EXFILTRATION TEST:

AIR TESTING shall be done immediately following cleaning of the pipe. Air shall be slowly supplied to the plugged pipe installation until the internal air pressure reaches 4.0 psi greater than the average back pressure of any groundwater that may submerge the pipe. At least 2 minutes shall be allowed for temperature stabilization.

The rate of air loss shall then be determined by measuring the time interval required for the internal pressure to decrease from 3.0 to 2.5 psi greater than the average back pressure of any groundwater that may submerge the pipe.

The pipeline shall be considered acceptable when tested at an average pressure of 2.75 psi greater than the average back pressure of any groundwater that may submerge the pipe, if the section under test does not lose air at a rate greater than 0.0010 cubic feet per minute per square foot of internal pipe surface. Test time in seconds = 36.3 times the internal diameter of the pipe in inches.

TESTING WITH WATER shall be done by filling the upper manhole with water to a depth of at least 3 feet over the top of the pipe or groundwater level, whichever is higher, with the end plugged at the lower manhole. The rate of leakage shall be determined by measuring the amount of water required to maintain the water level in the upper manhole. The test shall be maintained for a period of at least 2 hours. The Engineer may, at his discretion, require a longer test period. Leakage shall not be in excess of the rate of 20 gallons per inch of pipe diameter per 1,000 feet of pipe per day.

INFILTRATION TEST: In the event that sufficient groundwater is present, an infiltration test may be made. In this case, the pipe shall be tested for watertightness by installing plugs at the upper end of the pipe and at the lower end on the exit side of a manhole. The rate of leakage will be determined by periodically removing and measuring the water accumulated at the lower manhole. Leakage shall not be in excess of the rate specified for water testing by exfiltration.

E. PIPE DEFLECTION TESTING

If flexible pipe material is used, the pipe installation shall be tested for excessive deflection after all backfill material has been placed and the line has been cleaned.

A mandrel having an outside diameter of 95% of the average manufactured internal diameter shall be pulled through the pipeline. If the mandrel does not pass freely through the pipe, the pipe shall be re-excavated, bedded and backfilled to adequately support the pipe and reduce the pipe deflection to 5% or less. The pipeline shall then be retested for both deflection and watertightness.

F. TELEVISION INSPECTION

After watertightness testing and pipe deflection testing have been completed, sewer lines shall be cleaned and televised (at contractor's expense) before permanent paving is applied. Any deficiencies in materials or workmanship identified through this inspection shall be corrected and the failed lines shall be retested for both deflection and watertightness and televised again.

APPENDIX D

SEWER LATERAL PIPE AND FITTINGS

A. SCOPE

This section covers sewer lateral pipe and fittings, complete.

B. MATERIALS

PVC LATERAL SEWER PIPE shall be integral bell and spigot pipe conforming to ASTM Specification D 3034, having a maximum dimensional ratio (DR) of 35, with rubber gasket joints conforming to ASTM Specifications F 477 and D 3212.

Fittings and accessories shall be as manufactured and furnished by the pipe supplier, or approved equal, and have bell and/or spigot configurations compatible with that of the pipe.

CONNECTIONS: Connections to pipe stubs of a different pipe material, if any, shall be made with a suitable connector. Connectors shall be stainless steel repair clamps with appropriate adaptors, similar and equal to Romac Industries, Inc., SS1 Transition Clamp Coupling for Sewer.

C. WORKMANSHIP

PREPARATION OF THE TRENCH: The trench shall be prepared to receive the pipe as specified in the “Trench Excavation and Backfill” section of these Technical Specifications. The excavation and preparation of the trench shall be completed a sufficient distance in advance of the pipe laying to prevent dislodged material from entering the pipe.

INSTALLATION OF THE PIPE: Pipe installation shall be in strict accordance with the manufacturer's instructions and recommendations, the Plans and this Section.

Before lowering into the trench, the pipe shall be inspected for defects, and all cracked or broken pipe shall be discarded. The ends and interior of the pipe shall be clean. Handling of the pipe shall be accomplished in a manner that will not damage the pipe.

