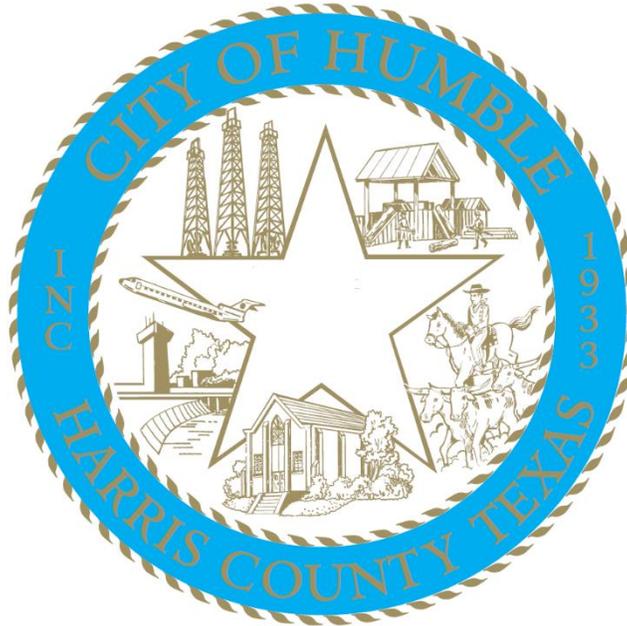


CITY OF HUMBLE

DESIGN CRITERIA MANUAL FOR WASTEWATER COLLECTION SYSTEMS, WATER LINES, STORM DRAINAGE, AND STREET PAVING



MARCH 2016

TABLE OF CONTENTS

SECTION I – GENERAL REQUIREMENTS 2

SECTION II – WASTEWATER COLLECTION SYSTEM DESIGN REQUIREMENTS 5

SECTION III – WATER LINE DISTRIBUTION SYSTEM DESIGN REQUIREMENTS 15

SECTION IV – STREET PAVING DESIGN REQUIREMENTS 24

SECTION V – STORM DRAINAGE DESIGN REQUIREMENTS 29

APPENDIX

CITY STANDARD CONSTRUCTION DETAILS

**SECTION I
GENERAL REQUIREMENTS**

1.0 GENERAL

1.01 SECTION INCLUDES:

Graphic requirements for construction drawings and project approval requirements.

1.02 DEFINITIONS

A. CADD (Computer Aided Drafting Design) - the preparation of documents utilizing computer facilities for the production of drawings, plans, prints and other related documents.

1.03 DESIGN REQUIREMENTS

A. Provide a cover sheet for all projects involving three or more design drawings (excluding standard detail sheets). Plan sheet numbers shall be shown on the cover sheet or area key map. Include a vicinity map to identify project locations. Also provide approval block for the City Director of Public Works with a note stating that approval is valid for 1 year only from date of signatures.

B. Drawings shall be prepared on nominal 22 inch x 34 inch overall drawings.

C. Show service area on cover sheet or area map.

D. Final drawings shall be produced by CADD on mylar. The engineer shall also submit, at the time of plan approval, an electronic CADD and PDF copy of the drawings showing all lot lines and associated lot information, rights-of-way, easements, contours, utilities, and all drainage and paving improvements. Two identical reproducibles shall be provided with a location for an approval signature by the City Director of Public Works on the cover. One approved set will be returned.

E. Details of special structures (not covered by approved standard drawings, such as stream or gully crossings, special manholes, or junction boxes, etc.) shall be drawn with vertical and horizontal scales equal to each other.

F. Each set of construction drawings shall contain paving and utility key drawings indexing specific plan and profile sheets. Standard City drawings, where applicable, shall be included. All sheets shall have standard title blocks.

G. Draw key overall layouts to a minimum scale of 1 inch = 100 feet.

H. Plan stationing must run from left to right, except for short streets or lines originating from a major intersection, where the full length can be shown on one sheet.

I. A north arrow and scale are required on all sheets and should be oriented either toward the top or to the right. This requirement is waived under the following conditions.

1. A storm or wastewater sewer whose flow is from west to east or from south to north.
2. A primary outfall ditch drainage facility whose flow is from west to east or from south to north.
3. It is the intent of this requirement that all stationing should start from the cardinal points of the compass and proceed in the direction of construction.

- J. Standard scales permitted for plans and profiles of paving and utility construction drawings are as follows:
1. Major thoroughfares, streets with esplanades over 400 feet in length, or special intersections / situations.
1 inch = 20 feet horizontal, 1 inch = 2 feet vertical
 2. Minor or residential single-family streets.
1 inch = 20 feet horizontal, 1 inch = 2 feet vertical
 3. Scales of Paragraph No. 2 above are minimum; larger scales may be used to show details of construction.
 4. Deviation of specified scales can only be permitted with special approval.
- K. Bench mark information will be provided on the project layout sheet along with information pertaining to traverse points (northing and easting). The benchmark information to be provided is datum, description of physical location and elevation. In addition, information pertaining to the design baseline will be provided on project layout sheet. The provided information to be provided for the design baseline should be beginning and ending of the baseline (northing and easting) and point of intersection of any line(s) deviating from 180° along with angle turned right.
- L. The seal, date, and original signature of the Licensed Professional Engineer responsible for the drawings shall be required in each sheet developed by the engineer. The engineer may use a stamped or embossed imprint for his/her seal; however, the embossed imprint must be shaded such that it will reproduce on prints.
- M. A copy of the final plat for new developments shall be included with the final drawings when submitted for final approval.
- N. If a roadway exists where drawings are being prepared to improve or construct new pavement or a utility inside the pavement, label the surface type.
- O. Show all streets and/or road alignment on drawings.
- P. Develop drawings to accurate scale showing proposed pavement, typical cross sections, details, lines and grade, and all existing topography within street right-of-way, and any easement contiguous with the right-of-way. At the intersection, the cross street details shall be shown at sufficient distance (20-foot minimum distance outside the primary roadway right-of-way) in each direction along cross street for designing adequate street crossings.
- Q. Match lines between plan and profile sheets shall not be placed or shown within cross street intersections including cross street right-of-way.
- R. Natural ground profiles shall be shown as follows:
1. For privately-funded projects, center line profiles are satisfactory except where a difference of 0.50 feet or more exists from one right-of-way or easement line to the other, in which case, dual profiles are required.
 2. For the City of Humble projects, provide natural ground profiles for each right-of-way line and easement.
- S. Basic plan and profile sheets shall contain the following information:
1. Identify all lot lines and property lines (as appropriate for developments and authorized by the city engineer), easements, right-of-way, and drainage outfalls.

2. Label each plan sheet as to street/easement widths, pavement widths, pavement thickness where applicable, type of roadway materials, curbs, intersection radii, curve data, stationing, existing utilities (type and location), and any other pertinent feature affecting design.
3. Show all utility lines four inch or larger within the right-of-way or construction easement in profile view. Show all utility lines, regardless of size, in the plan view including fiber optic cables.
4. Graphically, show flow line elevations and direction of flow for all existing ditches.
5. Label proposed top of curb grades except at railroad crossings. Centerline grades are acceptable only for paving without curb and gutters.
6. Curb return elevations for turnouts shall show in profiles.
7. The centerline elevation of all existing driveways shall be shown in profile.
8. Station all esplanade noses or the centerline of all esplanade openings with esplanade width shown - both existing and proposed.
9. The design of both roadways is required on all paving sections with an esplanade.
10. Station all PCs, PTs, radius returns, and grade change PIs in plan view. Station all radius returns and grade change PIs in profile with their respective elevations.

T. Project Approval Requirements:

1. Upon the completion of construction of the required improvements, the Design Engineer for the project shall submit a written request for a final inspection of the project. The letter shall state that he has inspected the improvement and that they conform to his design plans. An Affidavit stating that all bills have been paid shall be provided with the inspection request letter. One copy of the "As-Built" plans along with a copy of the test reports for all required tests shall be included with the inspection request. An electronic (CADD and PDF) file and a GIS-compatible update file (if available) of the record drawings shall be provided prior to acceptance. Once the Final Plat has been recorded, addresses assigned by the City will be posted to the GIS system.
2. Prior to final acceptance of the project, the developer (or contractor) shall post a One-Year Maintenance Bond in the amount of 100% of the final construction costs with the City. This bond shall allow the City to repair any portion of the project found during the One-Year Warranty period, should the item not be promptly repaired upon written notification to the bond holder. The One-Year Warranty period shall commence from the date of Letter of Acceptance issued by the City.

**SECTION II
WASTEWATER COLLECTION SYSTEM
DESIGN REQUIREMENTS**

2.0 GENERAL

2.01 SECTION INCLUDES:
Criteria for the design of wastewater collection systems.

2.02 REFERENCES:

- A. Texas Commission on Environmental Quality - "Design Criteria for Sewer Systems- Texas Administration Code - Chapter 217 (current revision).

2.03 DEFINITIONS:

This Chapter addresses the design of the wastewater collection systems within the public right-of-way or a dedicated public easement. Sanitary sewer service lines serving a single building located on private property, that are not in a dedicated easement, are under the jurisdiction of the Plumbing Code. Where used in these regulations, the following terms shall be construed to carry the meanings given below:

- A. Public Sewer - A closed conduit that conveys wastewater flow and which is located within the public right-of-way or dedicated public easement. A public sewer (or public sewer system) is intended to serve more than one (1) "owner".
- B. Private Sewer - A closed conduit that conveys wastewater flow and is constructed and maintained by a private entity. Private sewers shall be located on private property. Private sewers are subject to the design and construction requirements of the Plumbing Code.
- C. Sewer Main - A sewer that receives the flow from one or more lateral sewers.
- D. Lateral Sewer - A sewer running laterally down a street, alley, or easement that receives only the flow from the abutting property.
- E. Service Lead - A sewer that branches off a public sewer and extends to the limits of the public right-of-way. It shall be construed as having reference to a public sewer branching off from a main or lateral sewer to serve one or more houses, single-family lots, or other types of small land tracts situated in the same block with the said main or lateral sewer, but not directly adjacent thereto. Such a line shall never exceed 150 feet in length. If the sewer is designed to serve more than two houses, or the equivalent of two single-family residences along a street, a lateral sewer as defined above shall be constructed.
- F. Service Connection - A private sewer from a single source to the main or lateral sewer in the street, alley, or easement adjacent thereto. Service connections are covered by the building code. It will be owned and maintained by the owner of the property being served by said sewer.
- G. Project Area - The area within the immediate vicinity of the public sewer to be constructed. If, as an example, a public sewer is to be constructed within the public right-of-way, the project area would extend 10 feet to either side of the public right-of-way. If as an example, a public sewer is to be constructed within a dedicated easement adjacent to the public right-of-way, the project area would extend 10 feet to either side of the dedicated easement; depending upon the existing topographical elements, unless impacted by a

permanent structure (i.e.. telephone pole, trees, drainage ditches, etc.) If, as an example, a public sewer is to be constructed within a side lot easement (if approved by the City), the same criteria would apply as for a dedicated easement adjacent to public right-of-way.

- H. Stack - A riser pipe constructed on main or lateral sewers which are deeper than 7 feet to facilitate construction of service leads or service connections.
- I. Force Main - A pressure-rated conduit (i.e. ductile iron pipe, pressure-rated P.V.C., etc.) that conveys wastewater from a pump station to a discharge point.
- J. Pressure sewer systems – A wastewater collection system using a pump at each residence or customer.

2.04 DESIGN REQUIREMENTS:

- A. Obtain approval from the City of Humble for exceptions or deviations from these requirements. Exceptions or deviations may be granted on a project-by-project basis only.
- B. Drawings to be furnished:
Before any main or lateral sewer is constructed and before a permit will be issued for the construction of same, plans and profiles of the proposed sewer shall be prepared and submitted by a licensed professional engineer to the City for approval. On projects within the City limits, the drawing shall become the property of the City and shall remain on file in the City for the use of any person who may be interested in same.
- C. Details to be shown on drawings:
The detailed plan shall will show the exact location of the proposed line in the street, alley or easement with respect to the edge of the particular right-of-way, the transit base line, and any nearby utilities, pavement, major landscaping, and other structures affecting construction.
- D. Main and Lateral Sewers:
 - 1. Sewers shall be shown both in detailed plan and profile views. Lines shall change grade or alignment only at a manhole.
 - 2. The profile shall show other underground and surface utilities and facilities, both in parallel and at crossings; the size, grade of the proposed line, the elevation of same to hundredths of a foot at all manholes, changes of grade and dead-ends; and the proposed finished grade over the sewer (if improvements are requested). It shall show the actual ground line as it exists prior to construction of the sewer. Where proposed fill or cut is contemplated, the proposed new ground line shall be shown as a separate line from the actual ground line. Bedding shall comply with City of Humble Standard Details. Where the lines are parallel to a ditch the flow line of the ditch shall be shown.
 - 3. Where sewers are to be placed between existing pavement and the street right-of-way or under existing pavement, show the existing ground line at both sides (or the closest side or sewers near the edge) of the right-of-way or adjacent sewer easement.
 - 4. If there is a drainage ditch or storm sewer between the line and the houses served, grade shall be shown.

E. Sewer mains-plan and profile required:

1. Sanitary sewer layouts for subdivisions shall use a horizontal scale of 1" = 20 feet and vertical scale of 1" = 2 feet.
 - a. All easements containing or buffering sanitary sewers are shown at points of size change; all manhole locations are shown.
 - b. The sewer alignment shall accurately reflect the relative location of the sewer as shown on the detailed plan view.
 - c. All service leads that cross street pavement or serve adjacent property are to be shown on the layout. The detail plans and profiles shall show the flow lines of all service leads at the street or easement right-of-way.
 - d. The number and size of the lots depicted on both the overall sewer layout sheet and the individual plan and profile sheets shall match the number and size of the lots depicted on the final plat after recordation.
 - e. On the overall sanitary sewer layout sheet the size and direction of flow for all existing and proposed sewers shall be shown.
 - f. The location of the proposed sewer within either the public right-of-way, a dedicated easement adjacent to the public right-of-way, or side lot easement (if allowed by the City).
 - g. The overall sanitary sewer layout sheet shall show the area, in acres, which the proposed sewer(s) is (are) designed to serve. Include a location map that references the distance to nearby major thoroughfare and boulevard streets. The scale of the location map shall be 1 inch = 1,000 feet or less.

2. The plan view shall show, at a minimum, the following information for the project area:
 - a. All topographical features;
 - b. Stationing for the proposed sewers;
 - c. All existing and proposed utilities (i.e., water, gas, power, etc.);
 - d. Any significant landscaping and/or other structures which might impact construction and/or construction related activities;
 - e. The width and type of all existing and proposed easements;
 - f. All proposed service leads;
 - g. The limits of bore and/or tunnel;
 - h. Drawings for subdivisions shall show the proposed location, by stations, of all service leads, service connections, and stacks. The distance from the sewer to the nearest existing manhole shall be shown in the plan view or on an additional sewer layout sheet with a scale no more than 1 inch = 100 feet;

3. The profile view shall show, at a minimum, the following information for the project area:
 - a. Underground and/or surface utilities/facilities, which are either parallel to the proposed sewer or cross the proposed sewers;
 - b. The proposed sewer's diameter and grade for each manhole section;
 - c. The flow line elevation for all sanitary sewers at each manhole;
 - d. The rim elevation of all existing and proposed manholes;
The 100 year flood elevations where applicable with bolt down manhole lids and inflow prevents when below the 100 year flood elevation.
 - e. The flow line elevation at each sheet "break" (i.e., from one sheet to another);
 - f. Type of pipe bedding/backfill shall be noted on each plan/profile sheet;

- g. The finished grade for proposed and existing pavement where "fill" and/or "cut" is proposed, the proposed new ground line should be shown as a separate line from the existing ground line;
- h. The existing ground line for the "near side" of the public right-of-way where a sewer is to be placed between the edge of existing pavement and the edge of the public right-of-way;
- i. The existing ground line at the centerline of the proposed sanitary sewer where a sanitary sewer is to be placed within an existing easement. Show any proposed and/or existing pavement.
- j. The flow line elevation of all service leads where same crosses the edge of the public right-of-way or the dedicated easement adjacent to the public right-of-way, stacks shall be required when over 7' deep
- k. The limits of bore and/or tunnel;
- l. Locations where pressure pipe to be installed for water line crossings;
- m. The location of special backfill and/or proposed stacks shall be identified by "stations" indicated on the design plans.
- n. Crossing utility lines and storm sewers and parallel drainage facilities.

F. Service leads:

- 1. Service leads shall be at the property line between two (2) adjoining lots, or as directed by the City. A single 6-inch service lead located at the property line between two (2) adjoining lots may serve two (2) single-family residences with a wye placed at the end of the service lead. Do not extend the wye clean-outs beyond the edge of either the public right-of-way or dedicated easement.
- 2. Any service lead extension of more than 50 feet parallel to the street right-of-way shall be treated as a lateral sewer.
- 3. Service leads from developments with more than 17,500 gallons-per-day flow shall discharge into a proposed or existing manhole. Where the flow line is 24 inches or greater above the flow line of the manhole, provide a standard drop to manhole. Service shall conform to the following:
 - a. Service leads shall be provided to serve each lot within the proposed development.
 - b. Service leads shall utilize "full body" fitting (extruded or factory-fabricated) for connection to the proposed public sewer. An approved saddle-type connector for connection to an existing public sewer may be used, but not for proposed lines.
 - c. Saddle-type connectors shall be installed with the "stub" oriented between the "spring line" (3 o'clock and 9 o'clock positions) and 45 degrees from the "spring line" ("1:30" and "10:30" positions). These type of connections will only be allowed for new service taps on existing sanitary sewers. Tees (aka, "full body fittings") shall be oriented in the same manner.
 - d. The service lead shall be designated to minimize the use of bends as site conditions will permit.
 - e. Stacks shall be provided where the services are over 7 feet deep.
 - f. Each service end shall be marked for easy future excavations.
 - g. Each service shall have a cleanout within 2 feet of the property line.

G. General Requirements:

1. Sanitary sewers within the City of Humble shall allow for orderly expansion of the system and shall conform to the wastewater master plan for the City of Humble.
2. Sewers shall be sized based on the minimum requirements set out in this standard and the standard wastewater flow rates as established by the City.
3. All sewers shall conform to the minimum requirements of the Texas Commission on Environmental Quality Chapter 217– “Design Criteria for Sewage Systems”.
4. Sewers shall be separated from water lines by a minimum of nine (9) feet. Where the minimum separation is not maintained, refer to Section 3 for allowable clearances. Sewers crossing utilities other than water, a minimum of six (6) inches of clearance shall be maintained.
5. Place stacks and wyes or tees as shown. Where no stacks are shown, it is the responsibility of the licensed plumber to place a City approved saddle for connection to the line.
6. All lines and manholes shall be tested in accordance with TCEQ regulations.
7. Unless noted otherwise, all public sewers and service leads shall be embedded in cement stabilized sand as per latest City of Humble Standard Details. All such bedding shall be compacted to 95% standard proctor density. The cross-section so described herein shall be termed the "embedment zone."
8. Backfill all excavation areas/trenches under or within 2-feet of existing or proposed pavement with cement-stabilized sand from the top of the pipe "embedment zone" up to 1-foot below paving sub-grade. Cement-stabilized sand with a minimum cement content of 1.5 sacks per cubic yard must develop 100-psi compressive strength at 48 hours. Backfill shall be compacted to 95% standard proctor density.
9. The location of all special backfill and of proposed stacks shall be shown by stations in the drawings.
10. Construction notes shall designate the type, kind and class of pipe with exceptions to the construction notes to be shown on the plan and profile sheets.
11. Non-sanitary sewer easements or fee strips such as pipeline, power company, drainage district, railroad, etc., are in and of themselves insufficient and unacceptable to permit laying to sanitary sewers and/or force mains across or along the underlying private property or restricted non-sanitary use type of public property.
12. The final determination as to that portion of a street, alley, or easement to be occupied by a proposed sewer rests within the City. The Director will take into consideration existing, planned and proposed facilities such as manholes, pavement, pipe/conduits, along with existing trees, shrubs, or other unique surface conditions when arriving at a decision.
13. Where an easement for a public sewer ends at a public right-of-way, the last manhole shall be extended into the public right-of-way as a minimum of 2 feet beyond the property line; or as close to the public right-of-way as possible due to acceptable clearances required for other utilities (i.e., water line and storm sewers).
14. The drawings for the sewer shall show the location of any existing known pipe or duct that might interfere with the construction of the sewer and call to the attention of the City any known obstacles that might be encountered in constructing the sewer in any location under consideration. The Professional Engineer shall determine the existence of pipes, ducts and/or obstacles from a visual survey on the ground plus research of all public records and private records when available.

15. All gravity sanitary sewer mains under 12 feet of depth shall be constructed utilizing, SDR 26, PVC. Force mains shall be SDR 26 Class 160 PVC pipe.
16. Where a sanitary sewer line could be extended to serve an adjacent development, the public sewers main shall be extended across the full length of the development or to the edge of the property where streets may be extended.

H. Line Size:

1. The minimum pipe diameter for a public sanitary sewer shall be 8 inches.
2. Six inch service leads shall be confined to the limits of the lot, which they serve and shall serve only the equivalent of one single-family lot. No 6-inch sewer shall be laid in any street, alley, or right-of-way.
3. Six-inch service leads shall not serve more than the equivalent of two single-family lots or other types of small land tracts.
4. Six-inch service leads for single-family residential lots shall have a minimum grade of 0.70 percent.
5. For commercial service leads such as street bores, submit a copy of the approved plumbing drawings to establish the required size of the line. The minimum size lead shall be 6 inches.
6. All main and lateral sewers will end in manholes, except for special and/or unusual situations and subject to specific approval of same.
7. All sewer lines shall be laid at a size and depth to conform to designs permitting an orderly expansion of the sewer system of the City and so as to avoid a duplication of lines in the future.
8. The City shall be the final judge as to sizes and depths required and exceptions to "lateral service leads" as previously defined.

I. Line Depth:

1. The sewer shall be laid with the top of the pipe a minimum of 3 feet below finished grade or top of curb, whichever is lower. In areas with open ditches, the lines and leads shall be 2 feet below the flow line of the ditches or specific approval obtained and special protection provided.
2. Sewer laid in street rights-of-way with curb and gutter paved streets shall have a minimum cover of 4 feet from the top of the pipe to the top of the curb to anticipate future sewer extension.
3. Sewers laid in street right-of-way with crowned roads and side ditches shall have a minimum cover of 5 feet from the average ground line at the adjacent street right-of-way to the top of pipe.
4. Where the minimum cover as specified in paragraphs I, 1,2, and 3 above is not possible, the sewer shall be laid in Class 150 (150 psi) pressure pipe or rigid factory made pipe with cement stabilized sand as shown in standard detail. Ductile iron pipe shall be lined with either a polyethylene or polyurethane coating as approved by the pipe manufacturer and applied by either the pipe manufacturer or an approved application. The minimum liner thickness shall be 40 mil.

J. Line Grades.

1. The following table lists the minimum grades for 6-27 inch public sewers.

<u>Inside Dimension (I.D.) of Pipe in Inches</u>	<u>Minimum Slope</u>
6	0.50
8	0.33
10	0.25
12	0.20
15	0.15
18	0.11
21	0.09
24	0.08
27	0.06

For sewers larger than 27 inches in diameter, the Professional Engineer of record shall determine the appropriate grade utilizing the Manning Formula, $n = 0.013$ and a full pipe velocity of 2.0 fps.

K. Manholes:

1. All manholes shall be pre-cast concrete, unless the Professional Engineer submits a "cast in place" manhole design for review and approved by the City. All pre-cast manholes shall incorporate a "boot" type connector for sewer diameters up to 24 inch. For sewer diameters greater than 24 inches, utilize either the "boot" type connector (if available) or an integral gasket. All pre-cast manholes shall conform to the latest ASTM requirements.
2. For all public sewers, manholes shall be placed at all changes in alignment, changes in grade, junction points, and either at street, alley, or easement intersections as designs may require.
 - a. Sewers laid in easements shall have a manhole in each street crossed by the sewer.
 - b. The maximum distance between manholes shall be 500 feet for 8 inch to 48-inch pipe diameters. Spacings for larger diameter mains than 48 inches shall be determined on an individual project basis.
 - c. Sewers with the same, or approximate flow line elevation shall intersect each other at a 90-degree or greater angle. However, where a true perpendicular intersection cannot be obtained, and where the "entering" sewer intersects the receiving sewer at, or about, the same flow line, one or more manholes shall be utilized to maintain a minimum angle of 80 degrees at the point of intersection. Inverts shall be shaped to gentle curves and have a depth not less than 70% of the pipe diameter. Abrupt changes in alignment at pipe entrances that limit access of TV inspection will not be accepted.
 - (1) A distinct flow channel can be maintained within the manhole when the flowline elevations of the sewers are at, or within, one (1) pipe diameter of the smaller pipe; or
 - (2) Manholes shall be placed at all dead-end mains and laterals.
 - d. Criteria for connections to, and utilization of, manholes.

- (1) Where manholes are utilized to facilitate connections between public sewers, when possible the sewers shall either match the manhole's flow line, match the elevation of each other's crown or utilize and "outside" manhole drop.
- (2) Connections between public sewers at the manhole shall adhere to the following criteria when possible:
 - (a) The elevation of the crown of the discharging sewer shall either match the elevation of the crown of the receiving sewer or be approved as special cases by the City.
 - (b) A standard drop connection is required when the difference in elevation between discharging sewer flowline and receiving flowline is greater than 24 inches.
- (3) The routing of service connection directly to manholes will be allowed only where the flowline elevation of the existing sanitary sewer is more than 10 feet below grade.
- (4) When routing an approved service connection to a manhole (see Item "3"), the wall penetration shall not be greater than 10 inches in diameter and shall be cored and sealed using nonshrink grout. A pipe gasket shall be embedded in the grout.
- (5) When routing an approved service connection to a manhole (see Item "3"), the connections shall utilize a "drop and shall adhere to the following criteria:
 - (a) The manhole wall penetration shall be a minimum of 10 feet below the manhole rim elevation and shall not be greater than 10 inches in diameter;
 - (b) The drop shall be 6 inches in diameter and shall be constructed of SDR 26 PVC pipe (ATSM D 3034-94);
 - (c) The drop shall be located 45 degrees from the upstream side of the main sewer;
 - (d) The wall penetration (core) shall be sealed using a "grout" as approved by the City.
- (6) All public sewers shall terminate in a manhole. Clean-outs will not be utilized.
- (7) All sewer lines shall be air tested for leakage. Lines shall have deflection. Tests conducted a minimum of 30 days after installation and all manholes shall be vacuum tested. All tests shall be in accordance with Chapter 217 of TCEQ rules.

L. Lift Stations:

1. Lift station design shall comply with the City of Humble specifications, with a storage minimum volume (pump on to pump off) in the wet well equal to design flow (in gallons per minutes) multiplied by 0.25 multiplied by 15 minutes.
2. Minimum site size shall be 30 feet by 30 feet. Odor control measures shall be considered on an individual basis.
3. Pumps shall be sized to operate at optimum efficiency. Minimum acceptable efficiency at the operating point shall be sixty percent (60%) unless specifically approved by the City. Only submersible pumps will be accepted.
4. Operation and maintenance shall be considered in the design of the station and the location of the station.
5. Wet well working volume shall be sized to allow for the maximum of 4 starts per hour with one pump out of service.
6. Controls and equipment shall be approved by the Department of Public Works.

7. Emergency operations shall be considered. Provide fittings and a blind flange that will be readily accessible for emergency bypass pumping and connector for a portable generator. A manhole shall be installed within 10 feet upstream of the wet well to provide an access point for bypass pumping.
8. The inlet structure shall be designed to minimize turbulence.
9. The velocity in the Force Main and riser pipes shall be less than 6 fps and greater than 3 fps.
10. The wet well shall be sized to provide adequate clearance between the pumps (refer to manufacturers recommended clearances).
11. A peak factor of four (4) shall be used for Lift Station design.
12. A minimum of two (2) feet of clearance shall be provided between pumps and between pump and wall, or as required by the pump manufacturer.
13. Low water level shall be at least six (6) inches above impeller; higher if required by manufacturer. Complete immersion of submersible pump motor at low water level is preferred.
14. Tie steel in Lift Station bottom to wall (includes caisson construction situation) to provide watertight wet well.
15. Nuts, bolts, chains and all other metal components within wet well shall be stainless steel, not carbon steel.
16. Vent pipe shall be eight (8) inches minimum diameter.
17. The following Hazen-Williams Coefficient shall be used for various pipe types:

<i>PVC</i>	<i>New</i>	<i>C = 140</i>
	10-year	C = 130
DIP	New	C = 130
	10-year	C = 100

18. Provide board fence (either CCA cedar or heart redwood) with steel posts in concrete. Fence shall be at least six (6) foot high.
19. Entrance drive to be at least fourteen (14) feet wide. Drive shall terminate adjacent to the station with a parking space such that a truck-mounted hoist can remove pumps.
20. Indicate method of drainage of site on site plan. Internal drainage, sheet flow and valley gutter driveways are acceptable. Drain to street or storm sewer, never onto adjacent private property.
21. Locate control panel and wet well hatch 1 foot above 100-year flood plain minimum. Call out the 100-year flood plain elevation on the plans.
22. Dual stainless steel guide rails (or other pump removal method that avoids entering wet well) are required for submersible pumps. Size and spacing shall be approved.
23. A tee, plug valve and blind flange assembly is required on the force main on the downstream side of the discharge valves and header. This is required so truck-mounted pumps can bypass the lift station pumps and piping while work is being done.
24. Bedding for PVC force main shall be bank sand as per the latest City of Humble Standard Details.
25. PVC force mains shall be SDR 26 (ASTM 2241) Class 160 PVC pipe (green color).
26. Backfill structural excavations (wet well, etc.) with cement stabilized sand.
27. Lift station site plans shall be submitted in scales of 1-inch = 5-feet or 1-inch = 10-feet.
28. Provide a protective coating to interior walls of wet well. Minimum 100 mils of Raven 405 Epoxy Liner.
29. Lift station shall be equipped with City approved SCADA equipment and connected to the City's SCADA system to monitor and operate the lift station remotely.
30. Power supply to lift station shall be 3 phase (and 480 volts where possible).