After lowering the pipe into the trench, the bell or coupling end and spigot shall be cleaned of any foreign matter and a suitable lubricant applied to the joint. The joint shall be made in the manner recommended by the manufacturer. Care shall be taken not to buckle or disturb previously laid pipe.

Each joint shall be inspected to insure that it is properly made before backfilling. Care shall be taken to prevent any dirt or foreign matter from entering the open end of the pipe. Where it is necessary to cut pipe, such cuts shall be neatly made. The laid pipe shall be true to line and grade and, when complete, the sewer lateral shall have a smooth and uniform invert, within ±0.02 foot vertically and ±0.05 foot horizontally of the Plan alignment and grade. Where it is necessary to cut pipe, such cuts shall be neatly made.

All connections shall be made in a method approved and inspected by the City Department of Public Works. Connections to pipe stubs of a different pipe material, if any, shall be made with a suitable connector. Connectors shall be equivalent to full-circle stainless steel repair clamps with appropriate

adaptors. Calder couplings shall not be used. Connectors shall be similar and equal to a 12inch long Romac Style LSS sewer clamp coupling, and must be approved by the Engineer prior to installation.

BACKFILLING THE TRENCH: After the laid pipe has been inspected and approved by the Engineer, the trench shall be backfilled as required under the “Trench Excavation and Backfill” section of these Technical Specifications.

END CAPS: When laterals are to be tested for watertightness along with the main, all laterals shall be furnished with end caps which shall be adequately installed and/or braced to resist blowout or leakage during testing.

APPENDIX D

SEWER MANHOLES AND CLEANOUTS

A. SCOPE

This section covers the construction of sewer manholes and cleanouts, complete.

Excavation and backfill at manholes shall conform to the requirements of the “Trench Excavation and Backfill” section of these Technical Specifications.

B. MATERIALS

CAST-IN-PLACE CONCRETE: All materials used in cast-in-place concrete shall be Class B concrete in accordance with the applicable portions of Sections 51 and 90 of the State Standard Specifications and the “Concrete Work” section of these Technical Specifications.

PRECAST CONCRETE MANHOLE SECTIONS: All precast sections, including riser sections, cones, grade rings, and flat slab tops, shall conform to ASTM Specification C 478, and the dimensions shown on the Standard Details. Cones shall be eccentric. Grade rings shall be a standard product, manufactured particularly for use in manhole construction, sized to fit the cones on which they are to be placed, and the wall thickness shall not be less than that of the cones. Grade rings shall be not less than 2 inches, nor more than 6 inches high. All precast components shall have tongue and groove ends.

All manhole construction materials shall be approved in advance by the City Engineer. Precast manhole bases, including connection details, will require specific advance approval. Neoprene "boots" are not acceptable for connections to the manhole bases.

MANHOLE FRAMES AND COVERS: Principal dimensions shall be as shown on the Standard Details. Iron castings shall conform to ASTM Specification A 48, Class 30. Each cover shall have the word "SEWER" cast into the top with 2-inch high letters. Castings shall be of consistently high quality, and shall be free of material and manufacturing defects. Following cleanup and final machining, an asphaltic paint or similar protective coating shall be applied.

Covers shall have at least one blind pick hole or recessed lifting lug. Horizontal bearing surfaces shall be machined to smooth, plane surfaces providing for full contact between the frame and cover.

Frame and cover shall be similar and equal to Phoenix Iron Works P-1090.

The minimum weight of the frame shall be 135 pounds.

HEAVY DUTY COVERS: Unless otherwise indicated on the Plans, covers shall be designed for heavy traffic duty and conform to the following minimum requirements:

Cover weight shall be not less than 130 pounds. Strength of the cover shall be verified by load tests. Load testing of covers shall be done by a recognized independent testing laboratory. The cover shall support a minimum load of 40,000 pounds applied at the center of the cover over a maximum bearing area of 50 square inches. During testing, the cover shall be supported in the same way as it would be under normal service conditions.