31. A system of floats or Department of Public Works approved transducer system shall be provided to control pumps.
32. Lift station shall be equipped with a Godwin natural gas, self-priming standby pump, sized to meet the capacity of the lift station.

2.05 SUBMITTALS:

- A. Preliminary design - submit the following for review and comment:
 1. Copies of any documents that show approval of exceptions to the City design criteria.
 2. Design calculations for line sizes and grades.
 3. Contour map for overall area.
 4. Plan and profile sheets showing proposed improvements
 5. Geotechnical soils report for the project (City projects only).
- B. Final design - submit the following for approval:
 1. Final documents of the above plus plan and profile sheets and Geotechnical soils reports for non-City projects.
 2. Review prints.
 3. Original drawings.
- C. Final acceptance – submit the following for approval:
 1. As – Built plans with a letter from the design engineer stating that the project was constructed in conformance with the plans.
 2. Line pressure and mandrel test results.
 3. Manhole vacuum test results.
 4. Television inspection reports and videos.
 5. Request physical inspection by city staff.
 6. One-Year Maintenance Bond valid for one year from the date of acceptance by the City.

2.06 QUALITY ASSURANCE:

Prepare calculations and construction drawings under the supervision of a Professional Engineer trained and Licensed under the disciplines required by the drawings. The final construction drawings must be sealed, signed, and dated by the Professional Engineer responsible for the development of the drawings.

**SECTION III
WATER LINE DISTRIBUTION SYSTEM
DESIGN REQUIREMENTS**

3.0 GENERAL

3.01 SECTION INCLUDES:

Criteria for the design of water line distribution systems.

3.02 REFERENCES:

- A. TCEQ, Water Utilities Division "Rules and Regulations for Public Water Systems," latest revision.
- B. American Water Works Association (AWWA).
- C. National Sanitation Foundation (NSF).
- D. Texas Department of Health.
- E. Texas State Board of Insurance.

3.03 DEFINITIONS:

- A. Water Line - Closed conduits designed to distribute potable water for human consumption to various areas and provide fire protection. Line size and fire protection accessory locations are dependent on distance from primary source and quantity of demand.

3.04 DESIGN REQUIREMENTS:

- A. Obtain approval from the City of Humble for exceptions or deviations from these requirements. Exceptions or deviations may be granted on a project-by-project basis only.
- B. Easements for water lines:
 - 1. Lines shall be located within street right-of-way, permanent access easements with overlapping public utility easements, easements adjacent to street rights-of way or recorded water line easements.
 - 2. When outside of a public street right-of-way or permanent access easement with an overlapping public utility easement, easements must be dedicated.
 - 3. When possible, easements should be contiguous with public rights-of-way.
 - 4. Except for side lot easements, water line easements shall be contiguous to a paved access.
 - 5. For water lines located adjacent to street rights-of-way, the minimum width of easement shall be 10 feet.
 - 6. For water lines 16 inches or larger located outside of street rights-of-way, the minimum width of easement shall be 15 feet.
 - 7. For water mains located less than 5 feet from the right-of-way line, the outside edge of a water line easement shall be located from the right-of-way line as follows:
 - 14 inch and smaller pipe - 5 feet.
 - 16 inch and larger pipe - 10 feet
 - 8. Water lines along State rights-of-way shall be installed outside of the right-of-way in a separate 10-foot minimum contiguous easement. If additional utilities are anticipated in the easement additional width shall be provided.
 - 9. No back lot easements will be allowed for the installation of water lines.

10. Commercial Developments inside the City requiring on-site fire hydrants must provide a minimum 15-foot water line easement for the water line and fire hydrant.
11. In new developments, water lines shall be centered in water line easements.
12. When using side lot easements, such easements shall be a minimum of 15 feet in width, located on one lot or centered between lots. Water line shall not be closer than 5 feet from an easement edge.
13. Location of a water main in an easement not adjoining a public right-of-way shall be prohibited, except as specifically approved by the Director. When approved, these water mains will be centered in a 15-foot wide exclusive easement.

C. Location of water lines:

1. Locate within a street right-of-way.
2. Location of waterlines within an easement - locate waterlines in the center of a 10-foot minimum width dedicated waterline easement. Obtain approval for lines to be located in wider or multi-use easements.
3. When a water line is placed parallel to another utility line, or storm sewer other than a sanitary sewer, the water line shall have a minimum of 4 feet horizontal clearance from outside wall of the water line to the outside wall of the existing utility or storm sewer.

D. Water line size:

1. 6 inch lines may be used on dead-end lines within cul-de-sacs or if the line is less than 1,000 feet in length and interconnected between two lines which are 8 inches in size or larger. The maximum number of fire hydrants or flushing valves on a dead end line is one. One hydrant will be permitted on a looped 6-inch line.
2. 8-inch lines may be used for lines over 1,000 feet long or when 2 or more fire hydrants or flushing valves are required.
3. In areas anticipating commercial development, the minimum line sizes shall be 8 inches or larger based on anticipated required fire flows in accordance with Insurance Service Office (ISO) requirements.
4. 12 inch and larger lines - lines to be determined by the Professional Engineer (P.E.) and City of Humble.
5. All systems shall be designed to provide a minimum of 1,000 gallons per minute fire flow for a minimum of 2 hours.

E. Dead-end lines:

1. Dead-end lines within a public right-of-way.
 - a. On permanent dead-ends, other than cul-de-sacs, the line shall be 6 inches and shall not exceed more than 500 feet in length from the closest interconnection main line and shall terminate with a fire hydrant or automatic flush valve.
 - b. In permanent dead-end situations within cul-de-sacs, reduce pipe size successively. Carry 8 inch pipe to the next to last hydrant, then use 6 inch pipe to the line's end. Place the last service as near as possible to the end and install a fire hydrant at the end of the 6 inch line. The maximum length of this reduced line size configuration should not exceed 500 feet. 4-inch lines may be used on dead-end lines within cul-de-sacs supplying a maximum of 16 lots provided all structures are within a 250 feet of a fire hydrant. For this carry 6-inch pipe to the last hydrant then use 4-inch pipe to the line's end. Place the last service as near as possible to the end and install a standard 2-inch automatic flush valve at the end of the 4-inch line.

F. Depth of cover:

1. 14 inch and smaller mains shall have a minimum cover of 4 feet from top of curb. For open ditch roadway sections, 12 inch and smaller shall be installed at least 3 feet below the ultimate flowline of the ditch or 6 feet below natural ground at the right-of-way line, whichever is deeper.
2. 16 inch and larger mains shall have a minimum cover of 5 feet from top of curb. For open ditch roadway sections, 16 inch and longer mains shall be installed at least 4 feet below the flow line of the ditch or 7 feet below natural ground at the right-of-way line, whichever is deeper.

G. Water line crossings:

1. Public and private utility crossings other than sanitary sewer.
 - a. Where a water line crosses another utility other than a sanitary sewer, a minimum of 6 inches of clearance must be maintained between the outside wall of the water line and the outside wall of the utility.
2. Stream and Ditch Crossings
 - a. Elevated crossings:
 - (1) All water lines shall be welded steel or flanged ductile iron pipe and shall extend a minimum of 15 feet beyond the last bend or to the right-of-way line, whichever is greater.
 - (2) Elevated crossings are preferred to underground crossings.
 - (3) Use a separate elevated supporting structure for 16 inch and larger water lines unless otherwise approved by the City. Locate the structure a minimum of 10 feet from any existing or proposed structure.
 - (4) Support water lines on existing or proposed bridges meeting the following criteria may be used for 12 inch and smaller lines when approved in advance by the City.
 - (a) Have adequate structural capacity.
 - (b) Have sufficient clearance above the bent cap elevation for installation under the bridge.
 - (5) Design elevated crossings with the elevation of the bottom of the water line above the low chord of the nearest adjacent bridge or a minimum of 1 ½ feet above the 100 year flood plain elevation, whichever is higher.
 - (6) Extend pipe from right-of-way to right-of-way for crossings.
 - (7) Provide sufficient span length to accommodate the cross section of future widening of the stream or ditch, if available.
 - (8) Support the line on columns spaced to accommodate the structural capacity of the pipe considering deflection and loading.
 - (9) Base column support design on soil capacity, spacing, loading, and structural requirements.
 - (10) Piers are not allowed in the center of the stream.
 - b. Underground crossings:
 - (1) Provide a minimum 5-foot clearance above the top of the pipe to the ultimate flow line of the ditch.
 - (2) Provide sufficient length to exceed the ultimate future development of the stream or ditch.
 - (3) All water lines shall be welded steel or restrained joint pipe and shall extend a minimum of 15 feet beyond the last bend or to the right-of-way, whichever is greater and have valves located on both sides of the crossing.

H. State highway and county road crossings:

1. Extend carrier pipe from flow-line to flow-line for open ditch sections and 5' behind back of curb for curb and gutter sections.
 2. State highway crossings shall be constructed in conformance with the requirements of the Texas Department of Transportation (TxDOT) and shall be permitted by TxDOT.
 3. When additional right-of-way has been acquired or will be required for future widening, the casing, where required, should be coordinated with the appropriate agency.
- I. Street crossings:
1. All water mains and sprinkler line crossings under major arterial thoroughfares and major regional thoroughfares shall be encased using a minimum of PVC pipe, SDR 21 or steel pipe.
 2. Crossings under existing concrete streets shall be installed by trenchless construction. Water may be used to facilitate boring operations. Jetting the pipe main into place will not be permitted. When conditions exist that warrant open cut across and existing street, the Department of Public Works shall specifically approve the crossing.
 3. All open cut installations under existing or proposed streets shall be backfilled as shown in the City of Humble Standard Details.
 4. All street crossings shall be constructed in accordance with construction plans approved by the City. All street crossings shall be inspected by the City or its designated representative. All street crossings shall meet the requirements of these standards.
- J. Oil and gas pipeline crossings:
1. Do not use metallic pipe when crossing oil or gas transmission lines unless a properly designed cathodic system is implemented with City approval. Other pipe may be used, regardless of depth, subject to approval by the City. Maintain a minimum 2 foot separation between the pipeline and waterline. All required permits and correspondence with the pipeline company is to be done by engineer, not City personnel.
- K. On-site fire loops within commercial and multi-family developments.
1. For commercial and multi-family developments inside the City requiring on-site fire hydrants, comply with the following requirements to allow maintenance and future repair operations.
 - a. Do not allow placement of structures, equipment pads over the easement.
 - b. Provide 10 foot wide longitudinal pavement joint along easement lines where the water line is located under driveway or street pavement.
- L. Additional requirements: Pipe shall be C900 or C905 (DR 18) Class 235 PVC pipe conforming to AWWA requirements with integral bells.
- M. Auger (bore) construction:
1. Use the following general criteria for establishing auger or bore sections:
 - a. Auger or bore sections shall be clearly shown on drawings.
 - b. Improved streets - use auger construction to cross the street regardless of surface. Auger length shall be computed as roadway width at proposed bore location plus 5 feet to either side of the roadway, where applicable.

- c. Sidewalks - when the water line crosses under a sidewalk 4 feet or more in width and in good condition, the sidewalk shall either be bored and jacked or the sidewalk shall be removed and replaced to the City of Humble criteria, whichever is cost effective. Bore and jack length shall be at least the width of the sidewalk. The proposed type of construction shall be noted on the plans.
- d. Bore Pits - Bore pits shall be at least 3 feet from back of curb and 5 feet from the back of curb on a major thoroughfare. Bore pits and/or receiving pits to be located in street or driveway paving, shall be shown on plans.

3.05 APPURTENANCES

- A. Do not place appurtenances under pavement. Obtain approval from the Director for variances.
- B. Valves:
 - 1. Set at maximum distances along line as follows:
 - a. Six inch (6") through twelve inch (12") - 1000 feet.
 - b. Sixteen inch (16") through twenty inch (20") - 2000 feet.
 - c. Valves shall be on n-1 (where "n" is the number of lines intersecting) branches of intersecting water mains.
- C. Location:
 - 1. All mains shall be valved within the street right-of-way. Valves shall not be placed under or within 2 feet of ultimate pavement, except as specifically approved by the City Engineer.
 - 2. Valves are normally located on the projection of intersecting street right-of-way lines or at the curb return adjoining a paved street across the main. Tapping sleeves and valves are excluded from this requirement.
 - 3. Isolated fire hydrants and flushing valves from the service line with a valve located in the fire hydrant or flushing valve branch. This valve shall not be located in the slope or flowline of ditches on roadside ditch roadways.
 - 4. Intermediate valves, not located on the projection line of the right-of-way line, shall be located on lot lines or 5 feet from fire hydrants but not set in driveways.
 - 5. Locate valves a minimum of 9 feet horizontally from sanitary sewer crossings.
 - 6. Valve Type (all valves shall open counterclockwise and have mechanical joints):
 - a. Six inch (6") through twelve inch (14") – resilient seat gate valves.
 - b. Sixteen inch (16") through twenty inch (20") - butterfly valves (gate valves may be used with approval from the Public Works Department).
 - 7. All valves shall be provided with a 2 piece iron box labeled "water".
- D. Fire hydrants and flushing valves:
 - 1. Spacing:
 - a. Fire hydrants shall be placed at 500 foot intervals on streets in residential areas.
 - b. Commercial and Multi-Family Developments - 300 foot spacing and at all street intersections.
 - 2. Location in or along street right-of-ways.
 - a. Fire hydrants shall be primarily located at street intersections where possible.
 - b. Locate fire hydrants at P.C.s of the intersection curb radius, 3 feet behind the curb or projected future curb.
 - c. On all State highways and roadside ditch roadways, set the fire hydrants within 3 feet of right-of-way lines. Fire hydrants lead valves shall not be located in the slopes or flow lines of ditches.

- d. Set intermediate fire hydrants on lot lines, as extended to pavement, when located between right of way intersections. These locations may be adjusted 5 feet either way to miss driveways or other obstructions. In either case, do not locate fire hydrants closer than 3 feet from curbed driveways or 5 feet from non curbed driveways.
 - e. Fire hydrants and flushing valves shall not be installed within 9 feet of a sanitary sewer system under any condition.
3. Location of fire hydrants or flushing valves outside the street right-of-way.
 - a. The City Fire Marshal will establish and approve the location of fire hydrants and flushing valves in apartment complexes and platted private developments within the City.
 - b. Locate fire hydrants and flushing valves in protected, easily accessible areas behind curb lines.
 - c. For fire hydrants or flushing valves which are located adjacent to water lines constructed in 15 foot wide waterline easements, the fire hydrant or flushing valve shall be centered in a minimum 10'x10' separate easement.
 - d. For commercial and multi-family developments inside the City, provide isolation valves at each end of fire loops requiring on-site fire hydrants.
 - e. Fire hydrants in parking lots and near traffic shall be protected with concrete filled steel guard posts.
 4. Fire hydrants shall meet the following criteria: Fire hydrants be Mueller A-423 conforming to AWWA C502, 3-way 5.25" main valve; 6inch inlet M.J. shoe, with two (2) 2.5 inch NST hose nozzles and one (1) 4.0-inch 4.480 thread configuration: operating nut shall be 1-3/16-inch pentagon and shall open counter clockwise (left). Fire hydrant shall be breakaway.
- E. Fittings:
1. All fittings shall be identified and described on the construction plans.
 2. Fittings are not permitted in fire hydrant leads, except as specifically approved by the City.
 3. Water main fittings shall be ductile iron, mechanical joints only, with joint restraint (MEGALUG or approved equal).
 4. All plugs shall be provided with retention clamps.
 5. Polyethylene tube encasement shall conform with the minimum requirements of "Polyethylene Encasement for Gray and Ductile Cast-Iron Piping for Water and Other Liquids", ANSI/AWWA C105, current revision. Soils within the project shall be tested in accordance with Appendix A of ANSI/AWWA C105 to adequately determine the requirements for encasement.
 6. Concrete thrust blocking shall be required on all bends, tees, plugs and combinations there of.
 7. All fire hydrants to be tied together with 3/4-inch stainless steel all threads and eye-bolts with restrained joint fittings.
- F. Water main service:
1. In new developments, water service lines and meter boxes shall be provided for all lots. Services shall normally be at lot lines with a 1" minimum size to serve a single lot. Provide separate taps and service line for each individual meter. Lines shall be SDR 9 polyethylene tubing. Service lines shall be continuous from the tap to the meter box.
 2. Water main service for lines in or along street right-of-ways.
 - a. Meters 2 inch and smaller – Meters shall be placed at the property line. Meters shall be located in areas with easy access and protection from traffic and adjacent to right-of-way whenever possible.
 - b. Meters 3 inches and larger - locate in minimum 10' x 20' separate water meter easements.

- (1) Meters shall be located in areas with easy access and protection from traffic and adjacent to rights-of-ways whenever possible.
 - (2) Meters shall not be located in areas enclosed by fences.
3. For proposed apartments, provide one master meter sized for the entire development. Exceptions may be granted by the City for unusual circumstances only. If an exception is approved, do not interconnect multiple meters.
- G. All water facilities shall be flushed, pressure tested and bacterial tests run and approved prior to acceptance.

3.06 WATER QUALITY - OVERALL SYSTEM LAYOUT

- A. Circulation and flushing - The layout of the overall water distribution system shall provide the maximum circulation of water to prevent future problems of odor, taste, or color due to stagnant water.
1. Provide a source of fresh water at each end or at multiple points of a subdivision. Provide ways to create circulation and place valves and fire hydrants to allow simple flushing of all lines.
 2. Avoid dead-ends whenever possible, when necessary, isolate dead-ends with a line valve, keep as short as possible, and equip with a fire hydrant near the line's end.
 3. Where stubs are provided for future extensions, isolate the stubs with a valve and do not allow service connections to stubs until extended. Place one full pipe joint between isolation valve and plug.
- B. Layout and size of all water mains shall be consistent with the overall layout and phasing plan of the City's water system. The overall water system shall be designed to maintain adequate pressure throughout the system.
- C. In an unavoidable permanent dead-end situation, reduce the sizes of pipe successively. Carry an 8-inch pipe to the next to last fire hydrant, use a 6 inch to the end of the line. Provide a fire hydrant or automatic flush valve at the end of the main.

3.07 CLEARANCE OF WATER LINES FROM OTHER UTILITIES (New water lines constructed near sanitary sewers and force mains).

- A. New water lines parallel to sanitary sewers and force mains:
Locate water lines a minimum 9 feet horizontally, outside wall to outside all, when parallel to sanitary sewers or force mains. Any requests for variation from the 9 foot minimum separation shall be made in writing by the design engineer with a justification for the variance and the specific methods (conforming the TCEQ rules) that will be used to assure the integrity of the system.
- B. Where a sanitary sewer crosses the water main, and that portion of the sewer within 9 feet of the water is constructed as described in Section 290.44(e) of the TCEQ Rules and Regulations, the water line may be placed no closer than 2 feet from the sewer. The separation distance must be measured between the nearest outside pipe diameters. The water line shall be located at a higher elevation than the sewer, wherever possible and one joint, a minimum of 18 feet long, of the new pipe must be centered on the existing line.
- C. If the new water main cannot be installed 2 feet above a sewer main with an 18 foot joint centered on the water main the installation shall conform to one of the following:

1. Within nine feet horizontally of either side of the water line, the wastewater pipe and joints shall be constructed with pipe material having a minimum pressure rating of 150 psi. An absolute minimum vertical separation distance of one foot shall be provided. The wastewater line shall be located below the water line.
 2. All sections of wastewater line within nine feet horizontally of the water line shall be encased in an 18 foot (or longer) section of pipe. Flexible encasing pipe shall have a minimum pipe stiffness of 115 psi at five percent deflection. The encasing pipe shall be centered on the water line and shall be at least two nominal pipe diameters larger than the water line. The space around the carrier pipe shall be supported at 5 foot (or less) intervals with polyethylene spacers or be filled to the springline with washed sand. Each end of the casing shall be sealed with water tight non-shrink cement grout or a manufactured water tight seal.
 3. When a new water line crosses under a wastewater line, the water line will be encased as described for wastewater line in section (2) above or constructed of ductile iron or steel pipe with mechanical or welded joints as appropriate. An absolute minimum separation distance of 1 foot between the water line and the wastewater line shall be provided. Both the water line and wastewater line, must pass a pressure and leakage test as specified in AWWA C600 standards.
- D. Sanitary manholes - provide a minimum 9 foot horizontal clearance from outside wall of existing or proposed manholes. If a 9 foot clearance cannot be obtained, the water line may be located closer to the manhole when prior approval has been obtained from the City of Humble by using one of the procedures below; however, in no case shall the clearance be less than 4 feet.
1. Water line may be encased in a carrier pipe. Encasement shall be a PVC water line in a steel or PVC carrier pipe. Open cut and backfilled with cement stabilized sand compacted backfill.
- E. Fire hydrants. Do not install fire hydrants within 9 feet vertically or horizontally of sanitary sewer mains, service leads, manholes, and force mains regardless of construction.

3.08 SUBMITTALS

- A. General - Conform to the following submittal requirements in addition to those of general procedure of the City.
- B. Water Line Sizes - Submit justification, calculations, and locations for proposed 6-inch lines and for lines 12-inch and larger, for approval by the City, unless sizes are provided by the City.
- C. Valves - Submit information for approval by the City of Humble with justification and locations for use of 16-inch and 20-inch gate valves proposed as substitutes for butterfly valves.
- D. Elevated stream or ditch crossings - Submit design calculations for support columns and column spacing.
- E. Master Development Plan - For multiple phase developments, submit a master development plan.
- F. Developments with individual wells and septic systems submittals and design calculations will be provided to city engineer for his/her approval.

3.09 QUALITY ASSURANCE

- A. Prepare calculations and construction drawings under the supervision of a Professional Engineer trained and licensed under the disciplines required by the drawings. The final construction drawings must be sealed, signed, and dated by the Professional Engineer responsible for the development of the drawings.
- B. Final Acceptance – For requesting acceptance of a water main by the City, the engineer of record shall submit a written request with “As-built” plans, pressure leakage test results and approved bacteriological tests. Recorded copies of all required easements.

3.10 DESIGN ANALYSIS

- A. Water line sizes - Prepare narrative justification and calculations for proposed inch lines and for lines 12-inch and larger, unless sizing is provided by the City.
- B. Elevated stream or Ditch Crossings - Prepare design calculations for support columns and column spacing

SECTION IV

STREET PAVING DESIGN REQUIREMENTS

4.0 GENERAL

4.01 SECTION INCLUDES:

Geometric design guidelines for streets, criteria for street paving, and standard paving notes for drawing call outs.

4.02 REFERENCES

- A. AASHTO - American Association of State Highway and Transportation Officials.
- B. ASTM - American Society for Testing Materials.
- C. ACI - American Concrete Institute.
- D. TxMUTCD - Texas Manual on Uniform Traffic Control Devices.

4.03 DEFINITIONS

- A. Geotechnical Engineer - An engineer certified by the American Association for Laboratory Accreditation (A2LA).
- B. HMAC - Hot Mix Asphaltic Concrete.
- C. Curb Sections - Full width concrete pavement with doweled on 6" high vertical curbs or 4-inch by 12-inch curbs. Curb and gutter sections require inlets and underground storm sewers.
- D. Roadway ditch sections - Ditch sections adjacent to either full width reinforced concrete pavement or asphaltic pavement. Roadside ditch sections do not require underground storm sewers; however, the ditch sections must be designed to accommodate the storm runoff.

4.04 DESIGN REQUIREMENTS

The following design requirements are applicable to all pavement within right-of-way limits within the City of Humble.

- A. General
 - 1. All paving plans and construction shall be approved by the City of Humble for all streets within the City.
 - 2. Street design should conform to all applicable planning tools, such as the Texas Manual on Uniform Traffic Control Devices, major thoroughfare plans, master plans, etc. Other considerations for design should include street function, street capacity, service levels, traffic safety, pedestrian safety, and utility locations. These additional considerations may effect the minimum requirements set forth herein. Refer to the City Thoroughfare Plan.
 - 3. Design shall conform to the City Construction Details.
- B. Minimum Width Requirements and Paving:
 - 1. Undivided curb and Gutter sections for low-density residential developments: 31 feet back to back of curb (B/B).

2. Curb and gutter sections of medium density residential, industrial, secondary and collector streets: 35 feet B/B of curb.
 3. Pavement of major arterial thoroughfares: two divided traffic lanes of 25 feet (4 lane divided) or 34 feet B/B of curb (6 lane divided).
- C. **Minimum Thickness and Reinforcement Requirements for Concrete Pavement:**
The following requirements are the minimum allowable. Pavement thickness and reinforcement shall be designed by the Professional Engineer responsible for the project based on a current soils analysis and recommendations by a qualified geotechnical engineer. Pavement design based on soils analysis, use, loading and life span may require greater thickness and more reinforcement than the minimums give, but City may determine that additional thickness is warranted.
1. For pavement widths less than or equal to 31 feet B/B of curb:
 - a. Minimum concrete slab thickness shall be 6 inches with $f_c = 3,500$ psi and reinforcement shall be Grade 60, $f_y = 60,000$ psi, #4 deformed reinforcing bars spaced at 24 inches center to center both ways and minimum lap lengths of 18 inches. Expansion joints shall be placed at the end of each curb return and at a maximum spacing of 60 feet. Expansion joints shall include a $\frac{3}{4}$ " redwood header, $\frac{3}{4}$ " smooth dowel bar (18" length) and a 26 gauge hard plastic tube. The expansion joint shall include a standard steel wing plate.
 - b. Minimum stabilized subgrade thickness shall be 8 inches.
 2. For major thoroughfares:
 - a. Minimum concrete slab thickness shall be 8 inches with $f_c = 3,500$ psi and reinforcement shall be Grade 60, $f_y = 60,000$ psi, #5 deformed reinforcing bars spaced at 18 inches center to center both ways and minimum lap lengths of 18 inches. Expansion joints shall be placed at the end of each curb return and at a maximum spacing of 60 feet.
 - b. Minimum stabilized subgrade thickness shall be 8 inches.
 3. For pavement widths greater than 31 feet B/B and not major thoroughfares:
 - a. Minimum concrete slab thickness shall be 7 inches with $f_c = 3,500$ psi and reinforcement shall be Grade 60, $f_y = 60,000$ psi, #4 deformed reinforcing bars spaced at 18 inches center to center both ways and minimum lap lengths of 18 inches. Expansion joints shall be placed at the end of each curb return and at a maximum spacing of 60 feet.
 - c. Minimum stabilized subgrade thickness shall be 8 inches.
 4. Joints shall use Load transfer devices.
- D. **Subgrade Treatment:** Geotechnical Engineer shall base depth of subgrade stabilization (8-inch minimum thickness) on structural number (SN) in conjunction with pavement thickness design. Following is a general guidance for subgrade treatment:
1. Subgrade shall be stabilized with the recommended percentage of material by weight as determined by Geotechnical Engineer.
 2. For subgrade soil conditions with a plasticity index (PI) of 20 or more, the subgrade shall be stabilized with lime. All final soil PI's shall be less than 20.
 3. For subgrade soil conditions containing a clean sand with no clay content, the subgrade shall be stabilized with cement slurry.
 4. For subgrade soil conditions containing silt, the subgrade shall be stabilized with lime-fly ash.
 5. All subgrade shall be compacted to a minimum of 95% standard proctor at optimum moisture plus or minus 2 percent.