APPENDIX D

SEWER MANHOLES AND CLEANOUTS

LIGHT DUTY COVERS: Light duty covers shall be bolt-down, pressure manhole type, and shall be used only where specifically called for on the Plans. Covers shall be fastened to the frame with a minimum of four stainless steel bolts and shall be gasketed for a watertight seal. Cover weight shall not be less than 125 pounds.

CLEANOUT FRAME AND COVER shall be cast iron, conforming to ASTM Specification A 48, Class 30. The frame and cover shall be similar and equal to South Bay Foundry SFB1249, Phoenix Iron Works P-7004, or approved equal and shall have the word "SEWER" cast into the cover with prominent letters.

JOINT SEALING COMPOUND COMPONENTS shall be RAM-NEK primer and joint sealing compound, KENT-SEAL primer and joint sealant, or approved equal.

MANHOLE WATER STOPS shall be installed on PVC or ABS sewer pipe with stainless steel bands to make a watertight seal between the pipe wall and the concrete manhole base.

PIPE, BENDS AND FITTINGS used in cleanouts and drop manhole construction as well as manhole stubs shall conform to the applicable sections of these Standard Specifications for sewer pipe.

MORTAR shall be proportioned with one part portland cement to two parts clean, well-graded sand which will pass a 1/8-inch screen. Admixtures may be used not exceeding the following percentages of weight of cement: Hydrated lime, 10 percent; diatomaceous earth or other inert materials, 5 percent. Consistency of mortar shall be such that it will readily adhere to the surfaces. Mortar mixed for longer than 30 minutes shall not be used.

C. WORKMANSHIP

CAST-IN-PLACE CONCRETE: Concrete work shall conform to the Standard Details, the applicable portions of Sections 51 and 90 of the State Standard Specifications and the “Concrete Work” section of these Technical Specifications.

GENERAL CONSTRUCTION: Manholes shall be constructed only when the temperature is above 32° Fahrenheit. All work shall be protected against freezing. Water shall be removed from the excavation and the excavation maintained "dry" during construction of the manhole and during the time required for the concrete or mortar to develop sufficient strength to resist rupture by groundwater pressure. All pipes connected to manholes shall have a joint within 2 feet of the manhole wall.

The subgrade for the manhole base shall be carefully prepared to provide a firm support for the manhole, and prevent future settlement of the manhole. Particular care shall be taken with deep manholes and manholes located in wet locations.
Cast-in-place manhole bases shall include waterstops on all plastic pipes cast in the base. The finish of the base shall be smooth, and equivalent to a steel trowel finish.

Manhole inverts shall be formed as shown on the Standard Details, either by laying pipe through and cutting out the top portion before completion of the base of the manhole, or by forming a "U" shaped channel in the concrete base slab. Cut edges of pipe laid through the manhole shall be fully covered by concrete when the manhole invert is complete. The finished invert shall be smooth and true to grade. No mortar or broken pieces of pipe shall be allowed to enter the sewer pipe.

APPENDIX D

SEWER MANHOLES AND CLEANOUTS

A groove shaped to match the tongue of the first precast concrete riser section of the manhole shall be formed in the base slab. A circular metal form suited to the particular precast manhole manufacturer's joint shall be used to form the groove.

Precast manhole bases shall have the invert slopes constructed to match the plan grades, without additional drop through the manhole, and shall have “O-Ring” or equivalent joints to the sewer pipe.

Except as specified herein, all precast manhole sections shall be set in joint sealing compound. Joint sealing compound components shall be applied in the field. One brush coat of primer shall be applied to the tongue and groove surfaces to be sealed, then the preformed strip of sealing compound shall be pressed firmly to the dry, clean, primed joint surface (groove portion). Precast sections shall be set evenly in a full bed of sealing compound. After the precast sections have been placed, the interior joint surface shall be trimmed smooth with a trowel or sharp tool to remove any excess joint compound projecting into the manhole.

Grade rings may be set with mortar if necessary for adjustment of the final cover elevation. Mortar joints shall not be more than 3/4-inch thick. Excess mortar shall be trimmed flush. The outside of each mortar joint shall be sealed with an approved bituminous sealing compound.