- E. Requirements for Intersections, Turnouts, Transitions, and Thoroughfares:
1. At a "T" intersection with a street that has not been improved to its ultimate width, concrete pavement shall be stopped either at the right-of-way line or the end of the curb return, whichever would require less concrete removal at a future date.
 2. For roadway turnouts placed at an existing street intersection, the turnout shall be designed to fit the ultimate pavement width of the intersecting cross street and then transitioned to the existing roadway.
 3. The usual transition length for meeting an open-ditch street is 50 feet for streets widths less than or equal to 31 feet B/B; 75 feet for up to 35 feet B/B width; and 100 feet for 41 feet B/B width.
 - a. Streets other than concrete shall have transitions of a minimum thickness of 8 inches of stabilized subgrade, 8 inches of stabilized base, or approved equal, with 2 inches of hot-mix asphaltic surfacing.
 - b. Concrete streets shall have transitions of a minimum thickness of 8 inches of stabilized subgrade and 6 inches of concrete pavement.
 4. When paving only one roadway of a proposed two roadway thoroughfare (boulevard section) all left-turn lanes and esplanade crossovers shall be paved to the centerline of the street right-of-way.
- F. Requirements for Roadway Pavement with Open-Ditch Sections.
1. Minimum grade on ditches shall be 0.20 percent.
 2. Ditch capacity shall be designed to handle runoff as determined by the City Drainage Design Requirements.
 3. Minimum side slopes of ditches shall be 3:1. Sides may be sloped to 4:1 or 5:1 for easier maintenance by property owner.
 4. Culverts for roadside ditch only, shall be designed to carry ditch discharge, but not less than 18-inch diameter pipe constructed of reinforced concrete. The maximum length shall be 24 feet.
 5. The radius for cul-de-sac pavement shall be 45 feet.
- G. Requirements for Roadway Pavement with Curb and Gutter Sections:
1. Minimum gutter gradient shall be 0.30 percent.
 2. Maximum cut from finished grade at property line to top of curb shall be 1.25 feet. The recommended maximum slope for driveways shall be ten (10) to one (1) slope. Variations of this requirement may be allowed with specific approval of the City.
 3. Minimum grade shall be 1.0 percent fall around intersection turnout for a maximum radius of 25 feet. Grades for larger radius shall be determined on an individual basis.
 4. Vertical curves shall be installed when algebraic differences in grades exceed 1 percent. Maintain a minimum of 0.02-foot elevation change at 10-foot intervals by altering the calculated elevations. Provide length of vertical curve, PI station and elevation, high/low point station and elevation, algebraic difference and K value. The maximum desirable tangent grade to vertical curves for local streets is 3.5 percent.
 5. When a curb and gutter intersects a drainage ditch, the grade of gutter shall be above the designed water surface of the ditch.
 6. Major thoroughfares shall be super elevated in accordance with AASHTO whenever the centerline radius of lanes or right-of-way are less than 2,000 feet.
 7. The amount of cross slope over the pavement section should be shown on the drawings. The usual cross slope is 3/8 inch per foot.
 8. A minimum gradient of 0.70 percent around the longest radius is required on an L-Type street intersection or cul de sac.

9. When the curb grades are not established below the natural ground, fill lines shall be shown on the drawings and shall be of sufficient height to insure a minimum of 1/4-inch per foot transverse slope toward the curb from the property line between a point, 2 feet outside the right-of-way and the top of curb. If this type fill is required and the pavement is adjacent to a nonparticipating property owner, fill easements from this property owner shall be obtained, filed, and a copy of the easements shall accompany the final drawings. Construction of this nature will require back-slope drainage design to prevent trapping storm runoff.
10. Grades shall be labeled for all tops of curb. Centerline grades are acceptable for open-ditch sections only.
11. Standard height is 6-inches for residential feeder streets and 4 inch by 12 inch laydown curb for all other residential streets. Curb height for streets other than residential shall be 6-inches. The curb height for all esplanades shall be 6-inches

H. Requirements for Sidewalks:

1. All sidewalks and wheel chair ramps shall meet criteria of the Texas Accessibility Standards and the Federal Design Guidelines, i.e. slopes, texture and coloring. If applicable, the Texas Department of Licensing and Regulation (TDLR) shall review the plans and inspect the site.
2. Sidewalk wheelchair ramps shall be required at all intersections and driveways. Ramps shall not direct pedestrians toward the center of an intersection.
3. Sidewalks shall be provided for all developments. Concrete sidewalks (5 feet wide and 4 inches thick with steel reinforcement) shall be required along all street frontages. Sidewalks and ramps at driveway crossings and intersections shall be a minimum of 6 inches thick.

I. Requirements for Miscellaneous Items:

1. The type and amount of subgrade treatment shall be shown on the drawings.
2. Paving headers shall be placed at the end of all concrete pavements.
3. All concrete to be removed shall be removed either to an existing joint or a sawed joint.
4. Sight distance requirements based on a design speed of 30 mph shall be used for determining lengths of crest vertical curves for all pavements except boulevard sections, which shall be designed for 45 mph.
5. Standard City barricades shall be placed at the end of all dead-end streets not terminating in a cul-de-sac.
6. A letter of agreement approving the construction plan crossing is required when paving is placed over a pipeline or other easement or fee utility property.
7. When meeting existing concrete pavement, horizontal dowels shall be used if no exposed reinforcing steel for interconnection with new pavement exists. Horizontal dowels shall be Grade 60, #6 rebars, 24-inches long, drilled and embedded (with epoxy) 9-inches minimum into the center of the existing slab. Dowels shall be 12-inches center to center, unless otherwise specified.
8. When concrete is removed for interconnections, the pavement shall be full depth saw cut, and existing concrete removed. Use horizontal dowels as previously described.
9. Dead-end streets or ends of concrete slabs designed to be extended in the future shall have paving headers and 15-inches of reinforcing steel exposed beyond the pavement, coated with asphalt and wrapped with burlap or paving headers and dowel type expansion joint for future pavement tie.
10. Pavement extensions shall connect to the existing pavement with a pavement undercut and a minimum steel overlap of 18-inches.
11. Concrete pavement thickness design is required for all pavement within industrial areas and on major thoroughfares. Concrete pavement thickness design shall be based on AASHTO design procedures for rigid pavements.

12. Adjust manhole frames and covers within the limits of the pavement to meet the proposed final top of slab.
13. Adjust manhole frames and covers outside the limits of the pavement to conform to the final grading plan.
14. All street lighting shall be designed and installed in accordance with the street lighting standards published by the Illuminating Engineering Society of North America, latest edition and approved by CenterPoint Energy.

4.05 QUALITY ASSURANCE.

- A. All construction drawings and specifications shall be prepared by or under the supervision of a currently Licensed Professional Engineer of the State of Texas, and all documents shall be sealed, dated, and signed by the engineer responsible for the preparation.
- B. All geotechnical work shall be performed by or under the supervision of a currently Licensed Professional Engineer of the State of Texas disciplined in the science of soil analysis. All reports and documents shall be sealed, dated, and signed by the engineer responsible for the preparation.
- C. Final Acceptance – Submit the following with a written letter requesting inspection and acceptance.
 1. As – Built plans with a letter from the design engineer stating that the project has been constructed in accordance with the plans.
 2. Copies of test results for:
 - a) Concrete strength
 - b) Subgrade compaction
 - c) Subgrade PI after lime addition

4.06 DESIGN ANALYSIS

- A. All pavement design shall be supported by calculations to establish the required thickness and reinforcement.
- B. The current soils report with subgrade stabilizations.

SECTION V
STORM DRAINAGE DESIGN REQUIREMENTS

5.0 GENERAL

5.01 SECTION INCLUDES:

Criteria for the design of storm drainage improvements.

5.02 DRAINAGE POLICY

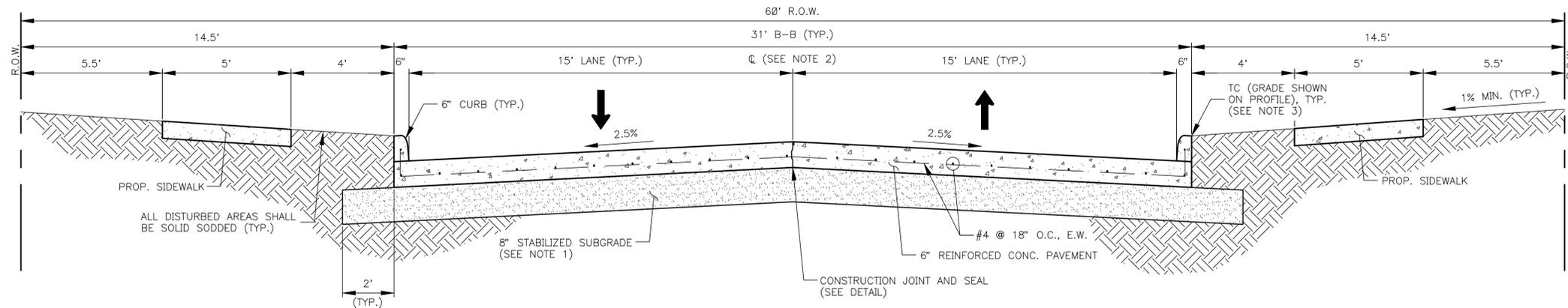
- A. Design requirements – This drainage criteria is administered by the City of Humble and shall be effective within the City of Humble and its extraterritorial jurisdiction. All drainage work proposed for design within these limits shall adhere to the latest edition of the City of Houston Design Manual Chapter 9 Stormwater Design Requirements and City of Houston Technical Paper No. 101 (TP-101) criteria, with the exception of proposed detention systems. All proposed detention systems, including pumped detention systems, shall follow the latest Harris County Flood Control District (HCFCD) design criteria.
- B. Any questions regarding use or function shall be addressed the City Engineer. The goal is to provide protection in a 100-year storm event. This is accomplished with the application of various drainage enhancements such as storm sewers, roadside ditches, open channels, detention and overland (sheet) runoff. The combined system is intended to prevent structural flooding from extreme events up to a 100-year storm. In order to protect existing properties, water levels due to run off shall not be increased upstream or downstream of a development due to the improvement.
- C. Street Drainage - Street ponding of short duration in significant storms is anticipated and designed to contribute to the overall drainage capability of the system. Storm sewers and roadside ditch conduits are designed as a balance of capacity and economics. These conduits are designed to convey less intense, more frequent 2 year storms with the intent of allowing for traffic movement during these events. When rainfall events exceed the capacity of storm sewer system, the additional run-off is intended to be stored or conveyed overland in a manner that reduces the threat of flooding to structures.
- D. Flood Control - The City of Humble is a participant in the National Flood Insurance Program. The intent of the flood insurance program is to make insurance available at low cost by providing for measures that reduce the likelihood of structural flooding.
- E. Relationship to the Permitting Process - Approval of storm drainage is a part of the review process for platting and permitting of new development. All plans for plats and proposed new construction shall include drainage improvements in the plans submitted to the Planning & Development Division.

5.03 REFERENCES

- A. City of Houston Design Manual Chapter 9 Stormwater Design Requirements (latest edition).
- B. City of Houston Technical Paper No. 101 (TP-101).
- C. Harris County Flood Control District Policy, Criteria, and Procedure Manual (latest edition).

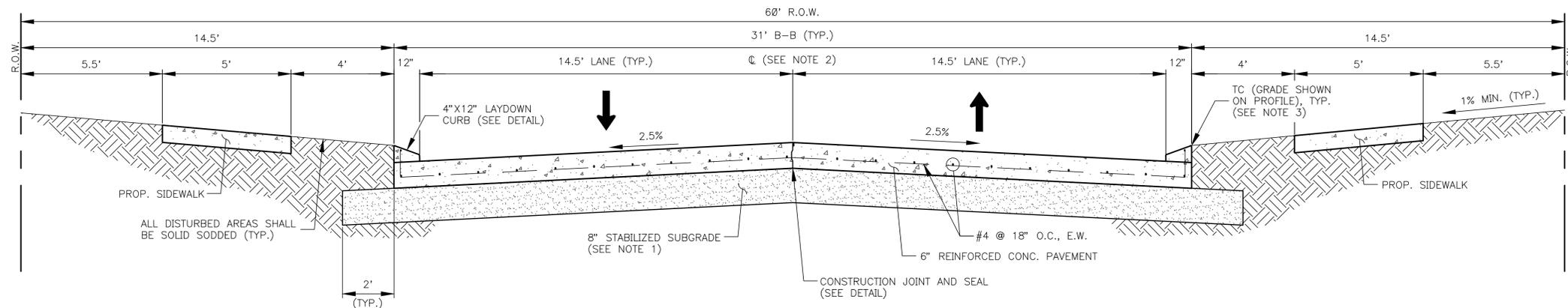
APPENDIX

CITY STANDARD CONSTRUCTION DETAILS



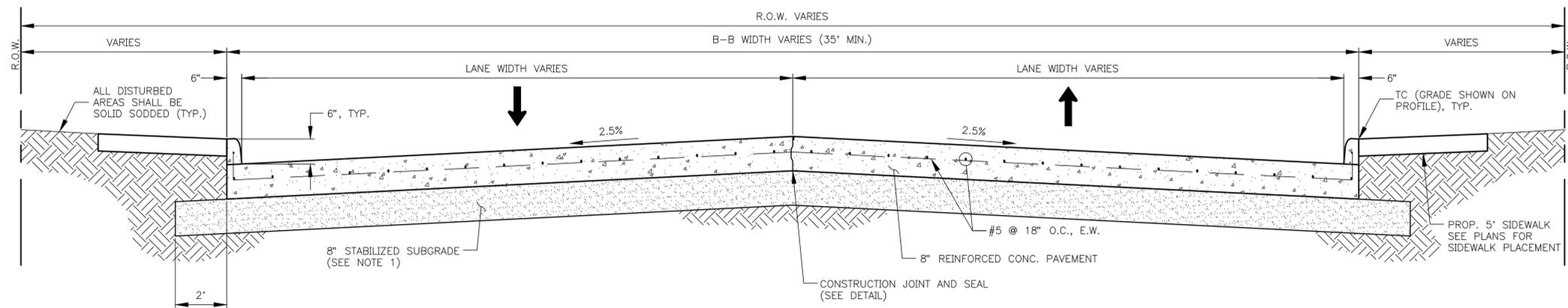
TYPICAL RESIDENTIAL 6" PAVEMENT SECTION WITH 6" CURBS

Scale: NTS



TYPICAL RESIDENTIAL 6" PAVEMENT SECTION WITH 4" LAYDOWN CURBS

Scale: NTS



TYPICAL 8" PAVEMENT SECTION

Scale: NTS

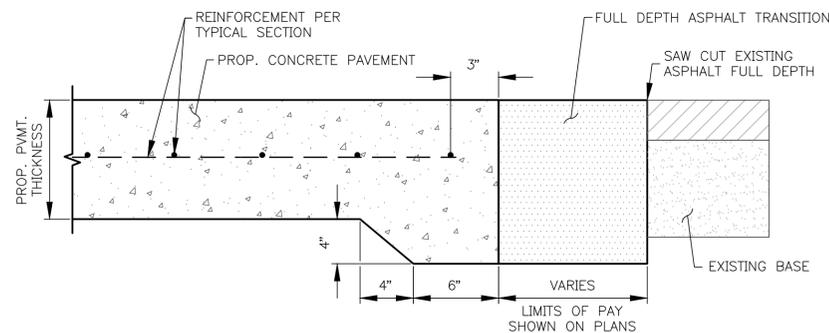
NOTES:

1. SUBGRADE SOILS SHALL BE STABILIZED TO A DEPTH OF AT LEAST 8 INCHES WITH MATERIAL (I.E. LIME, LIME-FLY ASH, OR CEMENT) AS RECOMMENDED BY THE GEOTECHNICAL ENGINEER. THE AMOUNT OF STABILIZATION MATERIAL SHALL BE CONFIRMED BY LAB TESTS AT THE TIME OF CONSTRUCTION.
2. THE BASELINE AS SHOWN ON THE PLANS DOES NOT ALWAYS REPRESENT THE CENTER OF PAVEMENT SECTION.
3. THE PROPOSED TOP OF CURB LINE SHOWN IN PROFILE REPRESENTS A 6 INCH CURB HEIGHT. THE GUTTER ELEVATION FOR BOTH 6" CURB AND 4" LAYDOWN CURB WILL BE CALCULATED BASED ON 6 INCH CURB HEIGHT.
4. ALL REINFORCING STEEL SHALL CONFORM TO A.S.T.M. DESIGNATION A-615, GRADE 60. MINIMUM LAP LENGTH SHALL BE 18".
5. THE LOCATION OF EXPANSION JOINTS MAY BE REQUIRED TO SUIT THE PROPOSED METHODS OF THE CONTRACTOR. THE MAXIMUM WIDTH BETWEEN TRANSVERSE EXPANSION JOINTS SHALL NOT EXCEED 60'-0".
6. CONTROL JOINTS SHALL BE SAW CUT A DEPTH OF ONE QUARTER OF PAVEMENT THICKNESS PLUS 1/2 INCH AND FILLED WITH JOINT SEALANT @ 20' MAXIMUM SPACING BETWEEN CONTROL JOINTS.

City of Humble, Texas

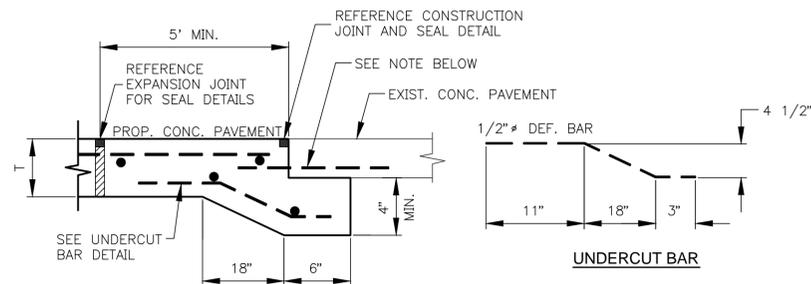
**City Standard Details
Paving Construction Details 1 of 4**

Job No.:	Scale:	SHEET
Date: March 2016	HORZ : N/A VERT : N/A	1
Dwn By:	One Inch	OF 16
Chkd By:	<small>If above mark does not measure one inch, then this diag. not to scale.</small>	



CONCRETE PAVING HEADER AT ASPHALT PAVING

NOT TO SCALE

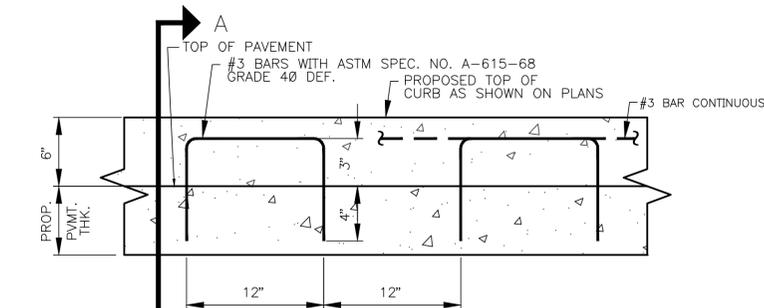


NOTES:
 PROVIDE 3/4" DIAMETER REINFORCING STEEL BAR, 20" LONG ON 12" CENTERS. DRILL AND EPOXY DOWEL 9" MIN. INTO EXISTING PAVEMENT WITH "PO ROC" OR EQUAL.

CONCRETE PAVING HEADER AT EXISTING CONCRETE PAVING

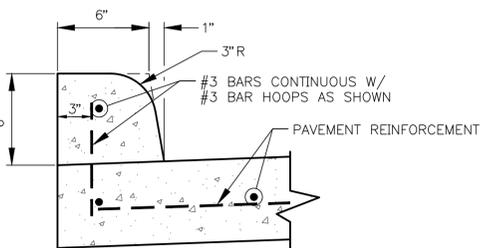
NOT TO SCALE

- GENERAL NOTES:
- ALL REINFORCING STEEL SHALL CONFORM TO A.S.T.M. DESIGNATION A-615, GRADE 60.
 - THE LOCATION OF EXPANSION JOINTS MAY BE REQUIRED TO SUIT THE PROPOSED METHODS OF THE CONTRACTOR. THE MAXIMUM WIDTH BETWEEN TRANSVERSE EXPANSION JOINTS SHALL NOT EXCEED 60'-0".
 - CONTROL JOINTS SHALL BE SAW CUT A DEPTH OF ONE QUARTER OF PAVEMENT THICKNESS PLUS 1/2 INCH AND FILLED WITH JOINT SEALANT @ 20' MAXIMUM SPACING BETWEEN CONTROL JOINTS.



BAR HOOP DETAIL

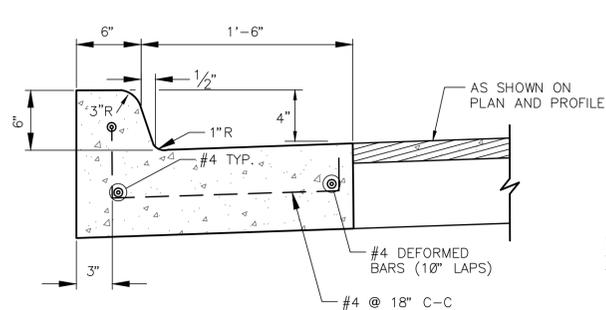
NOT TO SCALE



SECTION A-A

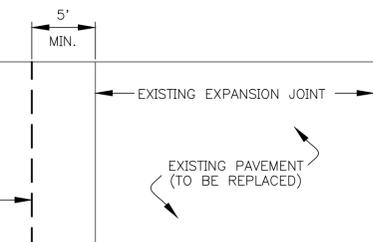
6" CONCRETE CURB NEW CONSTRUCTION

NOT TO SCALE

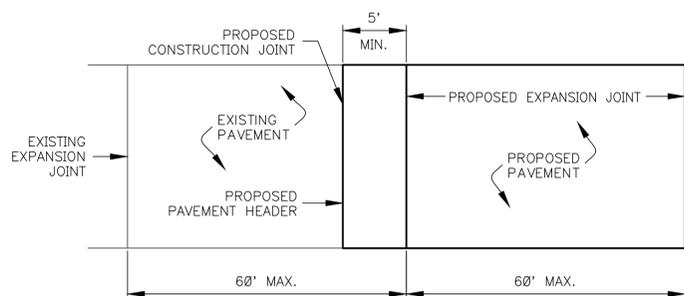


MONOLITHIC CURB AND GUTTER

NOT TO SCALE



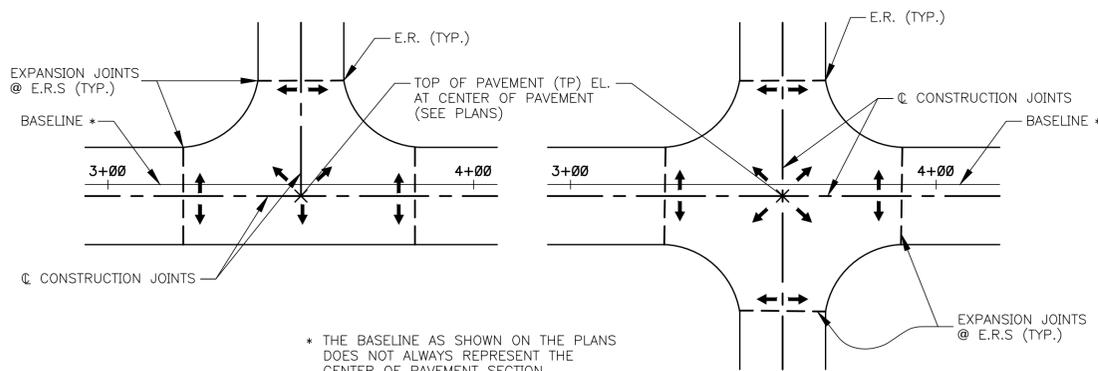
EXISTING



PROPOSED

PAVEMENT JOINT LOCATION DETAIL WHERE PROPOSED PAVEMENT MEETS EXISTING

NOT TO SCALE



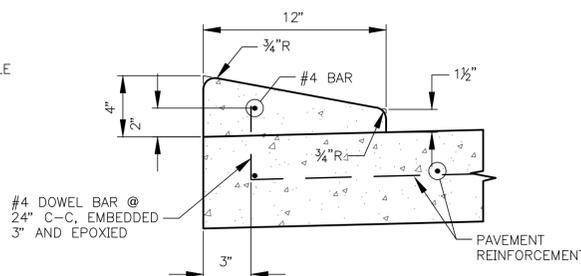
TYPICAL INTERSECTION JOINT LOCATION

NOT TO SCALE

* THE BASELINE AS SHOWN ON THE PLANS DOES NOT ALWAYS REPRESENT THE CENTER OF PAVEMENT SECTION

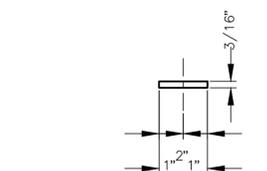
LAYDOWN CURB NOTES:

- TRANSITIONS FROM 6" CONCRETE CURB TO 4"x12" LAYDOWN CURB TO BE ACCOMPLISHED WITHIN 10 FEET, UNLESS OTHERWISE SHOWN.
- THE GUTTER ELEVATIONS FOR 6-INCH CONCRETE CURB IS CALCULATED FROM THE PROPOSED TOP OF CURB LINE ELEVATION SHOWN IN PROFILE MINUS 6-INCH CURB. THE GUTTER ELEVATION FOR LAYDOWN CURB WILL ALSO BE CALCULATED BASED ON 6-INCH CURB HEIGHT.



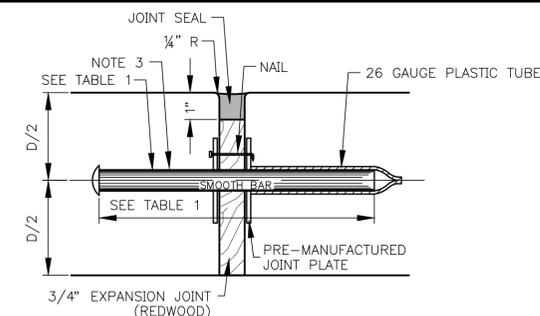
4"x12" LAYDOWN CURB

NOT TO SCALE



JOINT PLATE DETAIL

NOT TO SCALE



SECTION DOWEL TYPE EXPANSION JOINT

TABLE 1

PAVEMENT THICKNESS (IN)	DOWEL SIZES AND SPACINGS		
	DIAMETER (IN)	LENGTH (IN)	SPACING (IN)
6	3/4"	18	12
7	1	18	12
8	1 1/4	18	12

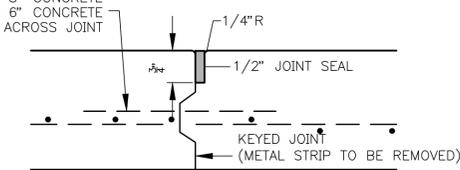
EXPANSION JOINT DETAILS

NOT TO SCALE

NOTES:

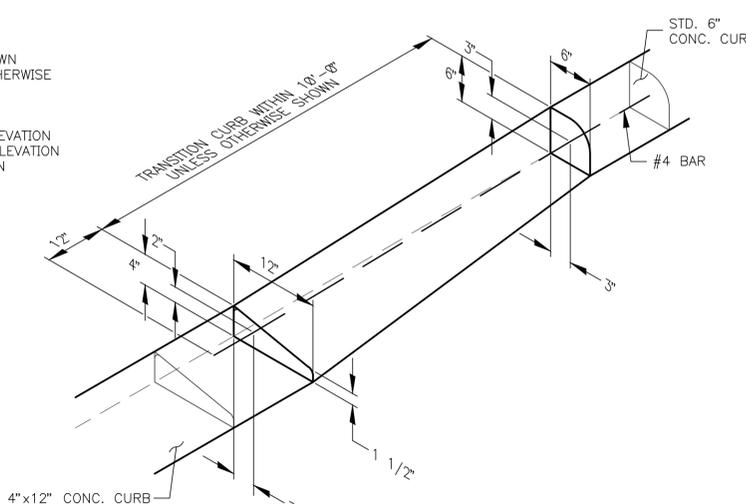
- STEEL TO MEET ASTM STANDARD SPECIFICATIONS FOR CONCRETE REINFORCING BARS. UNITS TO BE SPACED ON 12" CENTERS.
- EXPANSION JOINT TO BE PLACED AT THE END OF EACH CURB RADIUS AND SPACED AT A MAXIMUM DISTANCE OF 60 FEET.
- CENTER DOWEL HORIZONTALLY ON JOINT.
- CENTER DOWEL VERTICALLY IN CONCRETE BASE. EXTEND THICKENED CONCRETE AS NEEDED TO MAINTAIN 3" MIN. COVER.

USE #5 BARS - 36" LONG ON 18" C-C FOR 8" CONCRETE
 USE #4 BARS - 36" LONG ON 18" C-C FOR 6" CONCRETE
 TO TIE PAVEMENT REINFORCEMENT ACROSS JOINT



CONSTRUCTION JOINT AND SEAL DETAIL

NOT TO SCALE



TYPICAL CURB TRANSITION

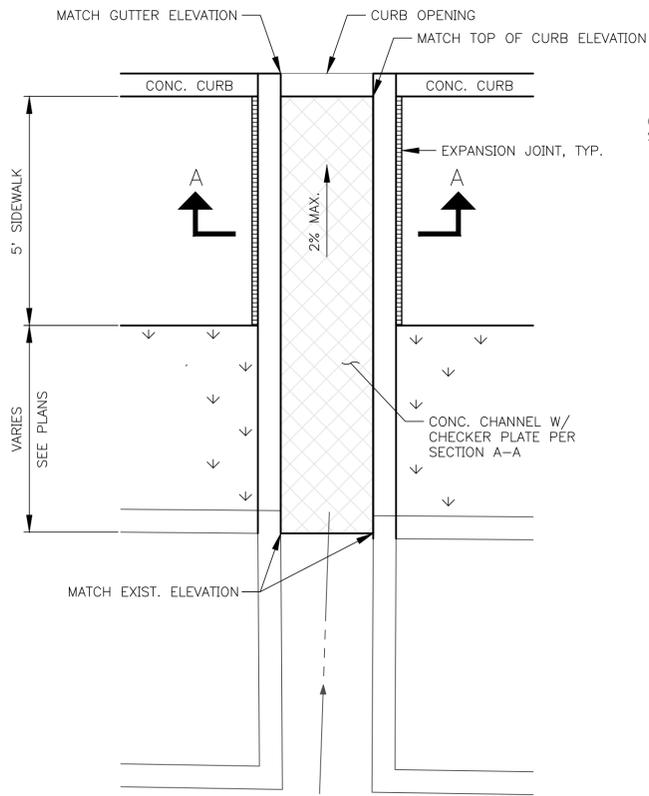
NOT TO SCALE

City of Humble, Texas

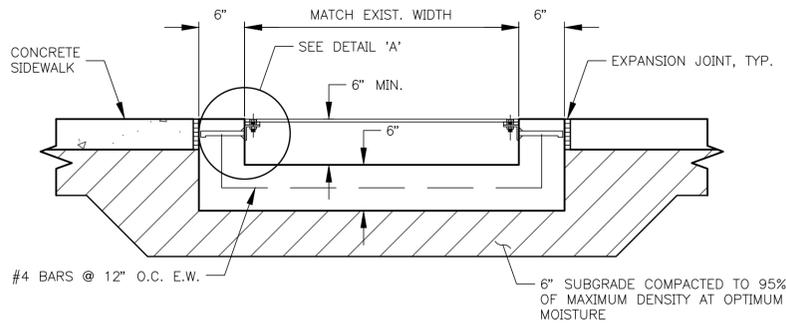
City Standard Details
 Paving Construction Details 2 of 4

Job No.:	Scale:	SHEET
Date: March 2016	HORZ : N/A	2
Dwn By:	VERT : N/A	OF 16
Chkd By:	One Inch	

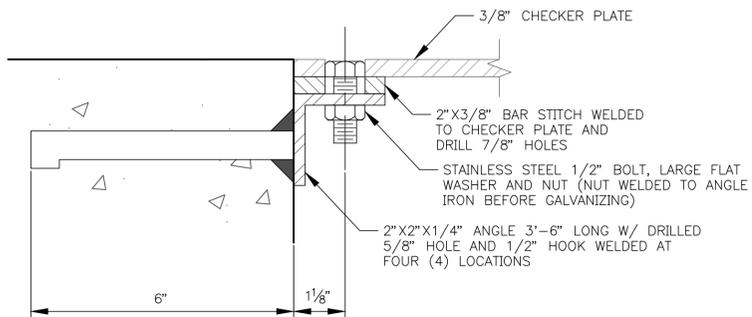
If above mark does not measure one inch, then this diag. not to scale



PLAN



SECTION A-A

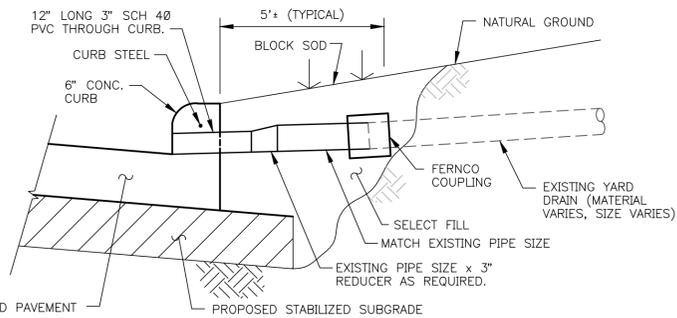


DETAIL "A"

- NOTES:**
1. ALL IRONWORK TO BE HOT DIPPED GALVANIZED EXCEPT AS NOTED.
 2. EIGHT 1 5/8" X 1 1/2" SLOTS PER PLATE.

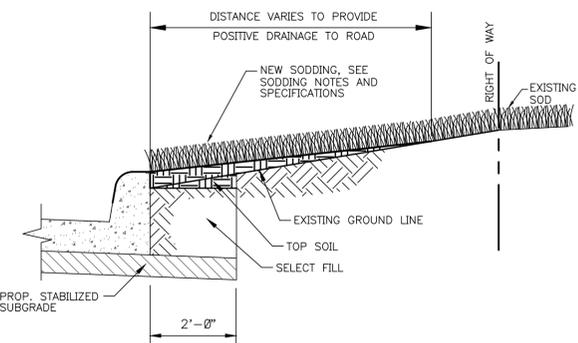
CHECKERPLATE DETAIL

NOT TO SCALE



YARD DRAIN CONNECTION DETAIL

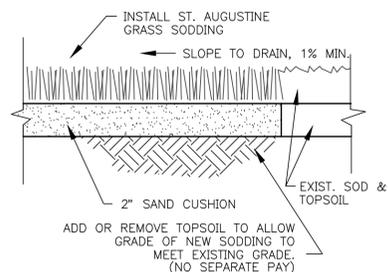
NOT TO SCALE



FILL BEHIND BACK OF CURB DETAIL

NOT TO SCALE

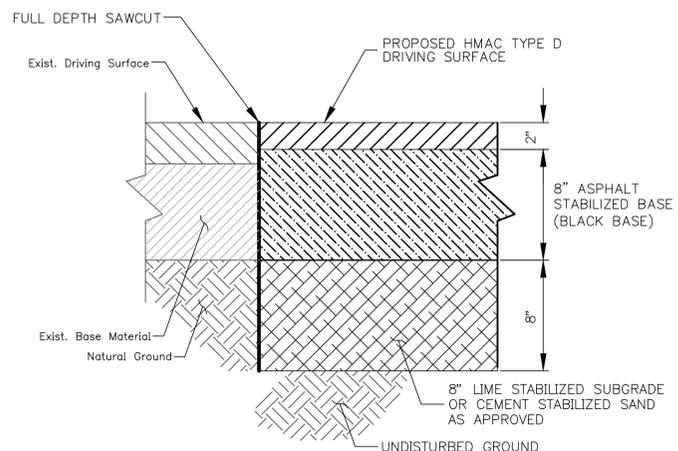
- SODDING NOTES:**
1. SODDING SHALL BE INSTALLED IN AREAS DISTURBED BY CONSTRUCTION.
 2. CONTRACTOR SHALL REPAIR SODDING IN AREAS DAMAGED BY CONSTRUCTION.
 3. IF EXISTING LANDSCAPING OTHER THAN GRASS IS WITHIN THESE AREAS, THE CONTRACTOR SHALL REBUILD OR REINSTALL THE LANDSCAPING OF THE AREA AFTER CONSTRUCTION IN AN EQUAL OR BETTER CONDITION.
 4. FILL BEHIND CURBS AND SODDING SHALL BE INCIDENTAL TO CONSTRUCTION COST.



- NOTES:**
1. SODDING SHALL BE ON AREAS DISTURBED BY CONSTRUCTION.
 2. SODDING LIMITS AT DITCHES SHALL BE THOSE AREAS DISTURBED BY THE GRADING PROCESS.
 3. CONTRACTOR TO REPAIR SODDING IN THE AREAS DAMAGED BY CONSTRUCTION AND SHALL BE CONSIDERED INCIDENTAL TO THE PROJECT COST.
 4. IN THE EVENT EXISTING LANDSCAPING OTHER THAN GRASS IS WITHIN THESE AREAS, THE CONTRACTOR SHALL REBUILD OR REINSTALL THE LANDSCAPING OF THE AREA AFTER CONSTRUCTION IN AN EQUAL OR BETTER CONDITION.

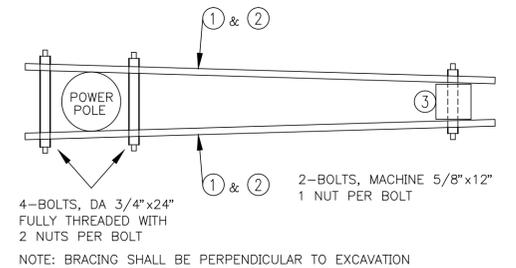
TYPICAL GRASS SODDING DETAILS

NOT TO SCALE

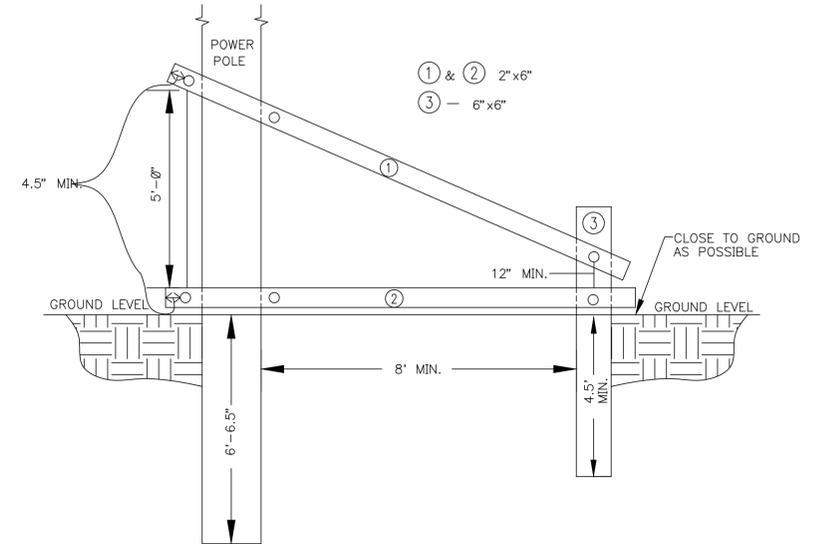


FULL DEPTH ASPHALT TRANSITION DETAIL

NOT TO SCALE



TOP VIEW



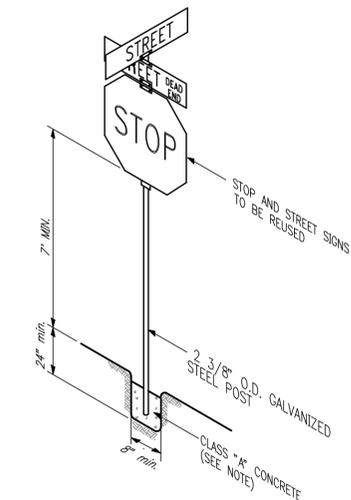
SIDE VIEW

TYPICAL DIAMETER ON POWER POLE BASE-18"

NOTE:
THE CONTRACTOR SHALL COORDINATE WITH THE POWER COMPANY AND OBTAIN APPROVAL PRIOR TO UTILIZING THIS DETAIL. THE CONTRACTOR SHALL MAKE APPROPRIATE CHANGES TO MEET POWER COMPANY REQUIREMENTS.

TEMPORARY POLE BRACING

NOT TO SCALE



- NOTE:**
1. ALL EXISTING SIGNS SHALL BE REMOVED AND RELOCATED OUTSIDE THE PROPOSED PAVEMENT.
 2. CONCRETE SHALL BE CONSIDERED INCIDENTAL TO THE PLACEMENT OF THE SIGN.

SIGN RELOCATION DETAIL

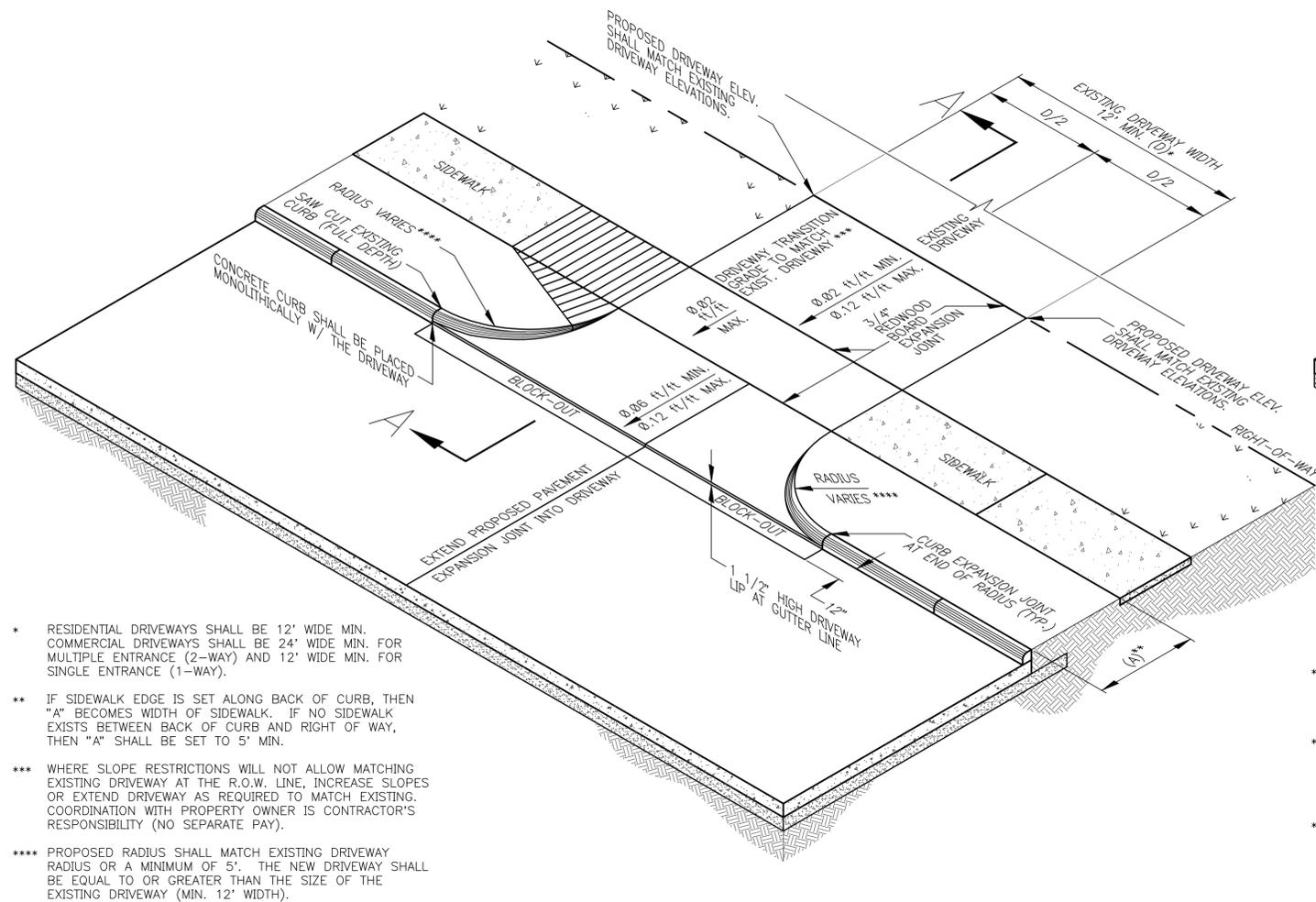
NOT TO SCALE

City of Humble, Texas

City Standard Details
Paving Construction Details 3 of 4

Job No.:	Scale:	SHEET
Date: March 2016	HORZ : N/A	3
Dwn By:	VERT : N/A	OF 16
Chkd By:	One Inch	

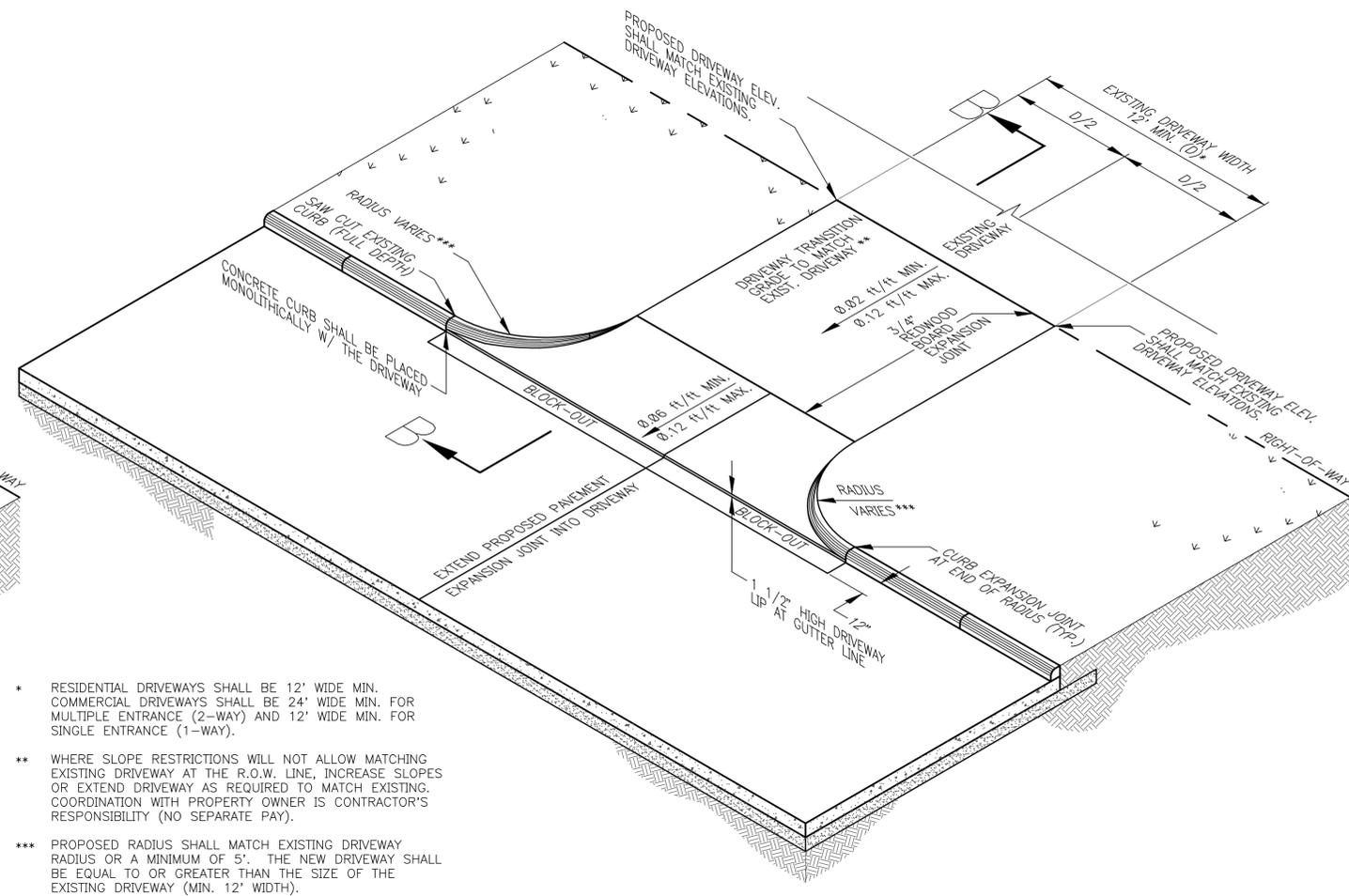
If above mark does not measure one inch, then this diag. not to scale.



- * RESIDENTIAL DRIVEWAYS SHALL BE 12' WIDE MIN. COMMERCIAL DRIVEWAYS SHALL BE 24' WIDE MIN. FOR MULTIPLE ENTRANCE (2-WAY) AND 12' WIDE MIN. FOR SINGLE ENTRANCE (1-WAY).
- ** IF SIDEWALK EDGE IS SET ALONG BACK OF CURB, THEN "A" BECOMES WIDTH OF SIDEWALK. IF NO SIDEWALK EXISTS BETWEEN BACK OF CURB AND RIGHT OF WAY, THEN "A" SHALL BE SET TO 5' MIN.
- *** WHERE SLOPE RESTRICTIONS WILL NOT ALLOW MATCHING EXISTING DRIVEWAY AT THE R.O.W. LINE, INCREASE SLOPES OR EXTEND DRIVEWAY AS REQUIRED TO MATCH EXISTING. COORDINATION WITH PROPERTY OWNER IS CONTRACTOR'S RESPONSIBILITY (NO SEPARATE PAY).
- **** PROPOSED RADIUS SHALL MATCH EXISTING DRIVEWAY RADIUS OR A MINIMUM OF 5'. THE NEW DRIVEWAY SHALL BE EQUAL TO OR GREATER THAN THE SIZE OF THE EXISTING DRIVEWAY (MIN. 12' WIDTH).

DRIVEWAY DETAIL WITH 6" CURB WITH SIDEWALK

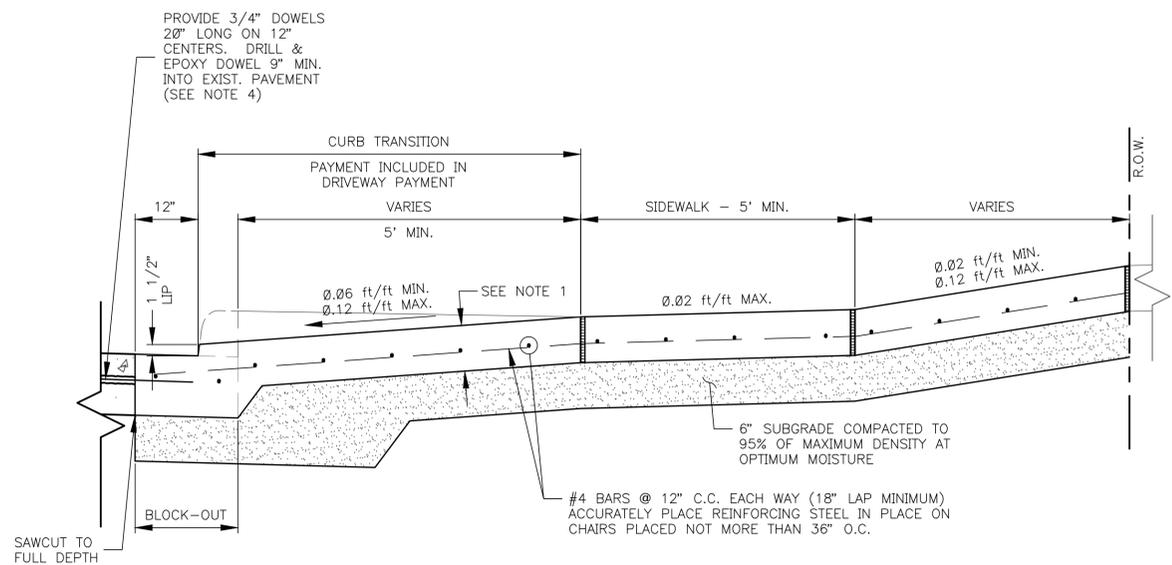
NOT TO SCALE



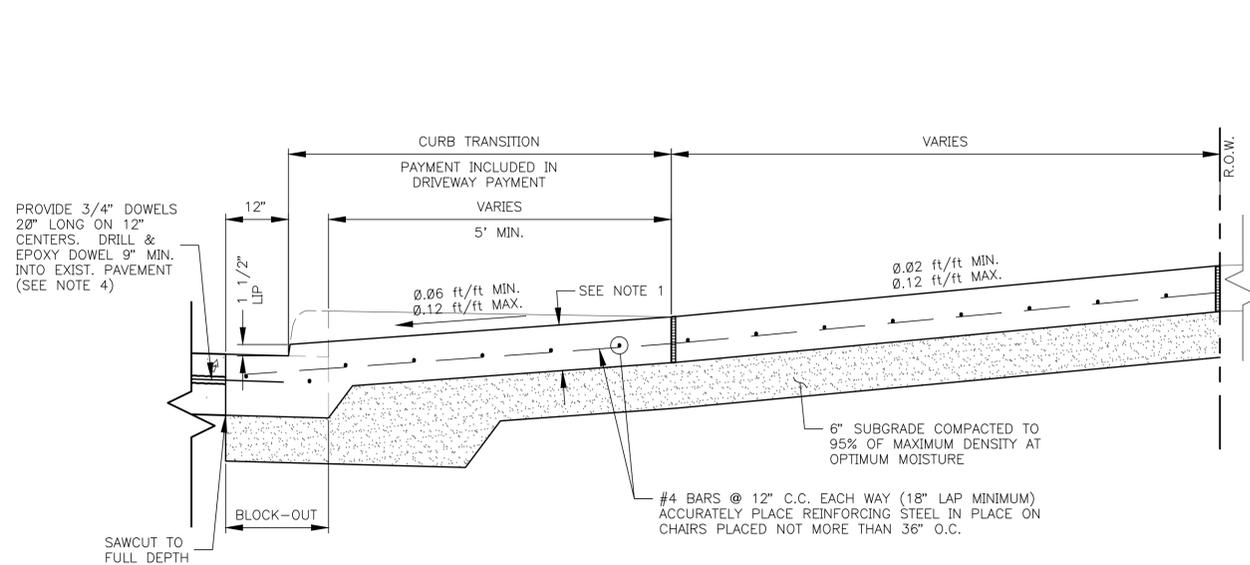
- * RESIDENTIAL DRIVEWAYS SHALL BE 12' WIDE MIN. COMMERCIAL DRIVEWAYS SHALL BE 24' WIDE MIN. FOR MULTIPLE ENTRANCE (2-WAY) AND 12' WIDE MIN. FOR SINGLE ENTRANCE (1-WAY).
- ** WHERE SLOPE RESTRICTIONS WILL NOT ALLOW MATCHING EXISTING DRIVEWAY AT THE R.O.W. LINE, INCREASE SLOPES OR EXTEND DRIVEWAY AS REQUIRED TO MATCH EXISTING. COORDINATION WITH PROPERTY OWNER IS CONTRACTOR'S RESPONSIBILITY (NO SEPARATE PAY).
- *** PROPOSED RADIUS SHALL MATCH EXISTING DRIVEWAY RADIUS OR A MINIMUM OF 5'. THE NEW DRIVEWAY SHALL BE EQUAL TO OR GREATER THAN THE SIZE OF THE EXISTING DRIVEWAY (MIN. 12' WIDTH).

DRIVEWAY DETAIL WITH 6" CURB WITHOUT SIDEWALK

NOT TO SCALE



SECTION A-A



SECTION B-B

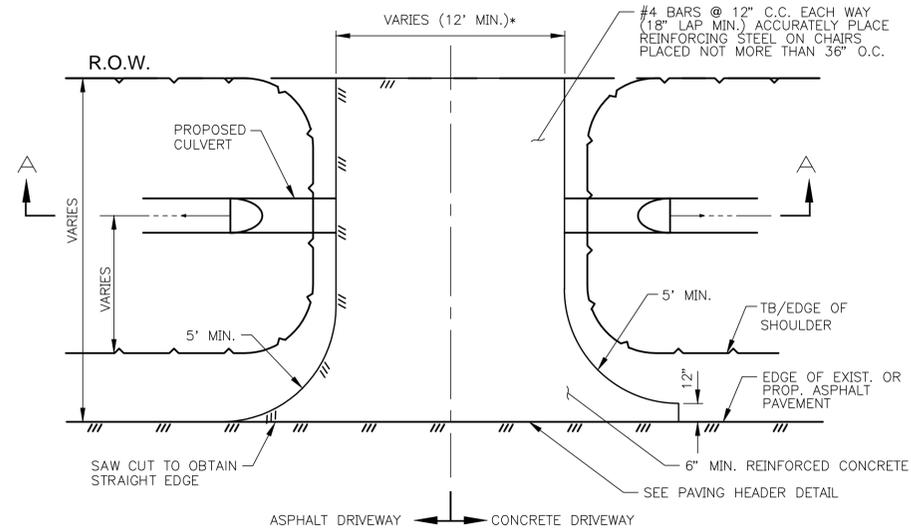
- NOTES:**
1. DRIVEWAYS SHALL BE 6" THICK FOR RESIDENTIAL USE AND 7" THICK FOR ALL OTHERS (I.E. COMMERCIAL, INDUSTRIAL, ETC.).
 2. 1 1/2" DRIVEWAY LIP MAY BE REDUCED TO OBTAIN POSITIVE DRAINAGE FROM THE DRIVEWAY TO PROPOSED GUTTER.
 3. MONOLITHIC CURB PLACED WITH DRIVEWAY SHALL BE INCIDENTAL TO THE DRIVEWAY AND WILL NOT BE MEASURED OR PAID SEPARATELY.
 4. IN THE EVENT THE EXISTING PAVEMENT INTEGRITY IS COMPROMISED OR SPALLING OCCURS DURING DRILLING OF DOWELS, OMIT PROPOSED DOWELS AND PROVIDE CONCRETE PAVEMENT HEADER WITH UNDERCUT PER DETAIL SHOWN ON CITY STANDARD PAVING CONSTRUCTION DETAILS SHEET 2 OF 4.

City of Humble, Texas

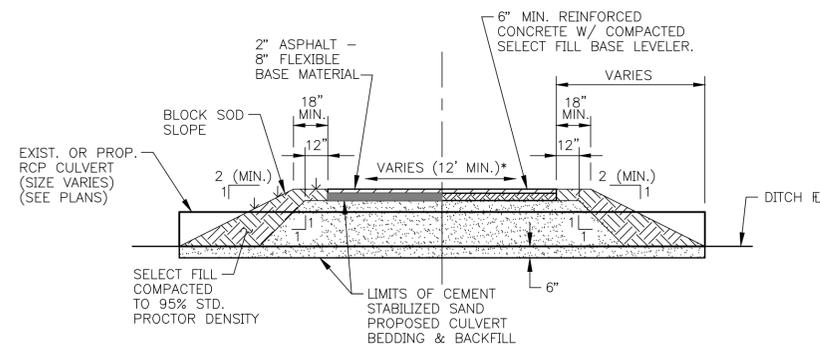
City Standard Details
Driveway Details 1 of 2

Job No.:	Scale:	SHEET
Date: March 2016	HORZ : N/A	5
Dwn By:	VERT : N/A	
Chkd By:	One Inch	OF 16

* RESIDENTIAL DRIVEWAYS SHALL BE 12' WIDE MIN.
 COMMERCIAL DRIVEWAYS SHALL BE 24' WIDE MIN. FOR
 MULTIPLE ENTRANCE (2-WAY) AND 12' WIDE MIN. FOR
 SINGLE ENTRANCE (1-WAY).