MANHOLE LEAKAGE TESTING: All manholes shall be tested for leakage by filling with water. Leakage shall not be greater than 0.15 gallons per day per square foot of interior surface area. All visible leaks shall be repaired.

INSTALLATION OF FRAMES AND COVERS NOT IN ROADWAYS: Frames and covers shall be joined to the top of the manhole or structure so that the cover, when placed, will be at the proper elevation and so that no ground or surface water may enter the manhole or structure. The finish grade at the tops of manholes will be established after the excavation has been backfilled and compacted to true subgrade.

INSTALLATION OF FRAMES AND COVERS IN ROADWAYS: Roadways are defined as the paved part of all roads, driveways, and parking areas, public or private, and in addition, the unpaved shoulders of public roads. Concrete collars shall be installed around frames of manholes in roadways. Installation shall be as shown on the Standard Details. Portland cement concrete shall be primed with an asphalt emulsion before it is overlaid with asphalt concrete.

After completion of the manhole, all plugs shall be completely removed from the sewers and all loose material shall be removed from the manhole.

LATERAL SEWER CONNECTIONS: Direct connections of laterals to manholes shall be installed only at terminal manholes, where specifically shown on the Plans, or where directed by the Engineer. The top of the lateral sewer pipe shall be a minimum of 0.2 feet higher than the top of the downstream main sewer pipe. The manhole invert shall be channeled for lateral sewers in the same manner as for main sewers.

PIPE STUBS for future connections shall be not more than 2 feet long and shall be plugged with standard gasketed plugs.

APPENDIX D

SEWER MANHOLES AND CLEANOUTS

CLEANOUTS shall be constructed as shown on the Standard Details. The frame shall be joined to the riser pipe so that groundwater will be prevented from entering the sewer.

DROP CONSTRUCTION AT MANHOLES shall be installed as shown on the Standard Details. Particular care shall be taken to support the entering pipe on well-compacted material.

APPENDIX D

WATER PIPE AND FITTINGS

A. SCOPE

This section covers pipe and fittings for the water system, complete.

B. MATERIALS

Water pipe shall be polyvinyl-chloride (PVC), or ductile iron. All pipe and fittings shall conform to National Sanitation Foundation (NSF) and American Water Works Association (AWWA) standards and shall comply with ANSI/NSF Standard 61 Annex G for potable water. All pipe and fittings shall conform to the following specifications:

POLYVINYL CHLORIDE (PVC) PIPE: Pipe 3-inches and smaller in diameter shall be SR (Schedule Rated) in accordance with ASTM Specification D 1785 for Schedule 40 and Schedule 80 pipe, or have a maximum SDR of 17 in accordance with ASTM Specification D 2241 for pressure rated pipe.

Pipe 4-inches and larger in diameter shall comply with AWWA Specification C900 and shall be of cast-iron-pipe-equivalent diameters.

Pipe 3-inches and smaller in diameter shall have either rubber ring or solvent welded joints. Pipe 4-inches and larger in diameter shall have solid cross-section rubber ring joints in accordance with ASTM Specification F 477.

Fittings shall be PVC with the same pressure rating and hydrostatic test pressure as the pipe, or cast iron fittings with rubber gaskets sized for PVC pipe.

DUCTILE IRON PIPE: Pipe shall be Class 50 minimum ductile iron pipe conforming to AWWA Specification C151. Pipe shall have bell and spigot, "push-on" rubber gasket joints conforming to AWWA Specification C111, unless flanged joints are required by the Plans, the Standard Details, or the Engineer. Flanged pipe shall conform to AWWA Specification C115. Pipe shall be cement-mortar lined in conformance with AWWA Specification C104 and bituminous coated.

CAST IRON FITTINGS: Cast Iron fittings shall comply with AWWA Specification C110, and shall be cement-mortar lined in conformance with AWWA Specification C104 and bituminous coated. Cast iron tees and crosses shall be supplied with flanged ends where a gate valve is to be installed.