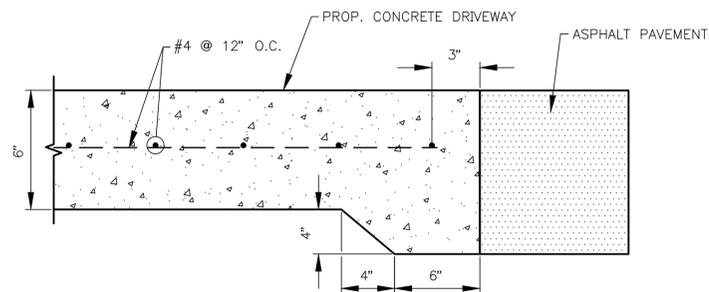
PLAN



SECTION A-A

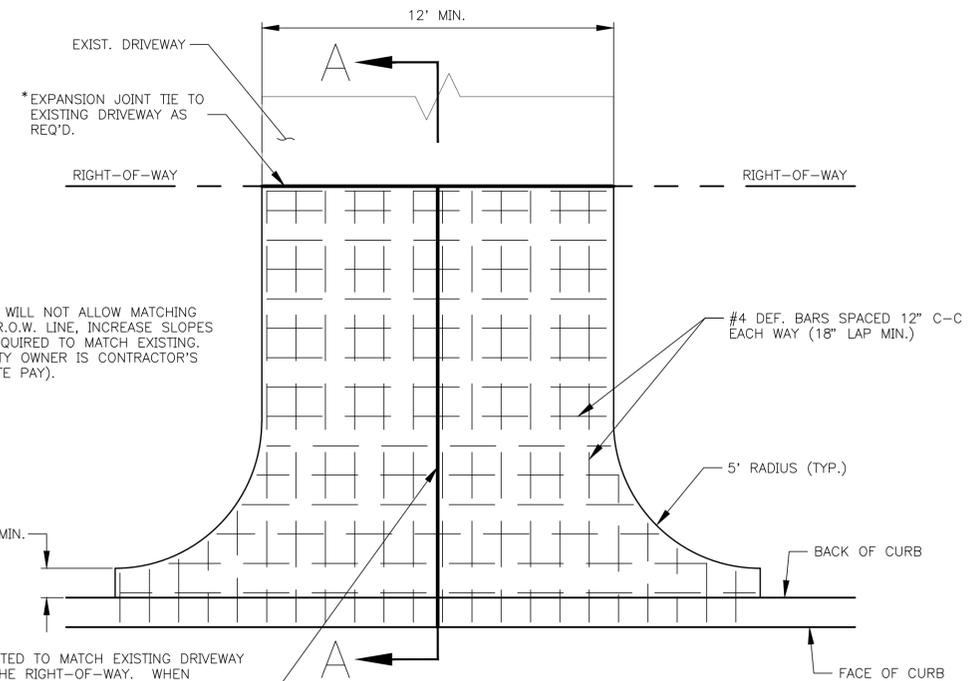
DRIVEWAY DETAIL AT ASPHALT PAVEMENT

NOT TO SCALE



CONCRETE PAVING HEADER AT ASPHALT PAVING FOR DRIVEWAYS

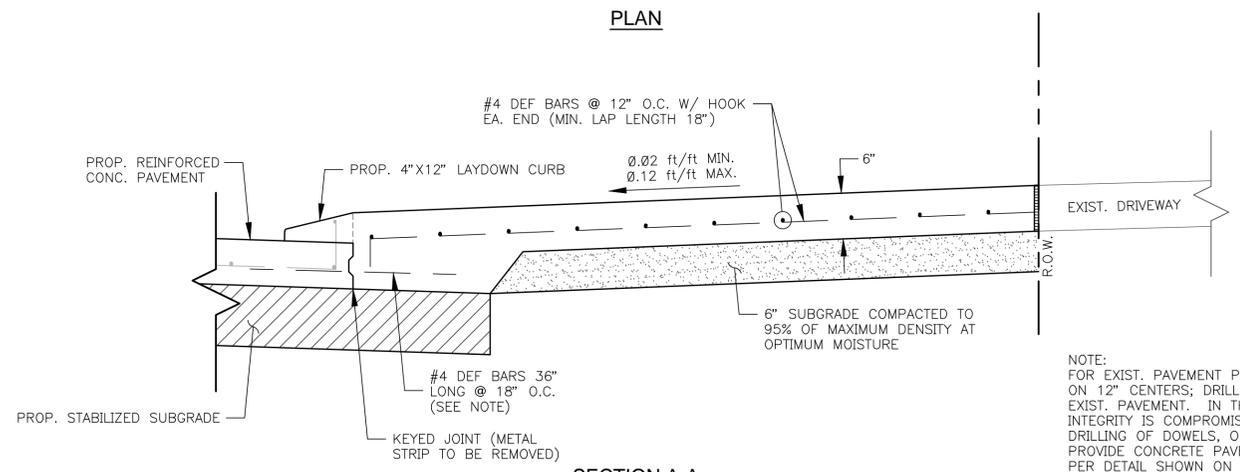
NOT TO SCALE



PLAN

* WHERE SLOPE RESTRICTIONS WILL NOT ALLOW MATCHING EXISTING DRIVEWAY AT THE R.O.W. LINE, INCREASE SLOPES OR EXTEND DRIVEWAY AS REQUIRED TO MATCH EXISTING. COORDINATION WITH PROPERTY OWNER IS CONTRACTOR'S RESPONSIBILITY (NO SEPARATE PAY).

DRIVEWAYS SHALL BE CONSTRUCTED TO MATCH EXISTING DRIVEWAY 12' MIN. WIDTH MEASURED AT THE R.O.W. LINE. WHEN DRIVEWAY EXCEEDS 20'-0" IN WIDTH, A 3/4" REDWOOD BOARD EXPANSION JOINT W/ STEEL RUNNING THROUGH IT, OR APPROVED APPROVED EQUAL, SHALL BE INSTALLED THE FULL LENGTH OF THE DRIVEWAY.



SECTION A-A

DRIVEWAY DETAIL WITH LAYDOWN CURB

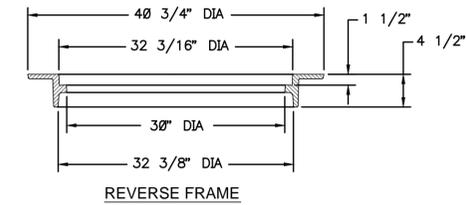
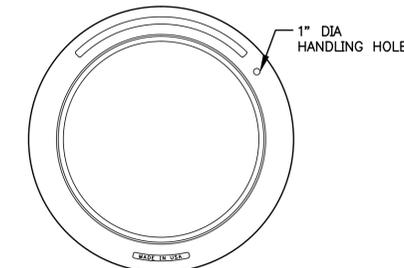
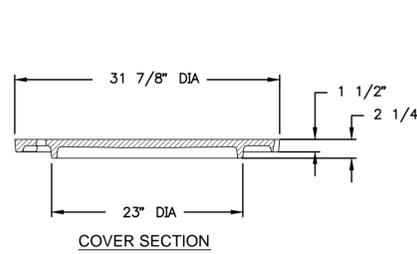
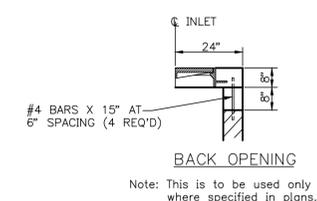
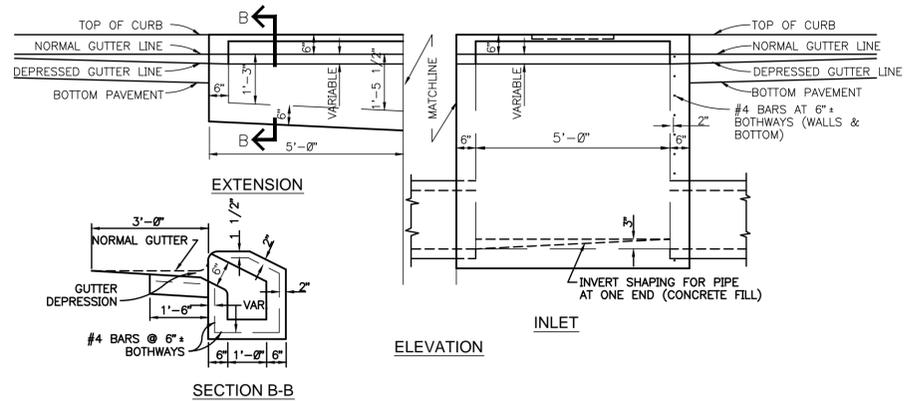
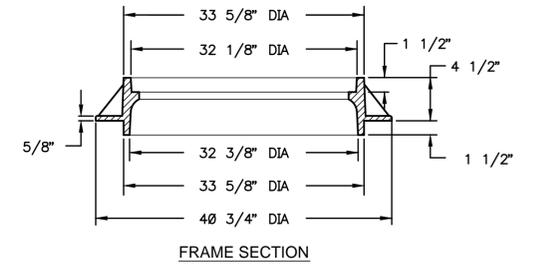
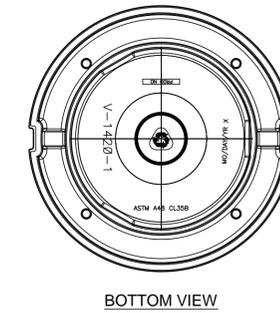
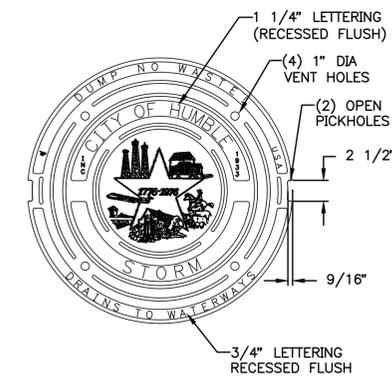
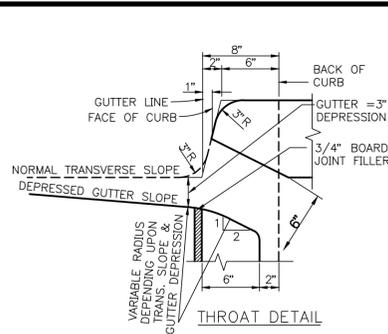
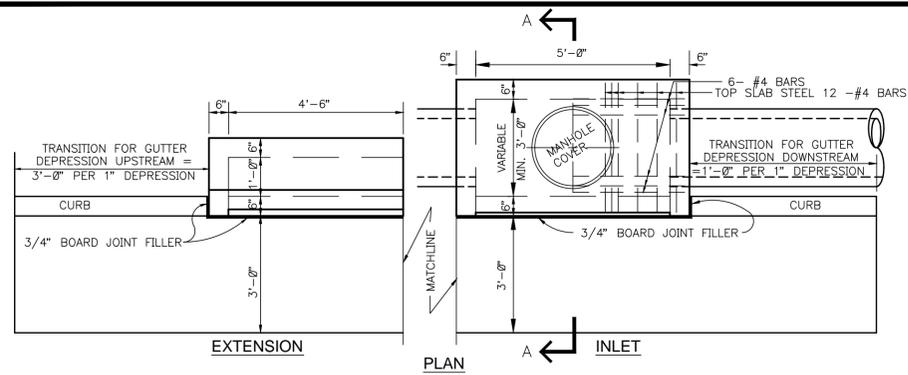
NOT TO SCALE

NOTE:
 FOR EXIST. PAVEMENT PROVIDE 3/4" DOWELS 20" LONG ON 12" CENTERS; DRILL & EPOXY DOWELS 9" MIN. INTO EXIST. PAVEMENT. IN THE EVENT THE EXISTING PAVEMENT INTEGRITY IS COMPROMISED OR SPALLING OCCURS DURING DRILLING OF DOWELS, OMIT PROPOSED DOWELS AND PROVIDE CONCRETE PAVEMENT HEADER WITH UNDERCUT PER DETAIL SHOWN ON CITY STANDARD PAVING CONSTRUCTION DETAILS SHEET 2 OF 4.

City of Humble, Texas

City Standard Details
 Driveway Details 2 of 2

Job No.:	Scale:	SHEET
Date: March 2016	HORZ : N/A VERT : N/A	6
Dwn By:	One Inch	OF 16
Chkd By:	If above mark does not measure one inch, then this diag. not to scale.	



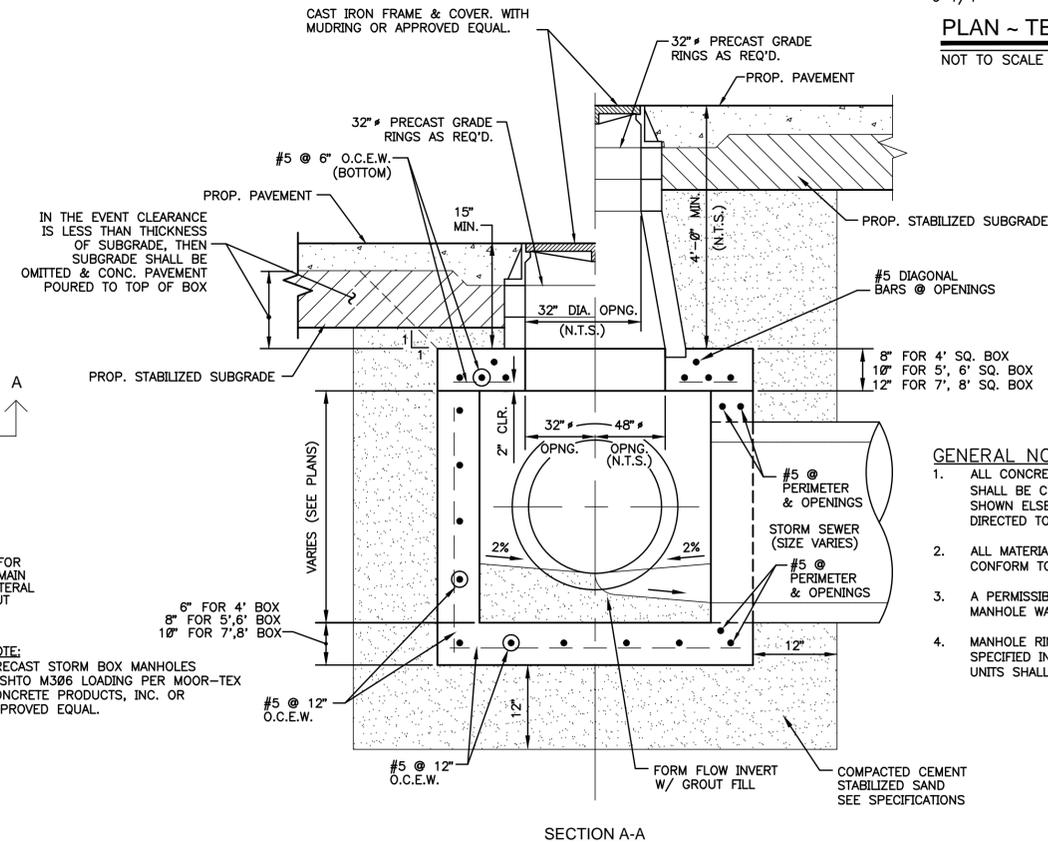
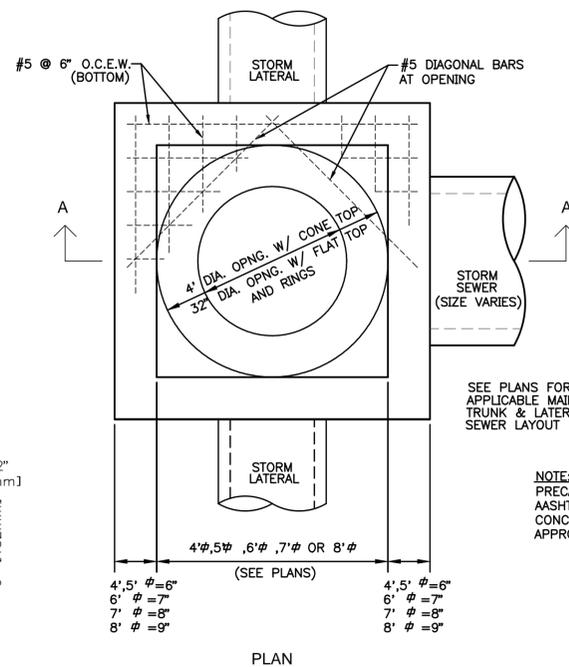
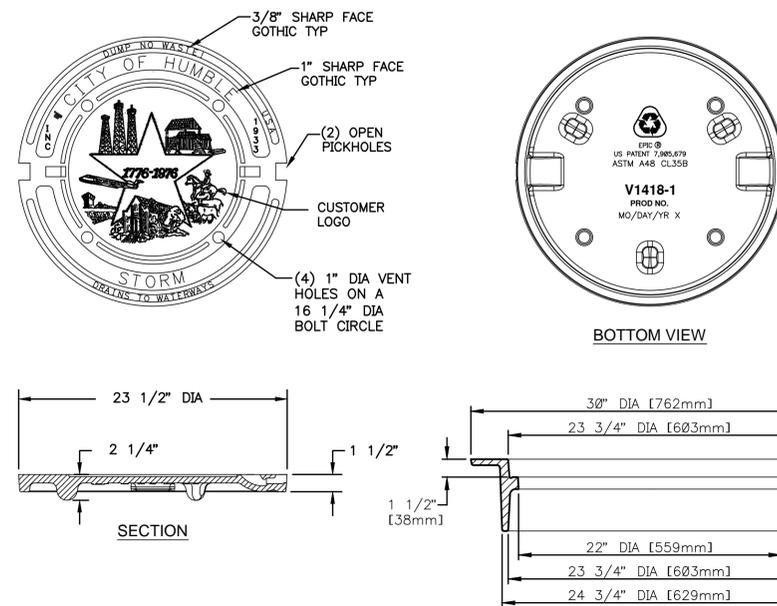
STORM MANHOLE FRAME & COVER
 NOT TO SCALE

GENERAL NOTES:

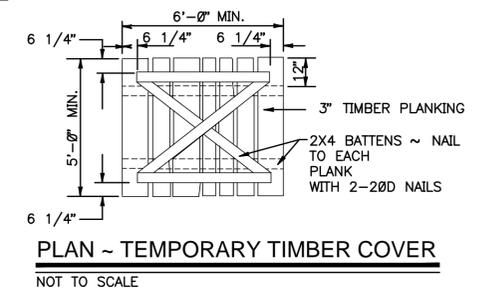
1. ALL CONCRETE SHALL BE CLASS A. ALL EXPOSED CORNERS SHALL BE CHAMFERED 3/4". PIPES SHALL ENTER INLETS AS SHOWN ELSEWHERE ON PLANS. SLOPE TOP OF INLETS AS DIRECTED TO MATCH GRADED SECTION.
2. ALL MATERIALS USED IN CASTING MANHOLE COVERS AND LADDER RUNG SHALL CONFORM TO A.S.T.M. SPECIFICATIONS.
3. A PERMISSIBLE CONSTRUCTION JOINT MAY BE PLACED IN THE INLET WALL WITH THE APPROVAL OF THE ENGINEER.
4. MANHOLE RING AND COVER SHALL BE 23 1/2" UNLESS OTHERWISE SPECIFIED IN THE PLANS. CONNECTION OF PIPES TO PRECAST UNITS SHALL BE GROUTED AS DIRECTED BY THE ENGINEER.
 * BUT NOT LESS THAN SIX INCHES OVER HIGHEST PIPE.
5. CONTROL POINTS FOR HORIZONTAL LAYOUT OF "C" INLETS, ALL TYPES, IS THE LATERAL CENTER OF THE INLET, WITHOUT REGARD FOR EXTENSIONS, AT THE BACK OF CURB.

- TYPE "C-1" INLET WITH ONE EXTENSION (5'-0" LONG)
 TYPE "C-2" INLET WITH ONE EXTENSION ON EACH SIDE
 TYPE "C-2A" INLET WITH DOUBLE EXTENSION (10'-0" LONG)

TYPE "C" INLET DETAILS
 NOT TO SCALE

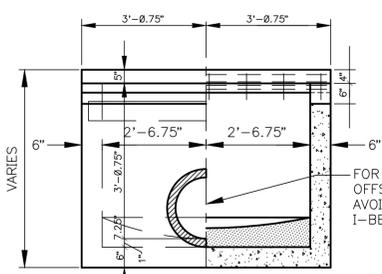


PRECAST STORM SEWER BOX MANHOLE
 NOT TO SCALE



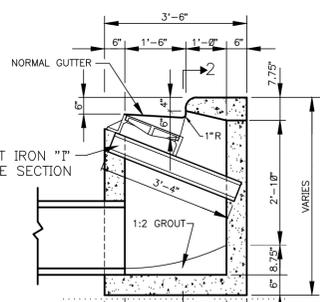
GENERAL NOTES:

1. ALL CONCRETE SHALL BE CLASS A. ALL EXPOSED CORNERS SHALL BE CHAMFERED 3/4". PIPES SHALL ENTER MANHOLE AS SHOWN ELSEWHERE ON PLANS. SLOPE TOP OF MANHOLE AS DIRECTED TO MATCH GRADED SECTION.
2. ALL MATERIALS USED IN CASTING MANHOLE COVERS SHALL CONFORM TO A.S.T.M. SPECIFICATIONS.
3. A PERMISSIBLE CONSTRUCTION JOINT MAY BE PLACED IN THE MANHOLE WALL WITH THE APPROVAL OF THE ENGINEER.
4. MANHOLE RING AND COVER SHALL BE 32" UNLESS OTHERWISE SPECIFIED IN THE PLANS. CONNECTION OF PIPES TO PRECAST UNITS SHALL BE GROUTED AS DIRECTED BY THE ENGINEER.



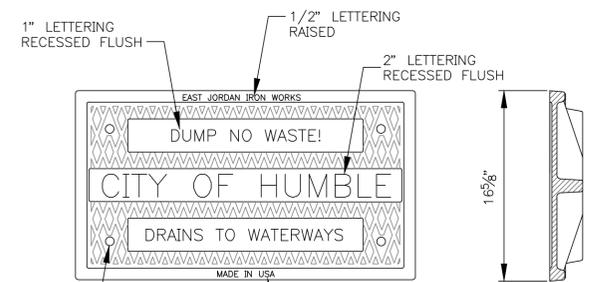
HALF FRONT ELEV. - HALF HORIZ. SECTION 2-2

No.	Size	Length	Shp.	Loc.
4	#4	8'-12"	SL	Horiz.
7	#3	1'-6"	BL	Vert.



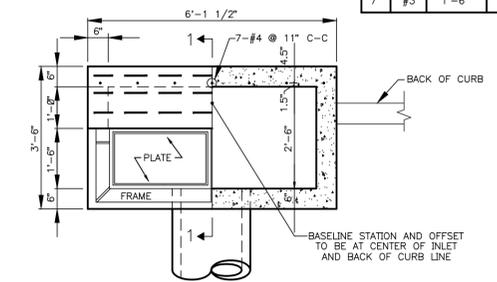
SECTION 1-1

SECTION THRU "I" BEAM

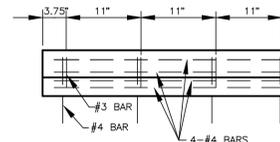


PLAN

COVER SECTION

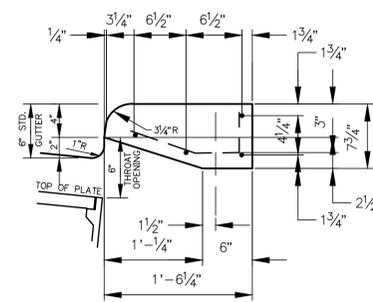


HALF PLAN - HALF HORIZ. SECTION

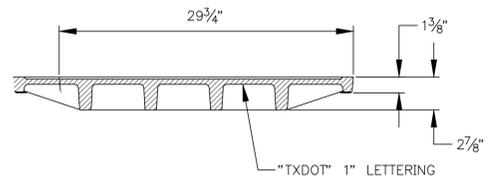


HALF FRONT ELEVATION

PRECAST CURB BEAM



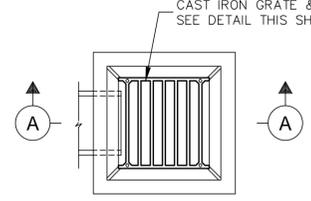
TRANS SECTION



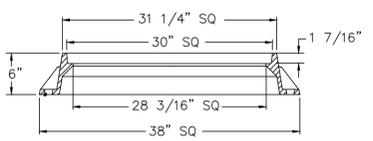
COVER SECTION

"B-B" INLET PLATE DETAILS

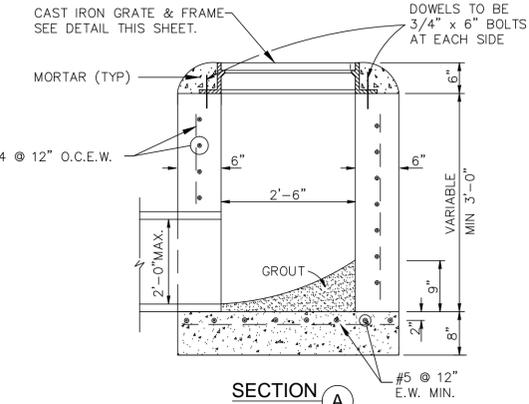
NOT TO SCALE



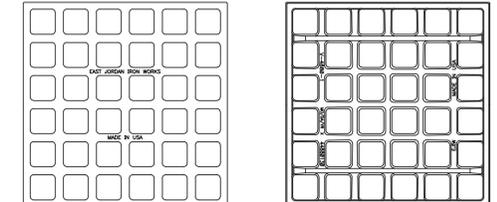
PLAN



FRAME SECTION



SECTION A



BOTTOM VIEW OF GRATE

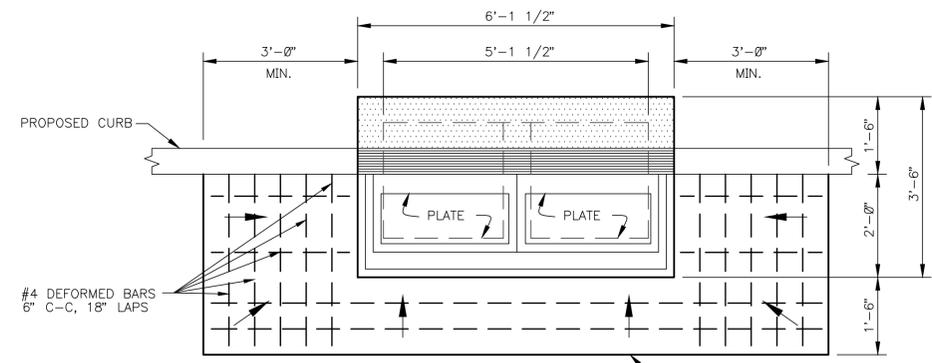
GRATE SECTION

TYPE "A" GRATE INLET DETAIL

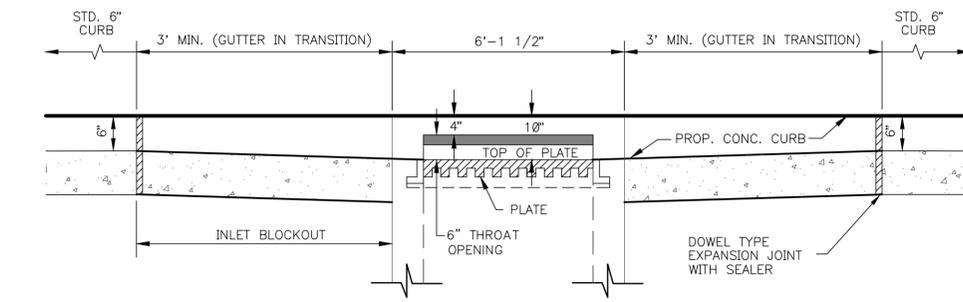
NOT TO SCALE

TYPE "B-B" INLET DETAILS

NOT TO SCALE

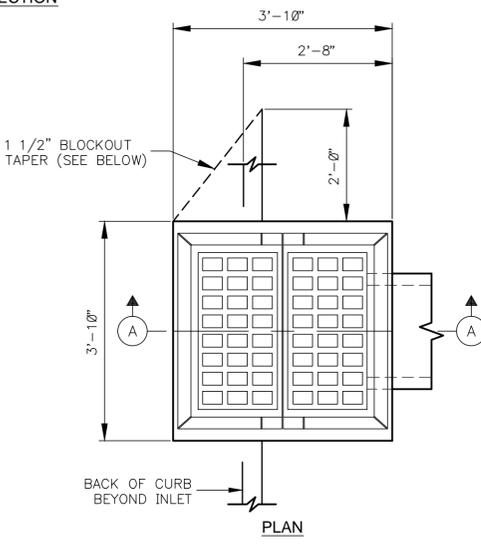


PLAN

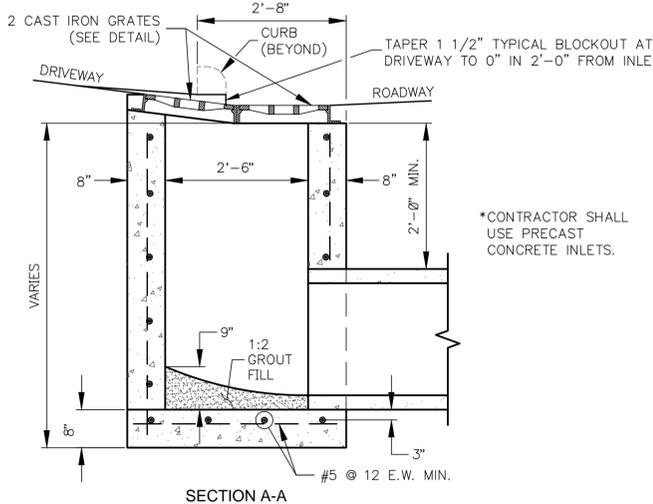


GUTTER DEPRESSIONS FOR TYPE B-B INLET

NOT TO SCALE



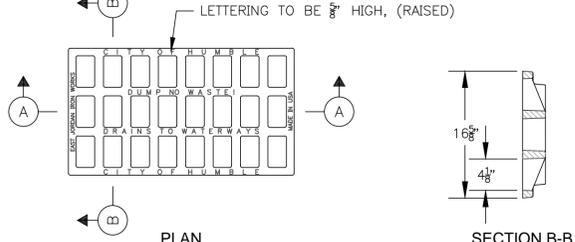
PLAN



SECTION A-A

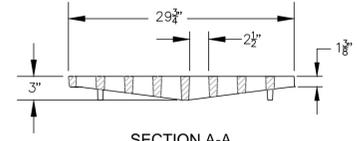
ALTERNATE TYPE B-B INLET WITH GRATE TOP

NOT TO SCALE



PLAN

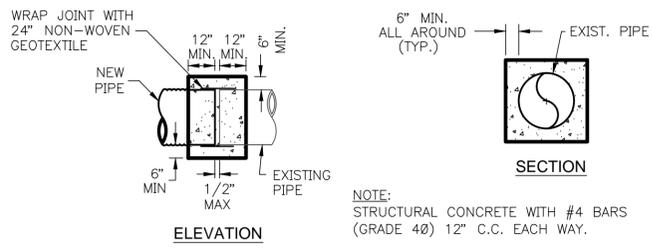
SECTION B-B



SECTION A-A

"BB" INLET GRATE DETAILS

NOT TO SCALE



ELEVATION

SECTION

TYP. CONC. COLLAR DETAIL

NOT TO SCALE

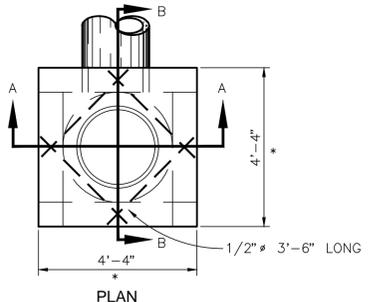
City of Humble, Texas

City Standard Details
Drainage Construction Details 2 of 3

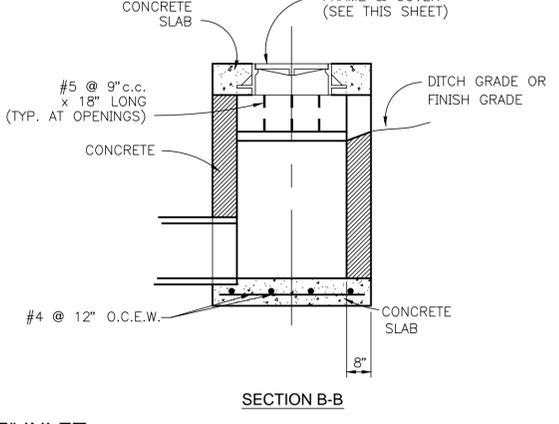
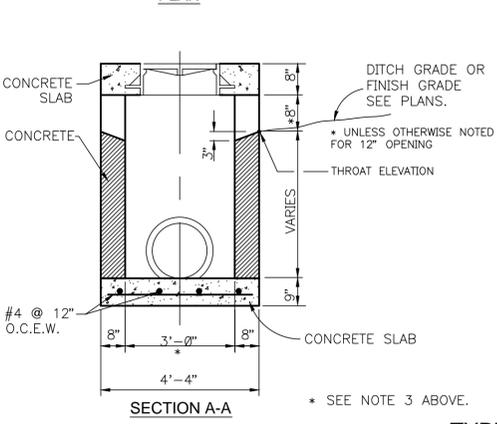
Job No.:	Scale:	SHEET
Date: March 2016	HORZ : N/A	8
Dwn By:	VERT : N/A	OF 16
Chkd By:	One Inch	

NOTE: STRUCTURAL CONCRETE WITH #4 BARS (GRADE 40) 12" C.C. EACH WAY.

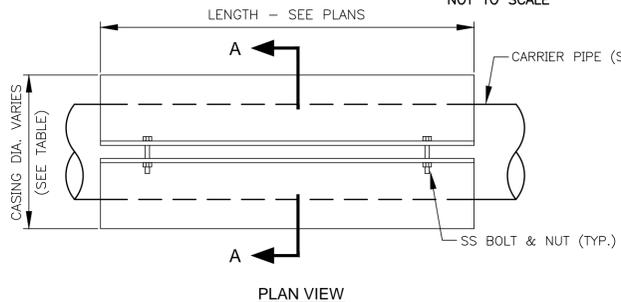
If above mark does not measure one inch, then this diag. not to scale.



- NOTES:
- IF PRECAST INLETS ARE NOT USED, INSTALL #4 REINFORCING BARS AT 6" O.C.E.W. IN WALLS.
 - WHERE SIZE OF PIPES PASSING THROUGH INLET EXCEEDS 30", INCREASE INSIDE WIDTH TO DIAMETER OF PIPE PLUS 1'-0" (O.D. + 1'-0")
 - WHERE INLETS ARE LOCATED ON BOX CULVERTS OR OTHER FLAT TOP STRUCTURES, MOUNT THEM PER MANWAY DETAIL WITH APPROXIMATELY SIZED SQUARE OPENING.

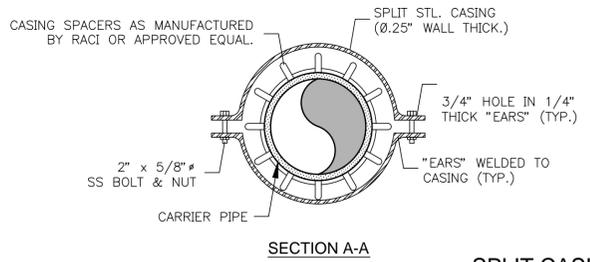


TYPE "E" INLET
NOT TO SCALE



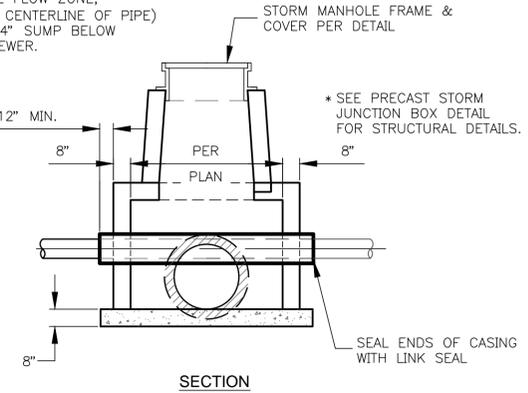
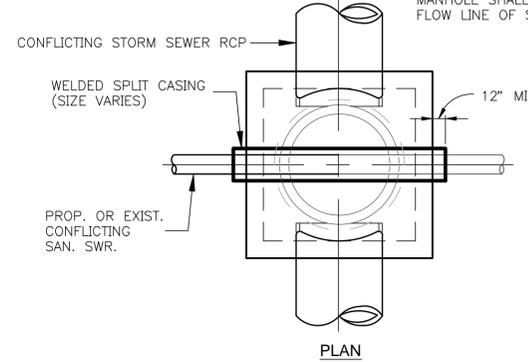
CASING TABLE		
CARRIER PIPE SIZE	SPLIT CASING SIZE	SPLIT CASING THK.
4"	10" (+6")	0.25"
6"	12" (+8")	0.25"
8"	16" (+10")	0.25"
10"	18" (+12")	0.25"
12"	20" (+14")	0.25"
16"	24" (+16")	0.25"

IN THE EVENT NO BELL JOINT OR OTHER OBSTRUCTION ON THE CARRIER PIPE FALLS WITHIN THE PROPOSED INSTALLATION LIMITS OF THE SPLIT CASING, SAID CASING SIZE MAYBE MINIMIZED AS SHOWN (*).

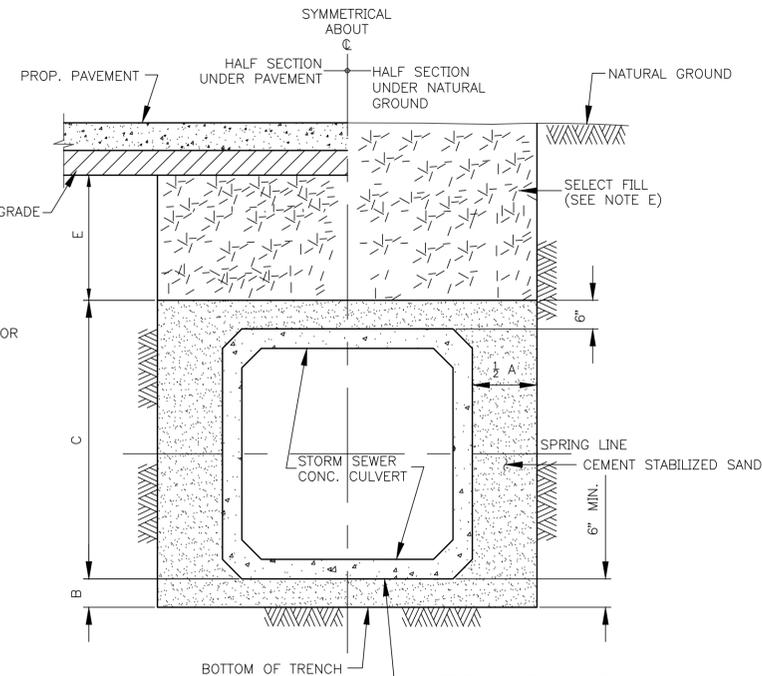


SPLIT CASING
NOT TO SCALE

* WHEN CONFLICTING UTILITY PIPE ENROACHES INTO STORM SEWER PIPE FLOW ZONE, (BETWEEN FLOW LINE & CENTERLINE OF PIPE) MANHOLE SHALL HAVE 24" SUMP BELOW FLOW LINE OF STORM SEWER.

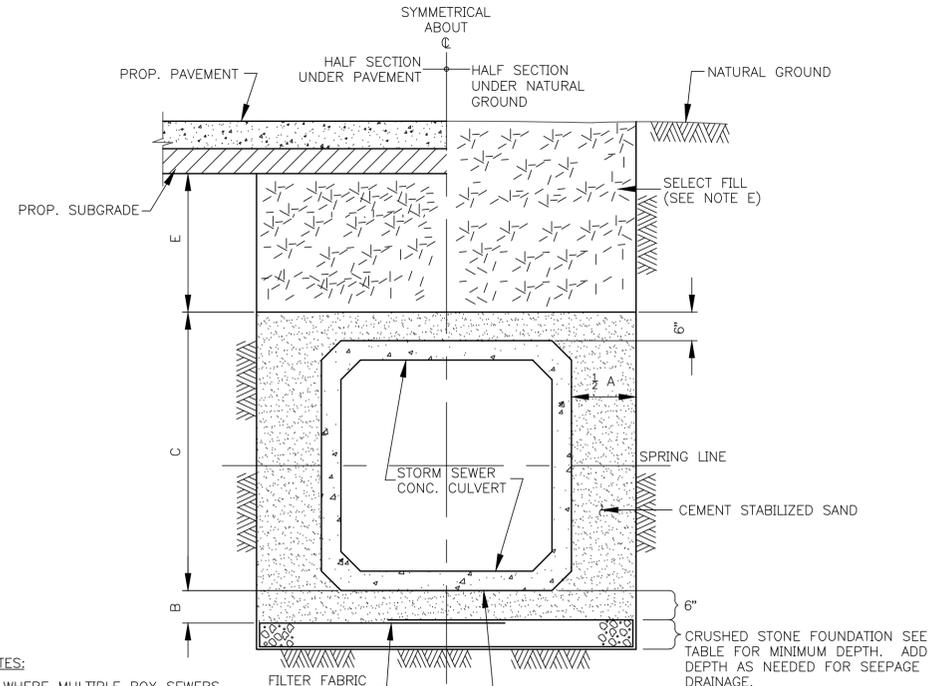


CONFLICT STORM SEWER MANHOLE
NOT TO SCALE



- NOTES:
- WHERE MULTIPLE BOX SEWERS ARE USED IN THE SAME TRENCH, MIN. OUTSIDE TO OUTSIDE BOX SEWER SEPARATION SHALL BE 6".
 - THIS DETAIL TO BE USED ONLY WHERE SOIL CONDITIONS ARE SATISFACTORY.

STORM SEWER BEDDING AND BACKFILL FOR PRECAST CONCRETE BOX WHERE SATISFACTORY SOIL CONDITIONS EXIST
NOT TO SCALE



- NOTES:
- WHERE MULTIPLE BOX SEWERS ARE USED IN THE SAME TRENCH, MIN. OUTSIDE TO OUTSIDE BOX SEWER SEPARATION SHALL BE 12".

PIPE SIZE (IN)	FOUNDATION DEPTH (IN)
3"x2' TO 6'x6'	12
6'x6' AND LARGER	18

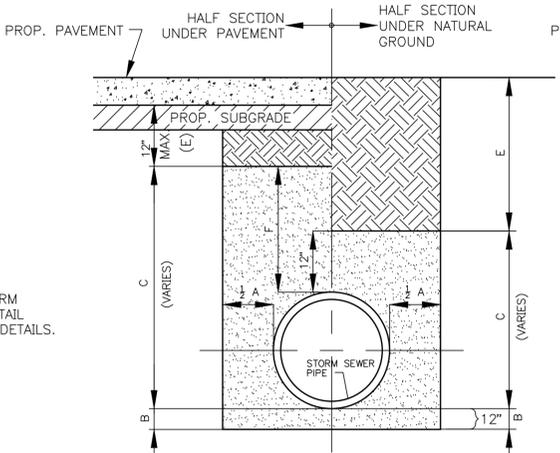
STORM SEWER BEDDING AND BACKFILL FOR PRECAST CONCRETE BOX WHERE UNSATISFACTORY SOIL CONDITIONS EXIST
NOT TO SCALE

BEDDING AND BACKFILL NOTES (APPLICABLE TO ALL DETAILS THIS SHEET):

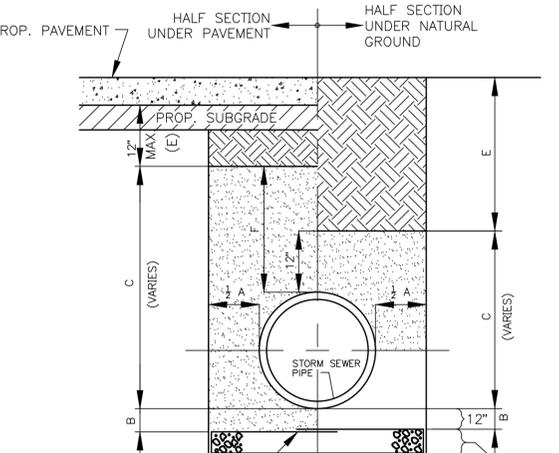
- MIN. TRENCH WIDTH SHALL BE PIPE O.D. PLUS AN ALLOWANCE "A" FOR THE NOMINAL PIPE SIZE:

NOMINAL PIPE SIZE	"A"
<18"	18"
18" TO 30"	24"
>30"	36"

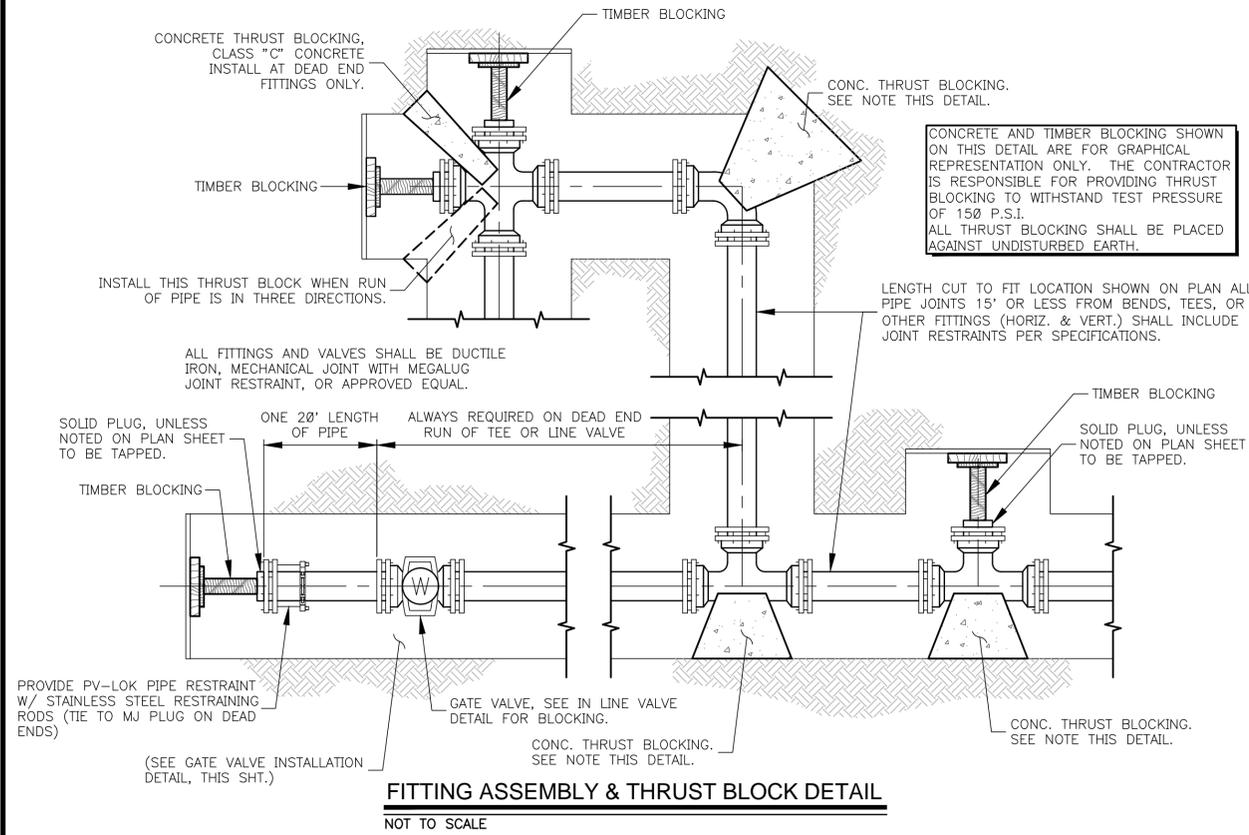
MAX TRENCH WIDTH SHALL NOT BE GREATER THAN MIN TRENCH WIDTH PLUS 24". UNLESS OTHERWISE NOTED.
IF OUTSIDE EDGE OF PIPE IS WITHIN 2' OF BACK OF CURB, BACKFILL SHALL BE PERFORMED AS UNDER PAVEMENT.
- CEMENT STABILIZED SAND (1.1 SACKS OF CEMENT PER TON, COMPACTED TO 95% OF MAX. STD. PROCTOR) PLACED BEFORE PIPE IS LAID UP TO FLOW LINE OF PIPE OR ABOVE- MINIMUM DEPTH = 6" (USE 12" FOR ROUND PIPE SIZES 24" AND LARGER).
- CEMENT STABILIZED SAND (AS SPECIFIED ABOVE) THOROUGHLY RODDED, PLACED AFTER PIPE IS LAID IN 8" LIFTS.
- COMPACTED BANK SAND BACKFILL, COMPACTED AS PER SPECIFICATIONS.
- SELECT EARTH BACKFILL WITH MAX LIQUID LIMIT OF 40, MIN. P.I. OF 7, MAX P.I. OF 20 CONTAINING NO ROCKS OR OTHER DEBRIS NOR CONTAINING ANY DIRT CLODS EXCEEDING 6" IN ANY DIMENSION. PLACED IN 6" LAYERS, MOISTENED IF NECESSARY AND THOROUGHLY COMPACTED TO 95% DENSITY AS DETERMINED BY ASTM D698, UNLESS OTHERWISE NOTED.
- CEMENT STABILIZED SAND TO ONE FOOT (1') BELOW BOTTOM OF PAVEMENT FOR PIPE SIZES 36" AND SMALLER. FOR PIPE SIZES 42" AND LARGER, TO 12" ABOVE TOP OF PIPE.
- MAX TRENCH WIDTH SHALL NOT BE GREATER THAN MIN TRENCH WIDTH PLUS 24". UNLESS OTHERWISE NOTED.
- IF OUTSIDE EDGE OF PIPE IS WITHIN 2' OF BACK OF CURB, BACKFILL SHALL BE PERFORMED AS UNDER PAVEMENT.



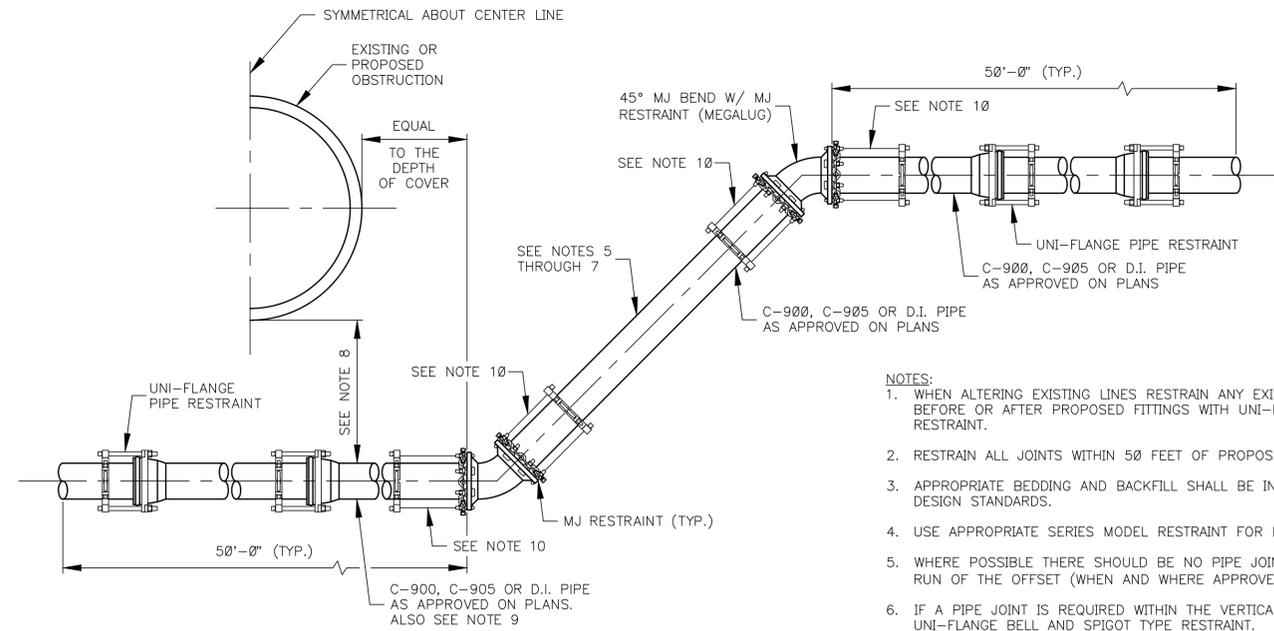
BEDDING AND BACKFILL DETAIL FOR STORM SEWER PIPES
NOT TO SCALE



WET CONDITION BEDDING
NOT TO SCALE

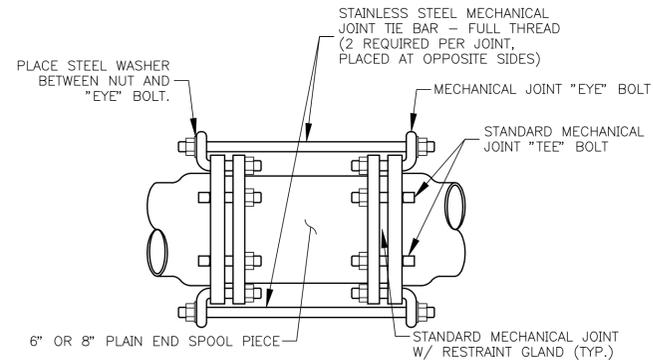


FITTING ASSEMBLY & THRUST BLOCK DETAIL
NOT TO SCALE

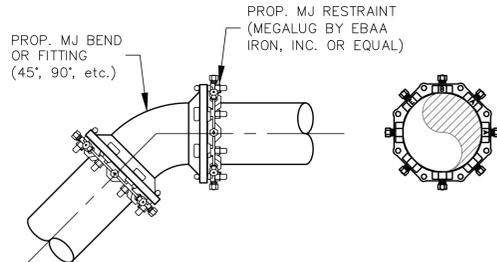


- NOTES:**
1. WHEN ALTERING EXISTING LINES RESTRAIN ANY EXISTING JOINTS EXPOSED BY CONSTRUCTION BEFORE OR AFTER PROPOSED FITTINGS WITH UNI-FLANGE BELL AND SPIGOT PIPE RESTRAINT.
 2. RESTRAIN ALL JOINTS WITHIN 50 FEET OF PROPOSED FITTINGS.
 3. APPROPRIATE BEDDING AND BACKFILL SHALL BE IN ACCORDANCE WITH THE DETAILS AND DESIGN STANDARDS.
 4. USE APPROPRIATE SERIES MODEL RESTRAINT FOR PIPE MATERIAL.
 5. WHERE POSSIBLE THERE SHOULD BE NO PIPE JOINTS WITHIN THE VERTICAL OR HORIZONTAL RUN OF THE OFFSET (WHEN AND WHERE APPROVED SEE NOTE 6 AND 7).
 6. IF A PIPE JOINT IS REQUIRED WITHIN THE VERTICAL OFFSET IT SHALL BE RESTRAINED WITH UNI-FLANGE BELL AND SPIGOT TYPE RESTRAINT.
 7. WHEN DEPTH OF OFFSET REQUIRES MORE THAN A STANDARD LENGTH OF PIPE NO SEGMENT SHALL BE LESS THAN 5' IN LENGTH.
 8. THE MINIMUM CLEARANCE SHALL BE DETERMINED BY THE AMOUNT OF BEDDING AND BACKFILL REQUIRED BY THE PROSPECTIVE PIPE AND THEIR USAGE. SEE THE BEDDING AND BACKFILL DETAILS FOR DIMENSIONS.
 9. A SOLID CONTINUOUS JOINT OF PIPE SHALL BE USED AT ALL TIMES FOR THE HORIZONTAL SECTION OF THE OFFSET.
 10. INSTALL STAINLESS STEEL RESTRAINING RODS FROM 45° MJ BEND TO ADJACENT MJ FITTING OR VALVE. IF NO FITTING OR VALVE EXISTS, INSTALL PV-LOK PIPE RESTRAINT OR APPROVED EQUAL.