MECHANICAL COUPLINGS, including flexible couplings, flanged coupling adapters, and bolted, sleeve-type couplings shall be as manufactured by Smith-Blair, Baker, Dresser, or approved equal. All mechanical couplings shall have the longest standard sleeve length.

LOCATOR CONDUCTORS shall be No. 12 direct burial insulated solid copper wire. The locator shall be attached to the top of the pipeline centerline. Locators at valve boxes shall be installed in accordance with the Standard Details.

CONCRETE: Concrete for thrust blocks shall be Class C concrete and shall conform to the applicable portions of Sections 51 and 90 of the State Standard Specifications and the “Concrete Work” section of these Technical Specifications.

APPENDIX D

WATER PIPE AND FITTINGS

C. WORKMANSHIP

GENERAL: All materials shall be stored and handled in a manner that will not damage the material or it's coating, and will keep the materials clean and free of contamination. Before installation, each article shall be inspected and any damaged or contaminated material shall be discarded. Any damaged coating shall be repaired. The interior and ends of the pipe and appurtenances shall be clean. When it is necessary to cut pipe, such cuts shall be neatly made.

LAYING: All pipe shall be laid on a smooth bed, prepared in accordance with the provisions specified in the "Trench Excavation and Backfill" section of these Technical Specifications. As soon as possible after the installation of the pipe, sufficient backfill material shall be placed on the pipe to protect it from temperature changes. The ends of the pipeline shall be closed with watertight caps or plugs at all times, except when laying pipe. The Contractor shall take all necessary precautions to prevent contaminated water, oil, grease, dirt, rodents, or other contaminants from entering the pipeline.

JOINTS: Bell and spigot or mechanical joints shall be made up in accordance with the instructions of the manufacturer. Adjoining pipe sections shall be level and both bell and spigot shall be clean. The bell shall be lubricated and the rubber gasket properly installed. The spigot shall then be inserted and seated in correct position by use of a joint puller or other approved method. After seating, each joint shall be checked with a feeler gauge to ensure that the gasket is not twisted and that the spigot is seated to the proper depth. Any improper joints shall be taken apart and correctly made. The maximum installed deflection at joints shall not exceed that recommended by the manufacturer.

FITTINGS: Joints of bell and spigot or mechanical joint fittings shall be made up and sealed as specified for pipe joints. Joints of flanged fittings shall be made up true and square so that there is no strain on the pipe or fitting. Bolts shall be tightened uniformly around the joint.

ANCHORAGE: Concrete thrust blocks shall be provided in accordance with the Standard Details included in the Plans. Size of thrust blocks shall be approved by the Engineer. Concrete shall be carefully placed against the valve or fitting to avoid covering or obstructing bolts or connectors at the valve or fitting joints.

FLEXIBLE COUPLINGS: Flexible couplings shall be installed in accordance with the recommendations of the manufacturer. The finished joint shall be watertight under the test pressure of the pipeline. After completion of the connection, any exposed steel shall be painted with two coats of coal tar epoxy.

CONNECTIONS TO EXISTING SYSTEM: Where the new water main connects to existing valves or pipelines, new reducers, flanged coupling adapters or transition couplings shall be installed to accommodate the new pipeline, as required.

SEWER LATERAL CROSSINGS: Crossings of sewer service laterals shall be made above the sewer lateral wherever possible. Depth of cover over the water main may be reduced to 30 inches where such reduction is necessary to allow crossing above sewer service laterals.

If it is necessary to cross below sewer service laterals, the water main shall be installed with at least 12 inches of vertical separation from the sewer lateral and no joints in the water main shall be placed within nine feet, horizontally, of the sewer service lateral.

APPENDIX D

WATER PIPE AND FITTINGS

BACKFILLING THE TRENCH: After the laid pipe has been inspected and approved by the Engineer, the trench shall be backfilled as required under the “Trench Excavation and Backfill” section of these Technical Specifications.

D. HYDROSTATIC TESTS

All parts of the entire pipeline installation shall be tested at a pressure of 125 PSI. Tests shall be made in the presence of the Engineer or his representative.