RESTRAINED MECHANICAL JOINT VERTICAL OFFSET
NOT TO SCALE



MECHANICAL RESTRAINT W/ RESTRAINING RODS
NOT TO SCALE

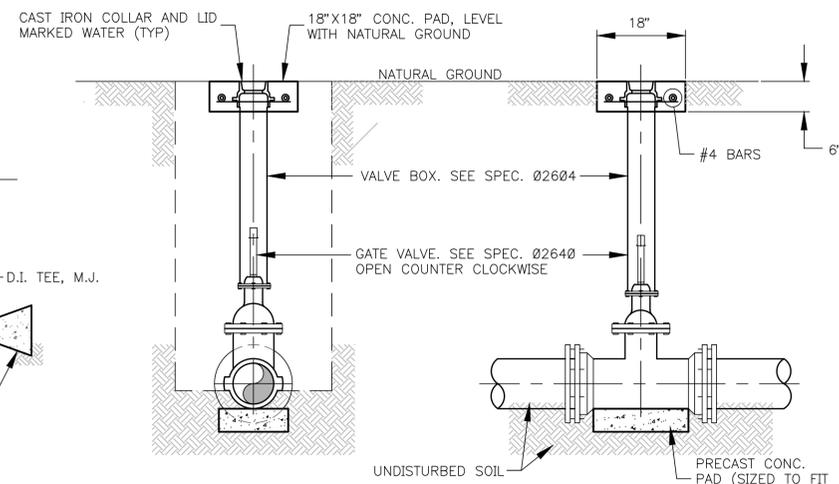
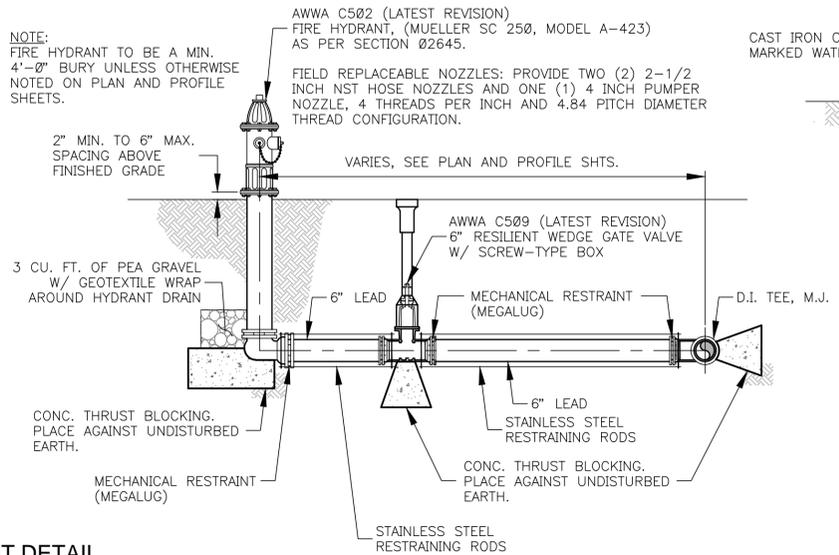


MECHANICAL JOINT RESTRAINT
NOT TO SCALE

FIRE HYDRANT NOTES:

1. ALL FIRE HYDRANTS SHALL CONFORM TO CITY OF HUMBLE FIRE DEPARTMENT REQUIREMENTS.
2. ALL FIRE HYDRANTS SHALL BE LOCATED 3' BACK OF CURB FOR CURB AND GUTTER STREETS AND 3' INSIDE RIGHT-OF-WAY (2' ABSOLUTE MIN.) FOR ROADSIDE DITCH STREETS.
3. FIRE HYDRANTS SHOWN AT INTERSECTIONS SHALL BE LOCATED AT THE CURB RETURN FOR CURB AND GUTTER STREETS AND AT THE PROPERTY CORNER FOR ROADSIDE DITCH STREETS UNLESS OTHERWISE SHOWN ON PLANS AND APPROVED BY OWNER.
4. ALL FIRE HYDRANTS SHALL HAVE A MINIMUM OF 5'-0" LEAD PIPE. LEAD PIPES SHALL NOT EXCEED 100' IN LENGTH AND SHALL HAVE NO VERTICAL OR HORIZONTAL BENDS.
5. EACH FIRE HYDRANT LEAD SHALL HAVE A VALVE, PER SPECIFICATIONS, BEING EITHER A GATE VALVE WITH A TEE CONNECTION TO THE MAIN OR A TAPPING SLEEVE AND VALVE CONNECTION TO THE MAIN.
6. VALVES SHALL NOT BE LOCATED AT THE FLOWLINE OF ANY DITCH.
7. NEW FIRE HYDRANTS REPLACING THOSE TO BE SALVAGED SHALL BE PLACED 2'+ EITHER SIDE OF THE EXISTING.
8. FIRE HYDRANTS SHALL BE SPACED AT APPROXIMATELY 500' FOR RESIDENTIAL AREAS AND 300' FOR COMMERCIAL AREAS.
9. FIRE HYDRANTS LOCATED IN AREAS OTHER THAN INTERSECTIONS SHALL BE LOCATED AT SIDE OF LOT LINES, UNLESS SHOWN OTHERWISE ON PLANS AND APPROVED BY OWNER.
10. NEW FIRE HYDRANTS SHALL BE LOCATED IN ALL AREAS WHERE EXISTING FIRE HYDRANTS ARE TO BE SALVAGED.
11. IN THE EVENT THAT A PROPOSED FIRE HYDRANT CANNOT BE LOCATED IN AREA DESCRIBED AS TYPICAL, ULTIMATE LOCATION OF FIRE HYDRANTS SHALL BE AS DETERMINED BY OWNER.
12. NEW FIRE HYDRANTS SHALL BE SET PLUMB AND LEVEL.

STANDARD FIRE HYDRANT DETAIL
NOT TO SCALE



FRONT ELEVATION
SIDE ELEVATION
GATE VALVE INSTALLATION DETAIL
NOT TO SCALE

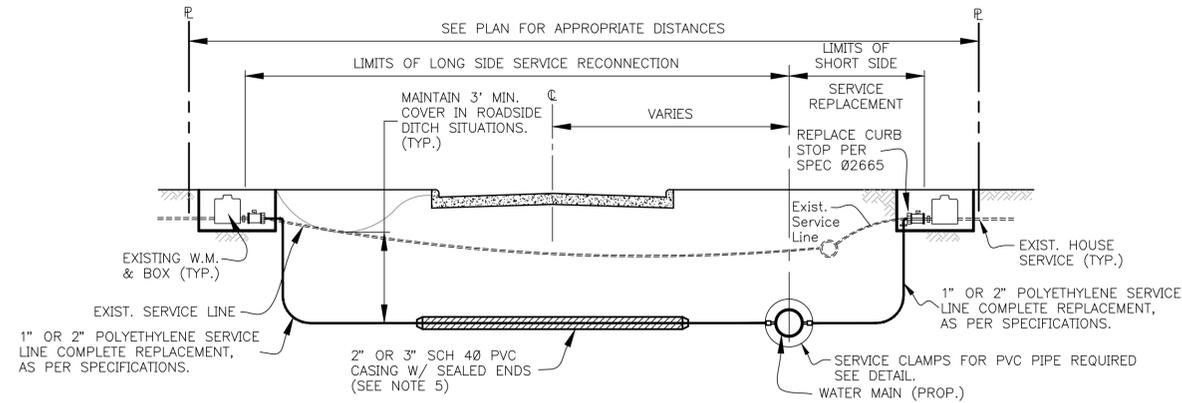
City of Humble, Texas

City Standard Details

Water Line Construction Details 1 of 3

Job No.:	Scale:	SHEET
Date: March 2016	HORZ : N/A	10
Dwn By:	VERT : N/A	OF 16
Chkd By:	One Inch	

If above mark does not measure one inch, then this diag. not to scale



TYPICAL RESIDENTIAL SERVICE RECONNECTION
NOT TO SCALE

NOTES:

1. TAPS MUST BE SPACED A MIN. OF ONE FOOT APART WHEN STAGGERED ON OPPOSITE SIDE OF THE WATERLINE, AND MUST BE SPACED A MIN. OF TWO FEET APART WHEN ON SAME SIDE OF WATERLINE.
2. FIELD VERIFY SIZE AND LINE TYPE (COPPER, GALV. STL., PLASTIC, ETC.) OF EXIST. FOR THE PROPER CONNECTION TO CURB STOPS AND FOR APPROPRIATE PACK JOINT COUPLING IF APPLICABLE.
3. INSTALL ALL SERVICE LINE RECONNECTS OR NEW SERVICE PERPENDICULAR TO PROPOSED MAINLINE.
4. NEW OR MODIFICATION TO LONG SIDE SERVICE TO BE AUGERED UNDER PAVEMENT UNLESS APPROVED IN WRITING BY THE CITY OF HUMBLE.
5. CASING ENDS SHALL BE SEALED WITH FERNOCO RUBBER REDUCING COUPLING WITH STAINLESS STEEL BANDS OR APPROVED EQUAL.
6. CONTRACTOR SHALL PROVIDE A MINIMUM OF 24 HOUR WRITTEN NOTICE TO CUSTOMERS PRIOR TO DISCONNECT/RECONNECT OF EXIST. WATER METER.
7. PROVIDE SEPARATE TAPS AND SERVICE LINE FOR EACH INDIVIDUAL WATER METER. DUAL SERVICES WITH USE OF U-BRANCH FITTING WILL NOT BE ALLOWED.

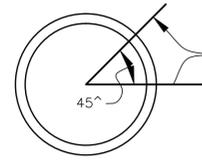
PIPE TAPPING SCHEDULE		
WATER MAIN TYPE AND DIAMETER	SERVICE SIZE	
	1"	2"
6" THROUGH 12" PVC (AWWA C900)	WBSS	WBSS
16" AND LARGER PVC (AWWA C905)	DWBSS	DWBSS

WBSS - WIDE BAND STRAP SADDLE
DWBSS - DUAL WIDE BAND STRAP SADDLE

NOTE: INSTALLATION TO INCLUDE FURNISHING AND INSTALLING THE FOLLOWING MATERIALS:

MATERIAL	3/4" AND 1" METERS	1 1/2" AND 2" METERS
TAP IN MAIN	1 AT 1-INCH	1 AT 2-INCH
SERVICE CLAMP	AS REQUIRED BY MAIN SIZE	AS REQUIRED BY MAIN SIZE
CORPORATION STOP	1 AT 1-INCH	1 AT 2-INCH
CURB STOP	1 AT 1-INCH	1 AT 2-INCH
SERVICE LINE TUBING	1-INCH	2-INCH

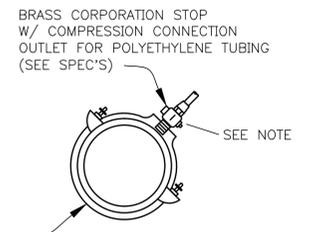
NOTE: FOR 2" DISTRIBUTION LINKS TO BE TAPPED TO NEW 8" MAIN, PROVIDE CORPORATION STOP PER SPEC'S W/CONNECTION OUTLET FOR CLASS 200 SDR 21 PVC PIPE.



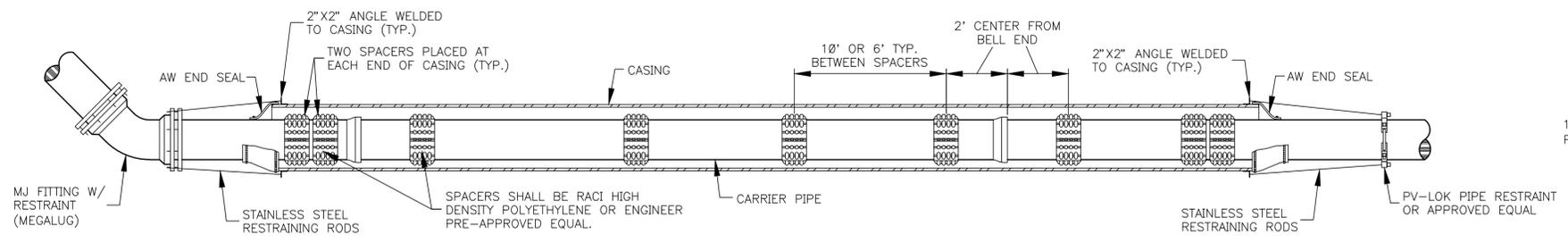
SERVICE TAPS TO BE MADE IN THIS ZONE UNLESS OTHERWISE SPECIFIED

BLOW-OFF & CHLORINATION TAPS ARE MADE IN VERTICAL POSITION

SERVICE TAPS
NOT TO SCALE

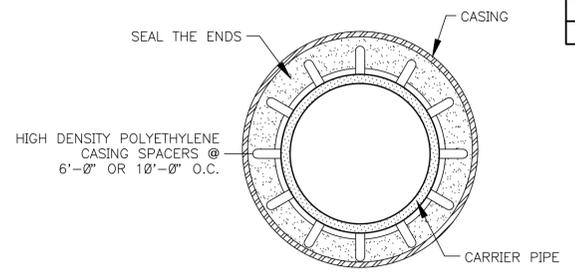


WIDE BAND SINGLE STRAP STAINLESS STEEL EPOXY COATED TAPPING SADDLE (AS APPLICABLE FOR PIPE SIZE)



PIPE CASING SPACER DETAIL

PIPE TYPE & SIZE	MAX. SPACING
PVC 4"-14"	10'
PVC 16"-30"	6'
Ductile Iron Pipe	6'



PIPE CASING SPACER SECTION

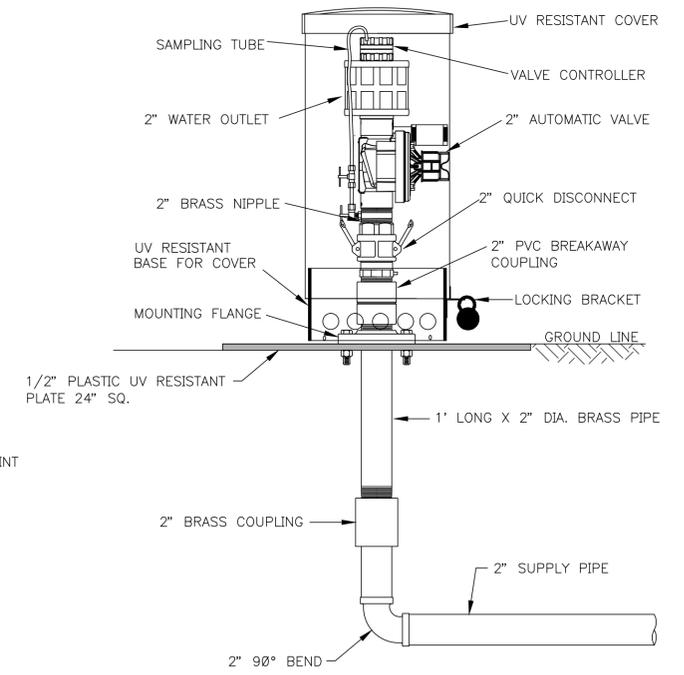
CASING SPACERS

CASING SPACERS SHALL BE USED TO INSTALL THE CARRIER PIPE INSIDE THE ENCASEMENT PIPE. CASING SPACERS SHALL FASTEN TIGHTLY ONTO THE CARRIER PIPE SO THAT WHEN THE CARRIER PIPE IS BEING INSTALLED THE SPACERS WILL NOT MOVE ALONG THE CARRIER PIPE. CASING SPACERS SHALL BE DOUBLED ON EACH END OF THE ENCASEMENT.

EACH CASING SPACER SHALL BE CAPABLE OF PROVIDING SUPPORT FOR THE CARRIER PIPE IN SERVICE AT A MAXIMUM SPACING. CALCULATIONS SHALL BE PROVIDED TO THE ENGINEER BY THE CASING SPACER MANUFACTURER SHOWING THAT THE CASING SPACER WILL SUPPORT THE SERVICE LOAD AT THE RECOMMENDED SPACING, INCLUDING A FACTOR OF SAFETY OF TWO (2). CASING SPACERS USED UNDER THIS SPECIFICATION SHALL MEET OR EXCEED THE SPECIFICATIONS DESCRIBED HEREIN AS PROJECTION TYPE CASING SPACERS.

PROJECTION TYPE CASING SPACERS SHALL BE CONSTRUCTED OF PREFORMED SECTIONS OF HIGH DENSITY POLYETHYLENE. THE FLEXIBLE SECTIONS SHALL BE JOINED TOGETHER AROUND THE PIPE TO PROVIDE A MINIMUM OF 12 PLASTIC PROJECTIONS PER SPACER SECTION. PROJECTION TYPE CASING SPACERS SHALL BE "RACI" TYPE PROJECTION SPACERS OR ENGINEER PRE-APPROVED EQUAL.

CASING DETAILS
NOT TO SCALE



AUTOMATIC FLUSHING DEVICE SHALL HAVE A 2" BRASS INLET, LEADING VERTICALLY THROUGH A UV RESISTANT GROUND PLATE, A MOUNTING FLANGE, AND ATTACHED TO A PLASTIC SCH. 80 TRAFFIC BREAK-AWAY COUPLING. A 2" ALUMINUM QUICK DISCONNECT DEVICE SHALL BE LOCATED ABOVE THE TRAFFIC COUPLING, LEADING INTO THE 2" AUTOMATIC VALVE. AUTOMATIC SOLENOID VALVE SHALL BE LOCATED ABOVE GROUND FOR EASY ACCESS AND HAVE A 150 PSI RATING. VALVE CONTROLLER WILL NOT REQUIRE A SECOND HAND-HELD DEVICE FOR PROGRAMMING, MUST HAVE A MINIMUM OF 12 FLUSHING CYCLES PER DAY AT UP TO 6 HOURS OF FLUSH TIME PER CYCLE (COMPARTMENTS HOLD TWO BATTERIES). SHALL BE SUBMERSIBLE TO 12 FEET, OPERATE WITH A 9 VOLT BATTERY, HAVE RESIN-SEALED ELECTRICAL COMPONENTS, AND SHALL BE LOCATED ABOVE WATER FLOW. SOLENOID SHALL HAVE NO LOOSE PARTS WHEN REMOVED FROM VALVE. VALVE, SOLENOID AND CONTROLLER SHALL HAVE RUBBER CAPS FOR ADDED PROTECTION. EACH UNIT SHALL HAVE A DOUBLE-VALVE AND ALL BRASS SAMPLING POINT. WATER SHALL EXIT UNIT HORIZONTALLY THROUGH HOLES LOCATED NEAR GROUNDLINE. ALL ABOVE-GROUND COMPONENTS SHALL BE CONTAINED WITHIN A UV-RESISTANT LOCKING DOME COVER, AS MANUFACTURED BY KUPFERLE FOUNDRY COMPANY, ST. LOUIS, MO, 1-800-231-3990, OR APPROVED EQUAL.

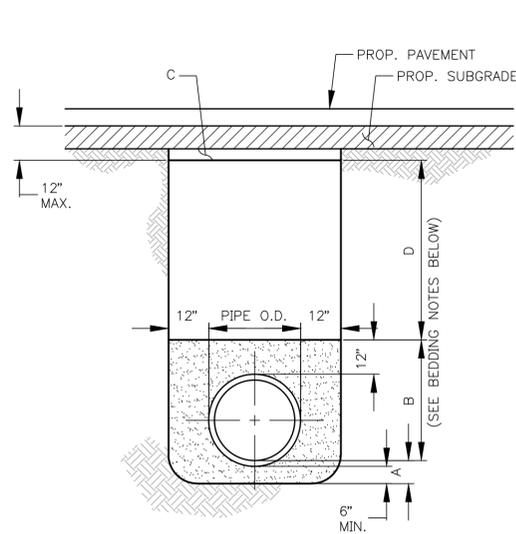
AUTOMATIC FLUSHING DEVICE
NOT TO SCALE

City of Humble, Texas

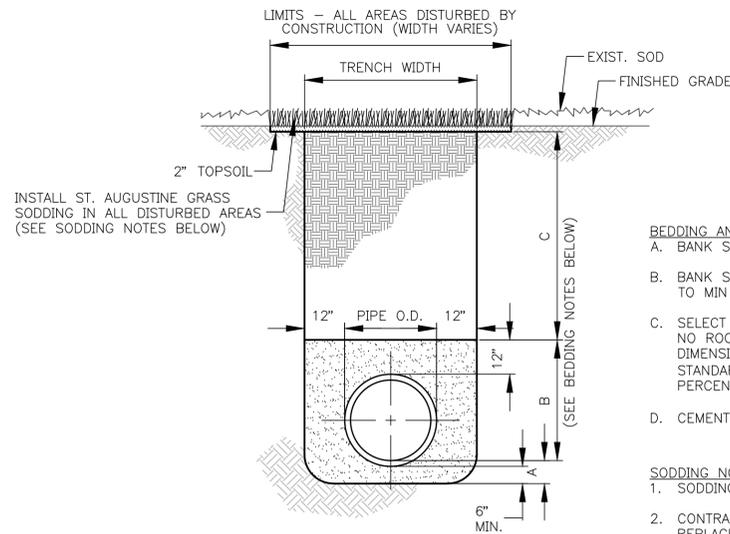
City Standard Details
Water Line Construction Details 2 of 3

Job No.:	Scale:	SHEET
Date: March 2016	HORZ : N/A	11
Dwn By:	VERT : N/A	
Chkd By:	One Inch	OF 16

If above mark does not measure one inch, then this diag. not to scale



**WATER PIPE TRENCH DETAIL
FOR PIPES UNDER CONCRETE PAVEMENT**



**WATER PIPE TRENCH DETAIL
FOR PIPES UNDER NATURAL GROUND**

BEDDING AND BACKFILL NOTES:

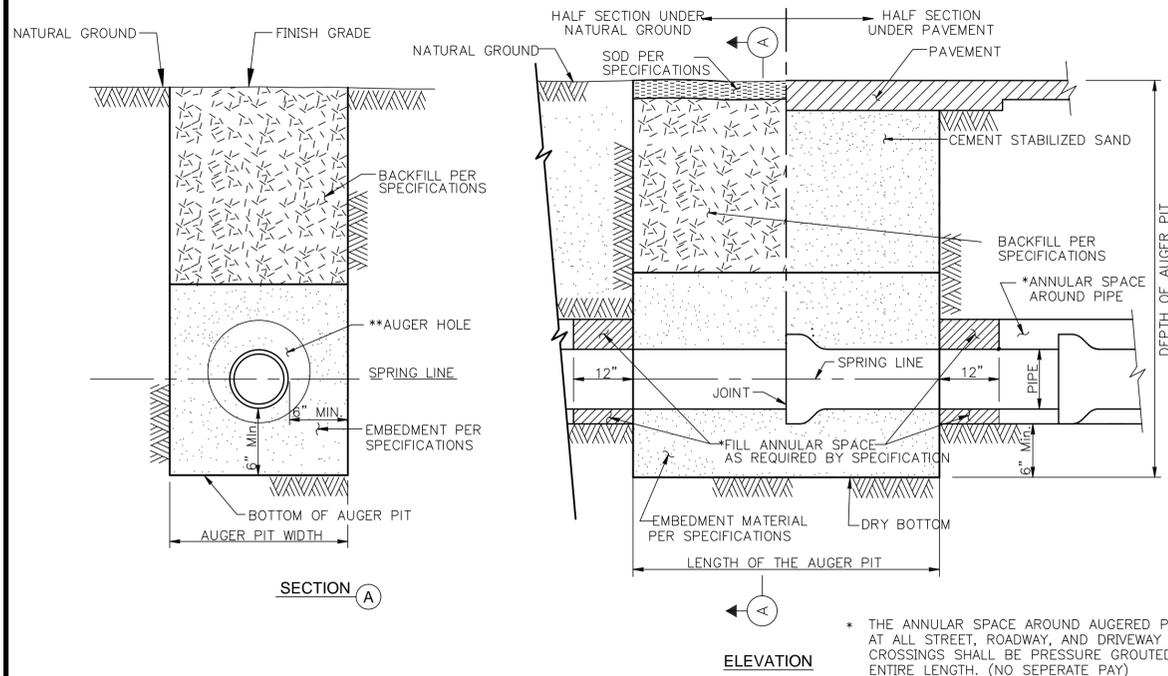
- A. BANK SAND PLACED BEFORE PIPE IS LAID.
- B. BANK SAND PLACED AFTER PIPE IS LAID, THOROUGHLY RODDED AND MECHANICALLY TAMPED TO MIN 95% OF MAX. DRY DENSITY AS DETERMINED BY ASTM D-698
- C. SELECT EARTH BACKFILL, MAX. LIQUID LIMIT 40 ASTM D4318, P.I. MIN 7, MAX 20 CONTAINING NO ROCKS OR OTHER DEBRIS NOR CONTAINING ANY DIRT CLODS EXCEEDING 6" IN ANY DIMENSION, PLACED IN 6" LAYERS AND COMPACTED TO AT LEAST 95% OF THE MAXIMUM STANDARD PROCTOR DRY DENSITY (ASTM D698) AND AT A MOISTURE CONTENT WITHIN TWO PERCENTAGE POINTS OF THE OPTIMUM MOISTURE CONTENT.
- D. CEMENT STABILIZED SAND (AS PER SPECIFICATIONS)

SODDING NOTES:

1. SODDING SHALL BE INSTALLED IN AREAS DISTURBED BY CONSTRUCTION.
2. CONTRACTOR SHALL REPLACE SODDING IN AREAS DAMAGED BY CONSTRUCTION AND THE REPLACEMENT SHALL BE CONSIDERED INCIDENTAL TO THE PROJECT.
3. IF EXISTING LANDSCAPING OTHER THAN GRASS IS WITHIN THESE AREAS, THE CONTRACTOR SHALL REBUILD OR REINSTALL THE LANDSCAPING AT NO ADDITIONAL COST TO THE PROJECT.

BEDDING, BACKFILL, AND SODDING NOTES FOR TRENCH DETAILS

NOT TO SCALE

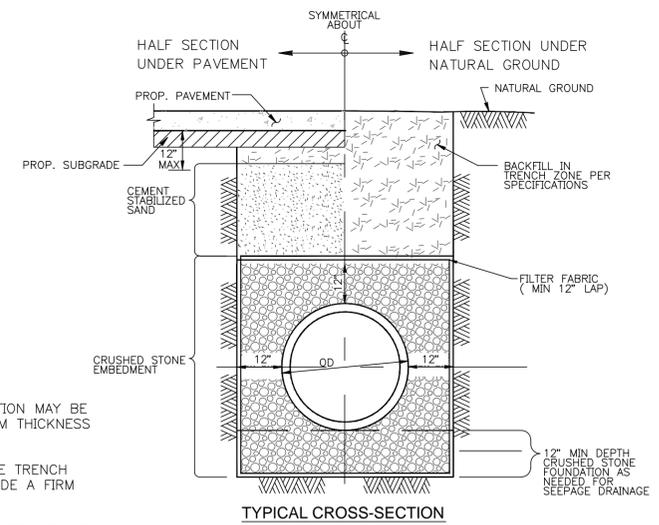


* THE ANNULAR SPACE AROUND AUGERED PIPE AT ALL STREET, ROADWAY, AND DRIVEWAY CROSSINGS SHALL BE PRESSURE GROUTED THE ENTIRE LENGTH. (NO SEPERATE PAY)

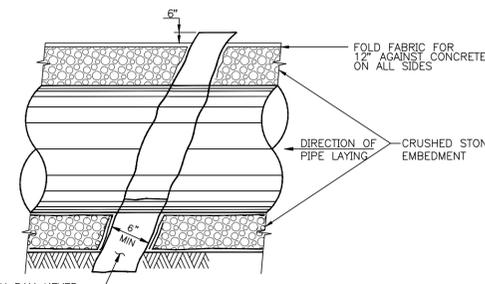
** DIAMETER OF AUGER HOLE SHALL NOT EXCEED PIPE BELL DIAMETER PLUS 2-INCHES

AUGER PIT AND AUGER HOLE

NOT TO SCALE



TYPICAL CROSS-SECTION



**LONGITUDINAL SECTION ALONG PIPE CENTERLINE
AT FOUNDATION TRENCH DAM**

WET CONDITION BEDDING

NOT TO SCALE

NOTES:

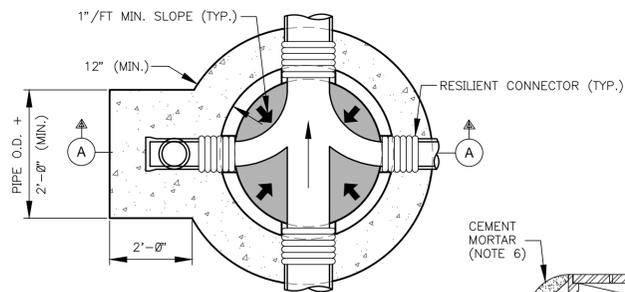
1. ACTUAL SHAPE OF CONCRETE TRENCH DAM CROSS SECTION MAY BE DETERMINED BY CONTRACTOR IN FIELD, MEETING MINIMUM THICKNESS AND KEY DEPTH REQUIREMENTS.
2. THIS DETAIL IS TO BE USED TO PROVIDE A FIRM STABLE TRENCH BOTTOM WHERE MECHANICAL DEWATERING CANNOT PROVIDE A FIRM STABLE TRENCH BOTTOM.
3. IN THE EVENT A FIRM STABLE TRENCH BOTTOM CANNOT BE OBTAINED PRIOR TO IMPLEMENTING THIS DETAIL OR AFTER IMPLEMENTING THIS DETAIL, THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE ENGINEER OR OWNER'S REPRESENTATIVE.
4. CRUSHED STONE EMBEDMENT SHALL MEET ASTM D2321 CLASS 1A, CLASS 1B OR CLASS II MATERIAL. USE A SUITABLE GRADED MATERIAL WHERE CONDITIONS MAY CAUSE MIGRATION OF FINES AND LOSS OF PIPE SUPPORT. FOR SEVERE CONDITIONS A SPECIAL FOUNDATION MAY BE REQUIRED. NOTIFY THE ENGINEER OR OWNER'S REPRESENTATIVE IF SUCH CONDITIONS ARE PRESENT.
5. TRENCH DAM SHALL BE PLACED A MINIMUM OF ONE BETWEEN EACH MANHOLE WHEN INSTALLED WITH SANITARY SEWERS OR 300 FEET WHICH EVER IS LESS WHEN INSTALLED WITH SANITARY SEWERS OR WATERLINES.