Before the test, the pipeline shall be sufficiently anchored to withstand the test pressure. During the filling of the line with water, precautions shall be taken to prevent air pockets at high points. Water may be allowed to stand in the line for several hours prior to the test. During the test, which shall be conducted for the time period determined by the Engineer, but not less than 30 minutes, the leakage shall not exceed 5 gallons per 24 hours per thousand feet of pipe per inch of nominal diameter. Test sections shall be as short as valve configurations permit. If any valved section of pipe shows greater leakage than specified, the Contractor shall locate and repair the leaks and shall retest that section of line at no additional cost to the Owner.

The Contractor shall provide all labor, tools, and equipment required to perform the hydrostatic tests.

E. FLUSHING AND STERILIZATION OF COMPLETED MAINS

GENERAL: In general, the methods outlined in AWWA C651-05 entitled, "Disinfecting Water Mains," should be used as a guide in performing this operation where applicable.

FLUSHING COMPLETED LINES: Preliminary flushing of completed lines prior to chlorination shall be accomplished as thoroughly as possible with the water pressure and outlets available. The flushing shall be done after the pressure tests have been made.

CHLORINATION OF COMPLETED LINES: Before being placed in service, the entire line shall be chlorinated. Chlorine shall be applied by one of the following methods: Liquid chlorine, gas-water mixture, fed-chlorine gas, or calcium hypochlorite water mixture, unless another method (such as Chlorine "HTH" Tablets) is approved by the Engineer. The chlorinating agent shall be applied at the beginning of each section adjacent to the feeder connection and shall be injected through a corporation cock, hydrant, or other connection ensuring treatment of the entire line. Water shall be fed slowly into the line with chlorine applied in amounts to produce a dosage of 4050 parts per million. Portions of the existing mains which have been connected to a new line or otherwise contaminated by construction shall be included in the system sterilized. A residual of not less than 10 parts per million after 24 hours shall be produced in all parts of the line. During the chlorination process, all valves shall be operated. If disinfection by chlorine "HTH" tablets is permitted by the Engineer, the tablets shall be secured to the top of the pipe with an approved adhesive.

Following chlorination and prior to discharge, the water shall be dechlorinated such that a residual of not more than 0.02 parts per million (instantaneous maximum) of chlorine is present in any water discharged.

APPENDIX D

WATER PIPE AND FITTINGS

FINAL FLUSHING: After chlorination, the water shall be flushed from the lines at the extremities until the replacement water tests are equal, chemically and bacteriologically, to those of the permanent water supply.

APPENDIX D

VALVES, FIRE HYDRANTS AND APPURTENANCES

A. SCOPE

This section covers valves, fire hydrants and appurtenances for the water system, complete.

B. MATERIALS

All valves, fire hydrants and appurtenances shall, when applicable, conform to National Sanitation Foundation (NSF) and American Water Works Association (AWWA) standards and shall comply with ANSI/NSF Standard 61 Annex G for potable water. All valves, fire hydrants and appurtenances shall conform to the following specifications:

GATE VALVES shall be Resilient Wedge Gate Valves conforming to AWWA Specification C509. Valves shall be rated for a minimum working pressure of 150 psi, and shall have end fittings to conform to the pipe or fittings being connected. Valves shall be Mueller Series 2300, American Series 2500, Clow Model 2639, or approved equal. Valves shall open counter-clockwise and shall be furnished with two-inch square operating nuts when installed underground.

VALVE BOXES shall be provided for all valves placed underground and shall be similar and equal to Brooks Products, Inc., No. 3-RT or Christy G5, with 8-inch PVC pipe extension sleeve; cover to be marked "WATER".

FIRE HYDRANTS shall be the wet barrel type conforming to AWWA Specification C502 and the following requirements:

Outlets shall be threaded National Standard and shall be equipped with protective screw-caps, attached to the hydrant barrel with security chains. Outlets shall be individually valved, and operating valve parts shall be brass or bronze, with O-ring seals. The hydrants shall have a National Standard 1-inch (1½-inch Flat to Point) pentagon operating nut turning counter-clockwise to open.

RESIDENTIAL HYDRANTS shall have two 2½-inch hose nozzles and one 4½-inch pumper nozzle and shall be Clow Model 960, or approved equal.

COMMERCIAL HYDRANTS shall have two 4½-inch pumper nozzles and one 2½-inch hose nozzle and shall be Clow Model 2065, or approved equal.

BREAK-OFF CHECK VALVES shall be Clow Model LBI400, or approved equal.

C. WORKMANSHIP

GENERAL: All valves and appurtenances shall be thoroughly cleaned before installation and shall be installed in strict accordance with the manufacturer's recommendations.

SETTING VALVES AND APPURTENANCES: Valves shall be set plumb and inspected in opened and closed positions to insure that all parts are in working condition. All underground valves shall be provided with valve boxes or vaults. Valve boxes in the street shall be anchored in accordance with the Standard Details.

APPENDIX D

VALVES, FIRE HYDRANTS AND APPURTENANCES

SETTING FIRE HYDRANTS: Fire hydrants shall be set in accordance with the Standard Details. The hydrant bury shall be 6-inch diameter heavy cast iron pipe with a machined flange top and a flange or mechanical joint bottom connection. A 6-inch x 6-inch flanged break-off riser, with a break-off groove shall be installed below the hydrant. A 6-inch diameter break-off check valve shall be installed below the break-off riser. A 6-inch x 6-inch flanged spool shall be installed below the break-off check valve. Hydrants shall be painted one coat red primer and two finish coats of yellow paint. Each hydrant location shall be marked by a blue reflective pavement marker 6" from street centerline on the side nearest the fire hydrant.

APPENDIX D

SERVICE CONNECTIONS & APPURTENANCES

A. SCOPE

This section covers service connections and appurtenances for the water system, complete.

B. MATERIALS

All service pipe, fittings and appurtenances shall, when applicable, conform to National Sanitation Foundation (NSF) and American Water Works Association (AWWA) standards and shall comply with ANSI/NSF Standard 61 Annex G. All fittings shall conform to ANSI/AWWA Standard C800. All service pipe, fittings and appurtenances shall conform to the following specifications:

SERVICE PIPE for 2-inch diameter and smaller service connections shall be Type K "soft" copper tubing, conforming to ASTM Specification B 88 or "Copper Tube Size" (CTS) PE 3408/3608 high-density polyethylene pipe, conforming to ASTM Specification D 2737 and labelled as suitable for potable water. All fittings shall have grip joints. No soldered fittings will be approved. Stainless steel pipe stiffeners shall be used with polyethylene pipe. For services larger than 2-inch diameter, service pipe shall be ductile iron or polyvinyl-chloride (PVC) conforming with the requirements of the "Water Pipe and Fittings" section of these Technical Specifications.

SERVICE SADDLES for 2-inch diameter and smaller service connections shall conform to the recommendations of the manufacturer of the pipe being saddled. For ductile iron pipe the saddles shall be malleable iron tapped for iron pipe, with double steel straps similar and equal to Smith-Blair Type 313, Ford Style F202, or Romac Type 202U. For PVC C900 pipe the saddles shall be steel, malleable iron or bronze tapped for iron pipe, with wide straps or saddles similar and equal to Smith-Blair Type 357 or 325, Romac Type 202S or 202BS, or Ford Style FS202 or 202BS. The outlets of all steel or iron service saddles shall be one or two pipe sizes larger than that required for the corporation stop, which shall be the same size as the service pipe. The saddles shall then be fitted with an appropriately sized nylon bushing to accept the corporation stop. This is required to protect the service saddle from galvanic action and corrosion caused by connection of dissimilar metals.

CORPORATION STOPS shall be bronze body, full bore, ball-type, sized per service line diameter, with iron pipe inlet threads, James Jones Type J-1935SG, Ford Meter Box Company Type FB1100-Q-NL, or approved equal. Only services 2-inch diameter and smaller shall have corporation stops.

CAST IRON TEES shall be used at the main for service connections larger than 2-inch diameter. Cast iron tees shall conform with the requirements of the "Water Pipe and Fittings" section of these Technical Specifications.

RESILIENT WEDGE GATE VALVES shall be used at the main for service connections larger than 2-inch diameter. Gate valves shall conform with the requirements of the "Valves, Fire Hydrants and Appurtenances" section of these Technical Specifications.

METER VALVES for 1-inch diameter and smaller services shall be bronze body, angle ball valve type, sized per service line diameter, with meter swivel nut, James Jones J-1966W, Ford Meter Box Company BA13-W-NL, or approved equal. Meter swivel nuts shall conform to AWWA Standard C700 for meter threads. Meter valves for 1-1/2-inch and 2-inch diameter services shall be bronze body, angle

ball valve type, sized per service line diameter, with meter flange, James Jones J-1974W, Ford Meter Box Company BFA13-W-NL, or approved equal. Meter valves for services larger than 2-inch diameter shall be Resilient Wedge Gate Valves conforming to the requirements of the “Valves, Fire Hydrants and Appurtenances” section of these Technical Specifications.

VALVES, SMALLER THAN 2-INCH DIAMETER, shall be screwed, bronze bodied "Full-Port" ball valves. Valves shall be James Jones J-1900, Mueller 300 Ball Valve, NIBCO T-685-80-LF, WATTS Series LFB-6080, or approved equal. When installed in a meter box or vault, ball valves shall be supplied with handles.

LOCATOR CONDUCTORS shall be No. 12 solid copper wire, insulated for direct burial. The locator shall be installed above the pipe envelope directly over the pipeline centerline. Locators at valve boxes shall be installed in accordance with the Standard Details.

METERS shall be sized per the service line diameter and have a hermetically sealed register with magnetic drive, read in cubic feet and shall meet or exceed AWWA Standard C700. Meters shall have a frost-free bottom, be designed to operate totally submerged and be compatible with the Sensus Automated Meter Reading (AMR) system. Meters for 1-inch diameter and smaller services shall be Sensus SR II Low Lead. Meters for 1-1/2-inch and 2-inch diameter services shall be Sensus SR Low Lead. Meters for services larger than 2-inch diameter shall be Sensus OMNI. Each meter shall be supplied with a Meter Transceiver Unit (MXU) for use with the Sensus RadioRead AMR system. The MXU shall be the Sensus Model 520M Pit Set Unit.

RESIDENTIAL FIRE SERVICE CONNECTION for 1-inch diameter and smaller services shall be a brass uni-body casting with integrated full-port locking angle ball valve and shall be the James Jones Residential Fire Service Connection, or approved equal.

METER BOXES for 1-inch diameter and smaller services shall be similar and equal to Christy Concrete Products, Inc. B16 Box with N16RP composite lid with 2" hole for Pit Lid Module. Meter boxes for services larger than 1-inch diameter shall be sized as needed and as approved by the City Engineer. Meter boxes shall be supplied with matching extensions.

C. WORKMANSHIP

Service connection installation shall be in accordance with City of Live Oak Standard Detail 307, 308, 309 or 310. New service lines, fittings and meters shall not be less than 3/4-inch diameter. New service lines, fittings and meters for services requiring a residential fire protection system shall not be less than 1-inch diameter. For double services, the service line from the main to the service tee shall not be less than 1-1/2-inch diameter, the service lines and fittings from the service tee to the meters shall not be less than 1-inch diameter, and the meters shall not be less than 1-inch diameter.

Service taps shall be made on the water main opposite all service meter locations as shown on the plans. Saddles and corporation stops shall be installed and service pipe installed to the meter box location.

An angle meter ball valve shall be installed at each meter location. Residential services requiring a residential fire protection system shall have a Residential Fire Service Connection installed at the meter.

APPENDIX D

SERVICE CONNECTIONS & APPURTENANCES

The meter and AMR equipment shall be provided to the Public Works Department, to be installed by the City at the time a Certificate of Occupancy is issued. A blank spool having the same end-to-end dimension as the meter shall be installed in place of the meter during service connection installation.