City of Humble, Texas

**City Standard Details
Water Line Construction Details 3 of 3**

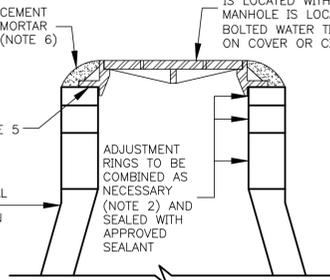
Job No.:	Scale:	SHEET
Date: March 2016	HORZ : N/A	12
Dwn By:	VERT : N/A	OF 16
Chkd By:	One Inch	

If above mark does not measure one inch, then this diag. not to scale

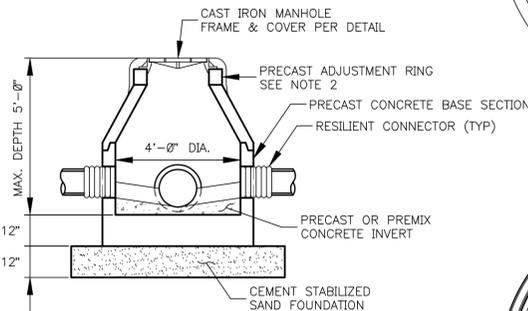


FOUNDATION PLAN

CAST IRON MANHOLE FRAME & COVER W/ "CITY OF HUMBLE" FORGED ON COVER, OR CITY APPROVED EQUAL—WHEN MANHOLE IS LOCATED WITHIN LIMITS OF ROADWAY PAVEMENT. WHEN MANHOLE IS LOCATED WITHIN LIMITS OF DRAINAGE DITCH, USE BOLTED WATER TIGHT MANHOLE W/ "CITY OF HUMBLE" FORGED ON COVER OR CITY APPROVED EQUAL.



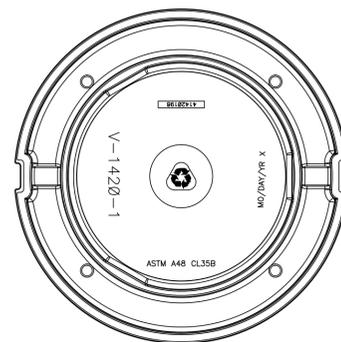
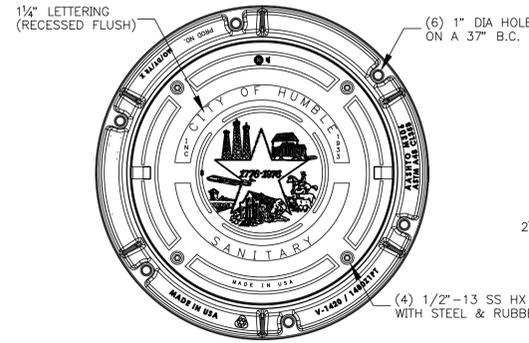
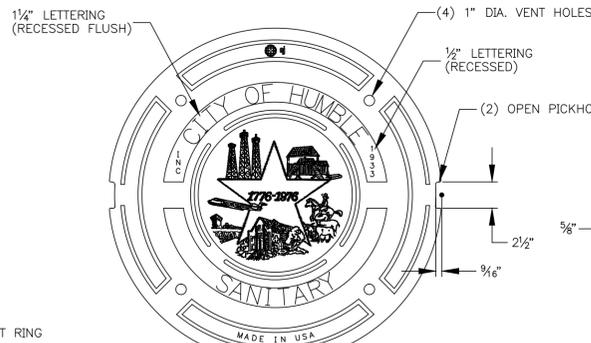
RESILIENT CONNECTORS FOR A WATER TIGHT SEAL BETWEEN MANHOLES AND SEWER PIPE SHALL CONFORM TO ASTM C-923; CAST IN GASKET CONNECTION AS PER PIPE MANUFACTURER'S REQUIREMENTS BETWEEN MANHOLE AND SEWER PIPE.



SHALLOW MANHOLE SECTION

NOTES:

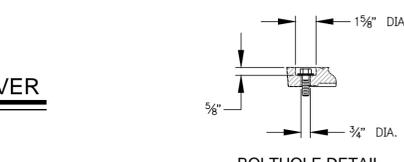
1. DEPTH OF MANHOLE DETERMINES SECTIONS REQUIRED.
2. PRECAST CONCRETE RINGS SHALL BE PROVIDED FOR A COMBINED ADJUSTMENT HEIGHT OF AT LEAST 12". THE TOTAL HEIGHT OF THE ADJUSTMENT RINGS SHALL NOT EXCEED 1'-6".
3. MANHOLE WALL THICKNESS FOR DEPTH EXCEEDING 12'-0" SHALL BE DETERMINED TO MEET LOADING CONDITIONS.
4. MANHOLE DROP AND INTERSECTING PIPES SHALL BE INSTALLED AS PER SPECIFICATIONS.
5. SEAT MANHOLE FRAME IN SEALANT PER SPECIFICATION.
6. OMIT CEMENT MORTAR WHEN MANHOLE IS LOCATED IN PAVED AREAS.
7. PROVIDE BACKFILL TO MATCH ADJACENT PIPE TRENCH BACKFILL PER SPECIFICATION.
8. PIPE CONNECTIONS TO EXISTING MANHOLES SHALL BE CORED. THE USE OF CONCRETE BREAKERS OR HAMMERS WILL NOT BE ALLOWED.



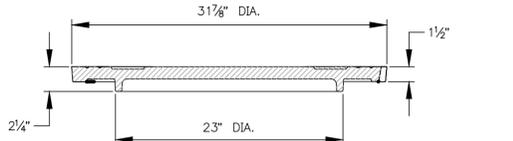
BOTTOM VIEW

SANITARY MANHOLE FRAME & COVER

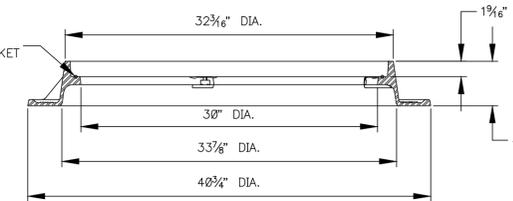
NOT TO SCALE



BOLTHOLE DETAIL



COVER SECTION



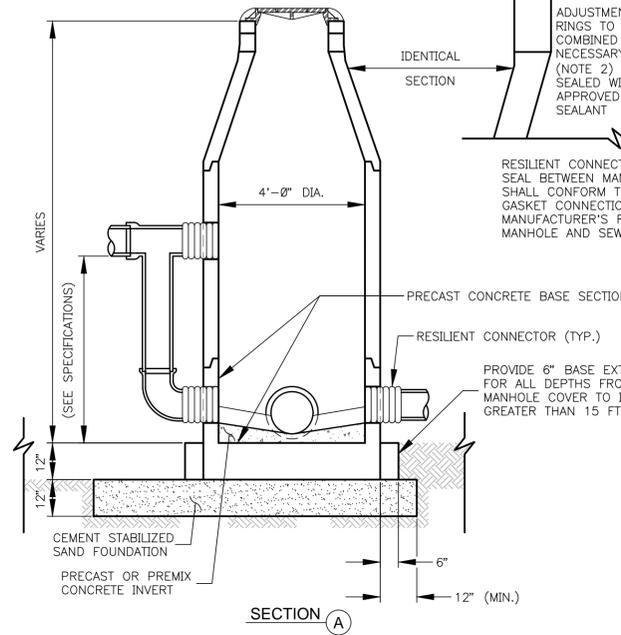
FRAME SECTION

BOLTED SANITARY MANHOLE FRAME & COVER

NOT TO SCALE

SANITARY SEWER PRECAST CONCRETE MANHOLE

NOT TO SCALE



SECTION A-A

BEDDING & BACKFILL NOTES:

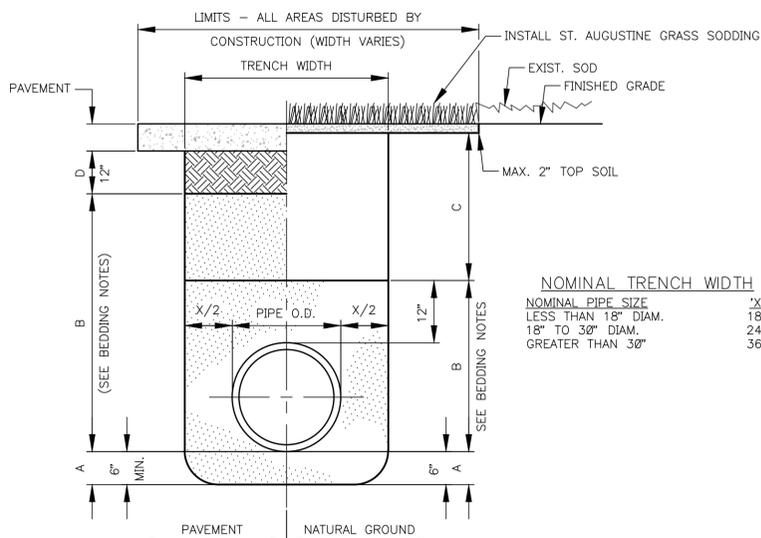
- A. CEMENT STABILIZED SAND (AS PER SPECIFICATIONS) PLACED BEFORE PIPE IS LAID UP TO FLOW LINE OF PIPE OR TO FLOW LINE OF PIPE OR ABOVE - MIN. DEPTH = 6".
- B. CEMENT STABILIZED SAND (AS SPECIFIED) THOROUGHLY RODDED, PLACED AFTER PIPE IS LAID. CEMENT STABILIZED SAND TO 6 INCHES BELOW BOTTOM OF SUBGRADE FOR BACKFILL UNDER ALL DRIVEWAYS AND SIDEWALKS.
- C. NATIVE EARTH BACKFILL, CONTAINING NO ROCKS OR OTHER DEBRIS NOR CONTAINING ANY DIRT CLODS EXCEEDING 6" IN ANY DIMENSION. PLACED IN 6" LAYERS, PROCESSED IF NECESSARY AND THOROUGHLY COMPACTED TO A DENSITY EQUIVALENT TO A MIN. OF 98% OF MAX. DRY DENSITY AS DETERMINED BY ASTM D698, UNLESS OTHERWISE NOTED.
- D. SELECT EARTH BACKFILL, MAX. LIQUID LIMIT 40 ASTM D4318, P.I. MIN 7, MAX 20 CONTAINING NO ROCKS OR OTHER DEBRIS NOR CONTAINING ANY DIRT CLODS EXCEEDING 6" IN ANY DIMENSION. PLACED IN 6" LAYERS AND COMPACTED TO AT LEAST 95% OF THE MAXIMUM STANDARD PROCTOR DRY DENSITY (ASTM D698) AND AT A MOISTURE CONTENT WITHIN TWO PERCENTAGE POINTS OF THE OPTIMUM MOISTURE CONTENT.

NOTES:

1. THIS DETAIL SHALL BE UTILIZED FOR INSTALLATION OF MANHOLES.
2. PROVIDE BACKFILL TO MATCH ADJACENT PIPE TRENCH BACKFILL PER STANDARD SPECIFICATION.

SODDING NOTES:

1. SODDING SHALL BE INSTALLED IN AREAS DISTURBED BY CONSTRUCTION.
2. CONTRACTOR SHALL REPLACE SODDING IN AREAS DAMAGED BY CONSTRUCTION. SUCH REPLACEMENT SHALL BE CONSIDERED INCIDENTAL TO THE PROJECT.
3. IF EXISTING LANDSCAPING OTHER THAN GRASS IS WITHIN THESE AREAS, THE CONTRACTOR SHALL REBUILD OR REINSTALL THE LANDSCAPING OF THE AREA AFTER CONSTRUCTION IN AN EQUAL OR BETTER CONDITION.

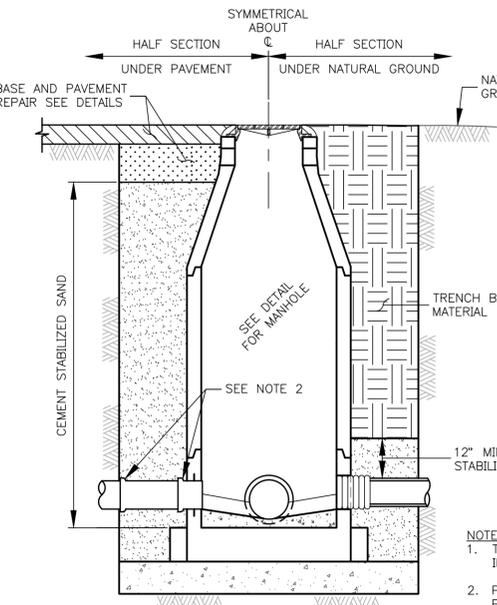


BEDDING AND BACKFILL DETAIL FOR SANITARY SEWER PIPES

NOT TO SCALE

NOMINAL TRENCH WIDTH

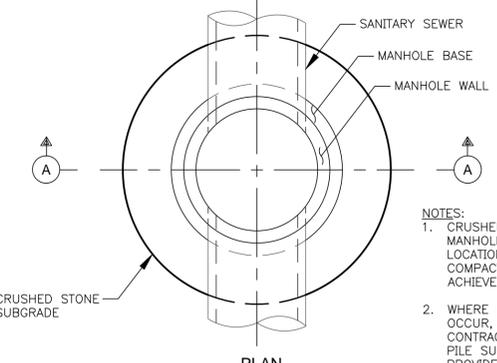
NOMINAL PIPE SIZE	TRENCH WIDTH
LESS THAN 18" DIAM.	18"
18" TO 30" DIAM.	24"
GREATER THAN 30"	36"



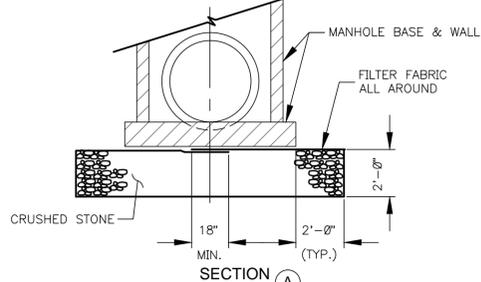
TYPICAL CROSS-SECTION

BACKFILL OF MANHOLES AND STRUCTURES

NOT TO SCALE



PLAN



SECTION A-A

WET CONDITION BEDDING FOR PROPOSED MANHOLE

NOT TO SCALE

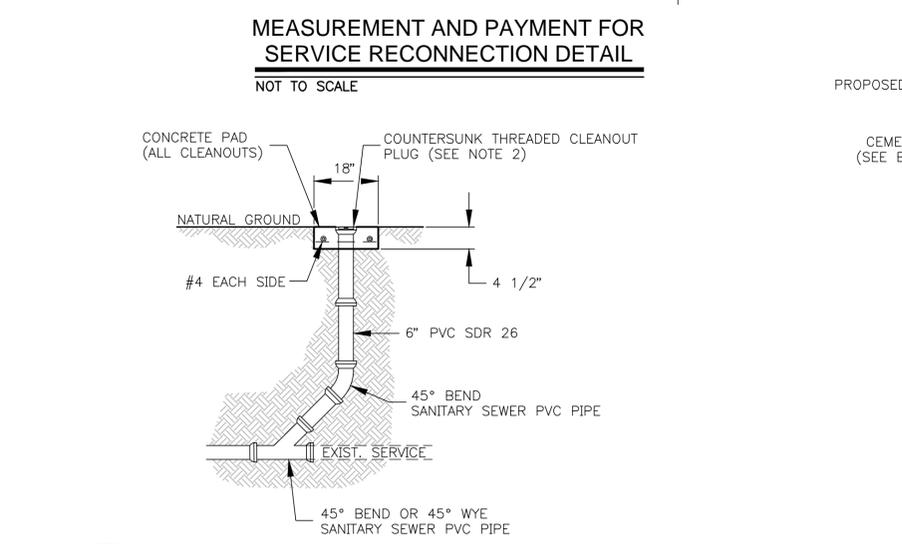
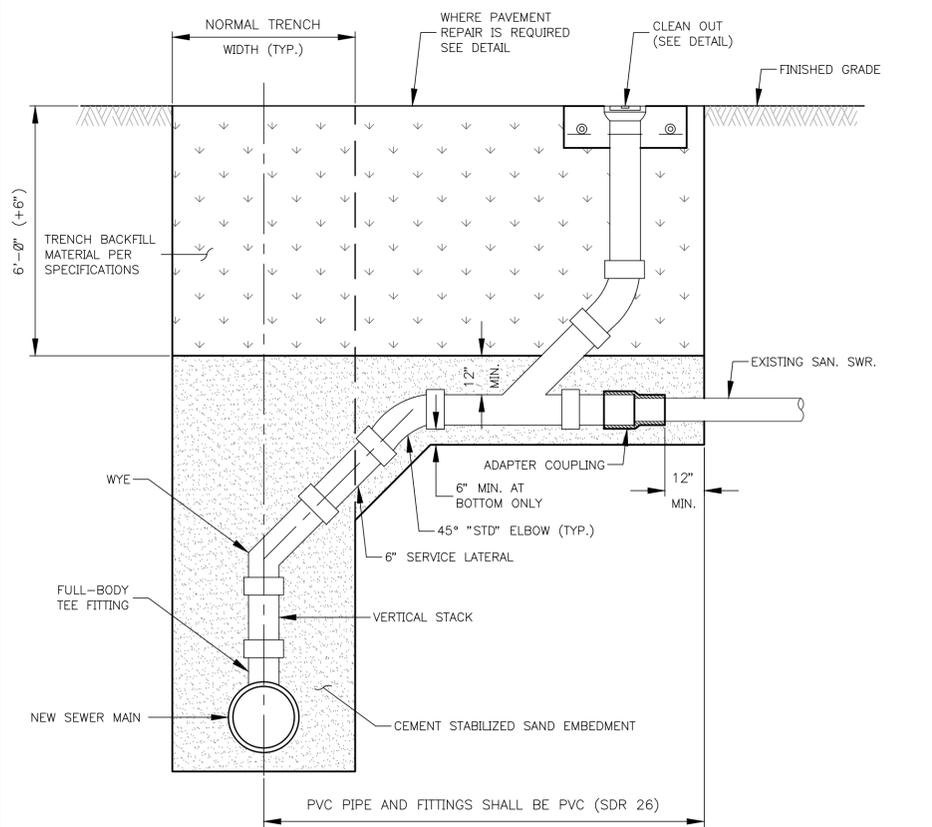
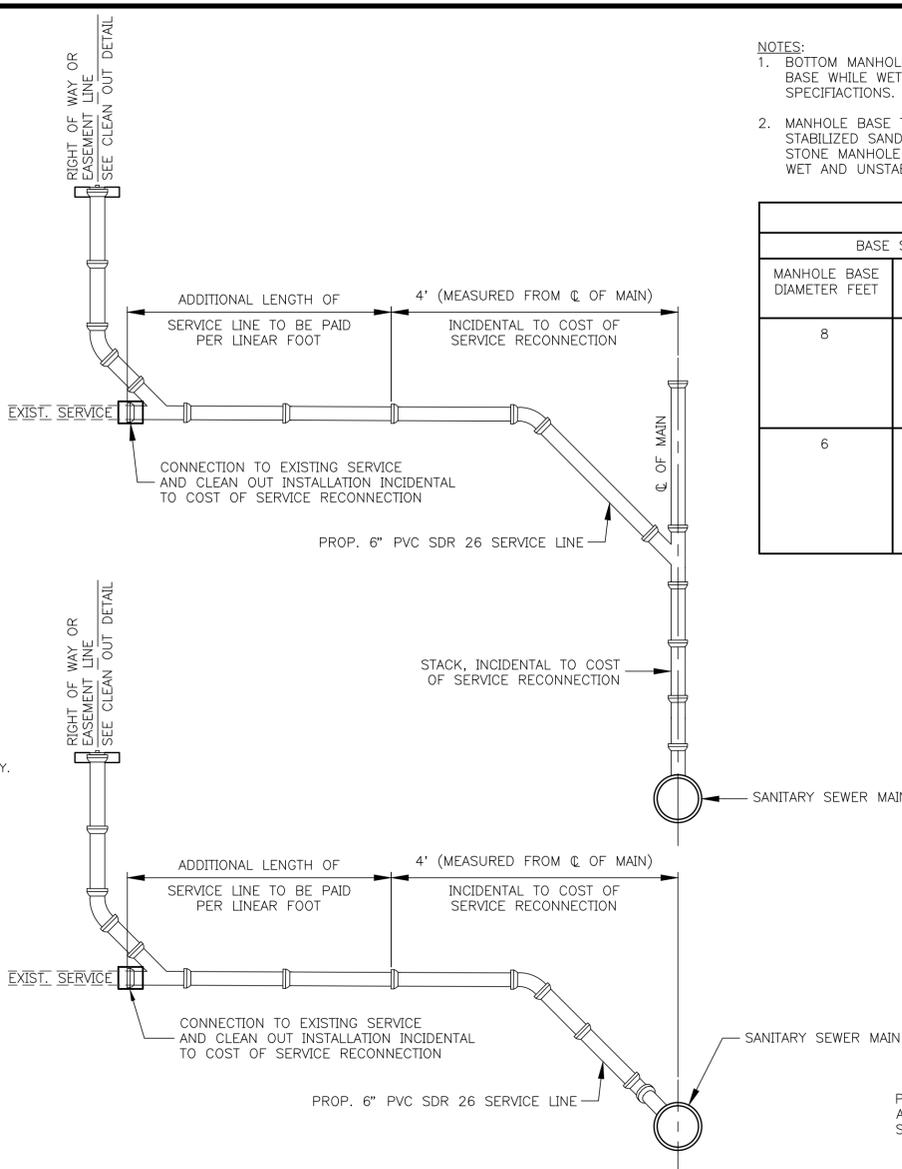
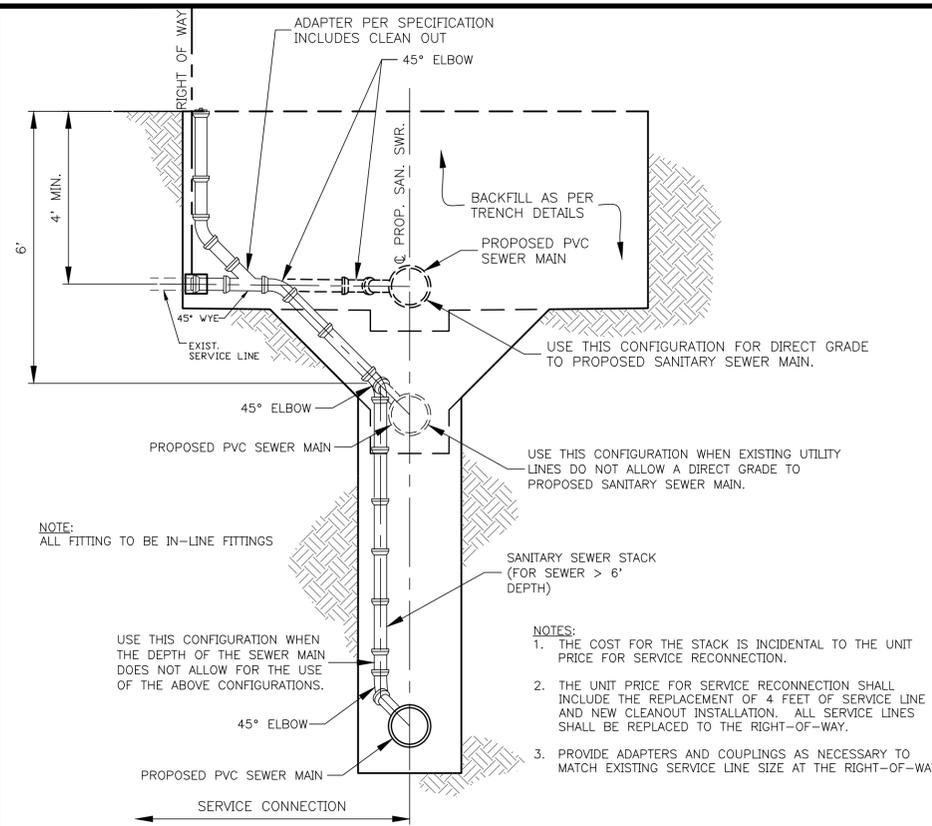
City of Humble, Texas

City Standard Details

Sanitary Sewer Construction Details 1 of 2

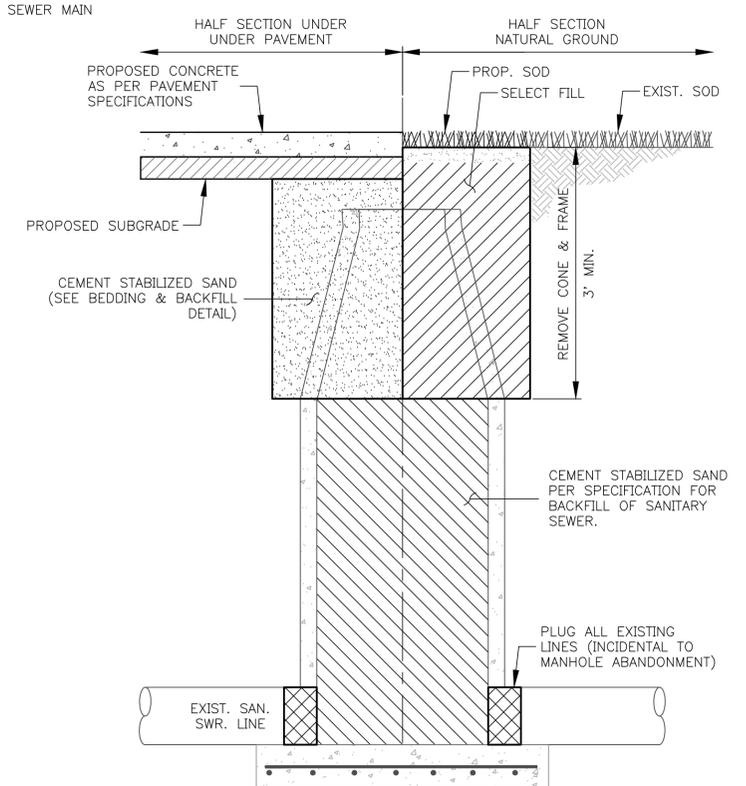
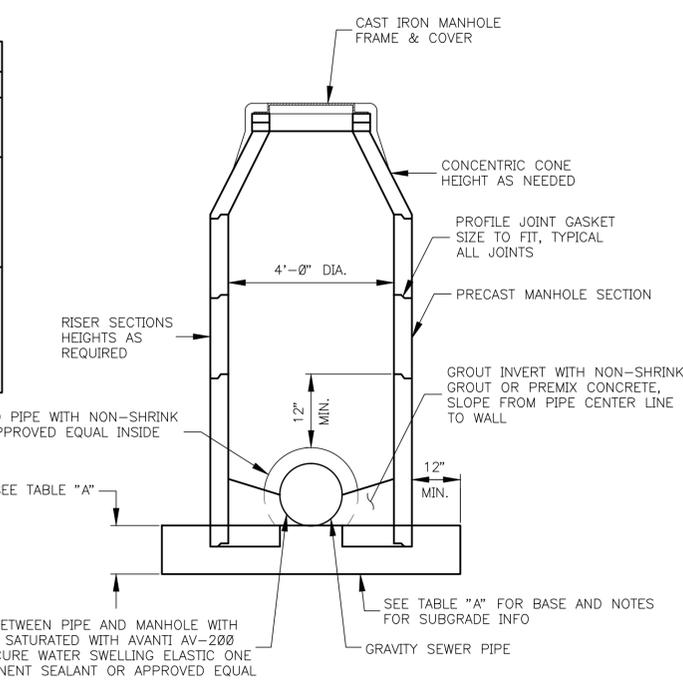
Job No.:	Scale:	SHEET
Date: March 2016	HORZ : N/A	13
Dwn By:	VERT : N/A	OF 16
Chkd By:	One Inch	

If above mark does not measure one inch, then this diag. not to scale.

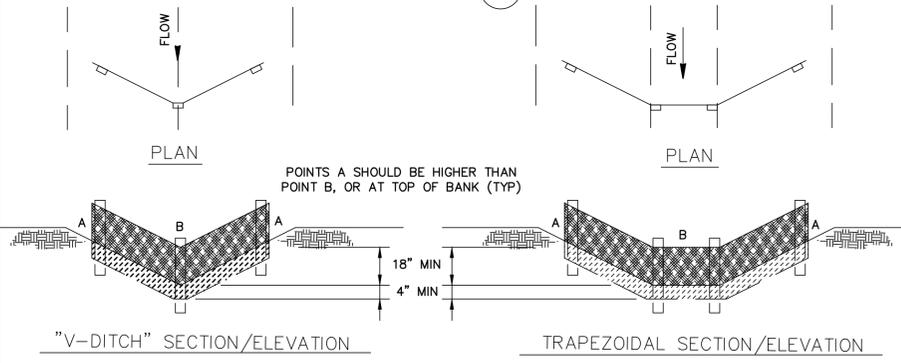
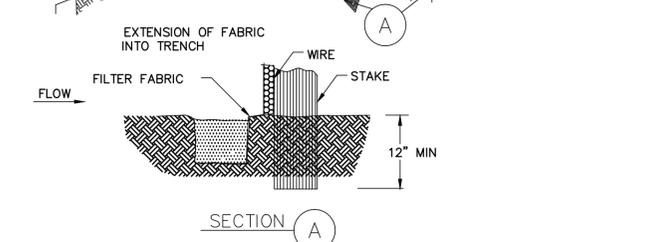
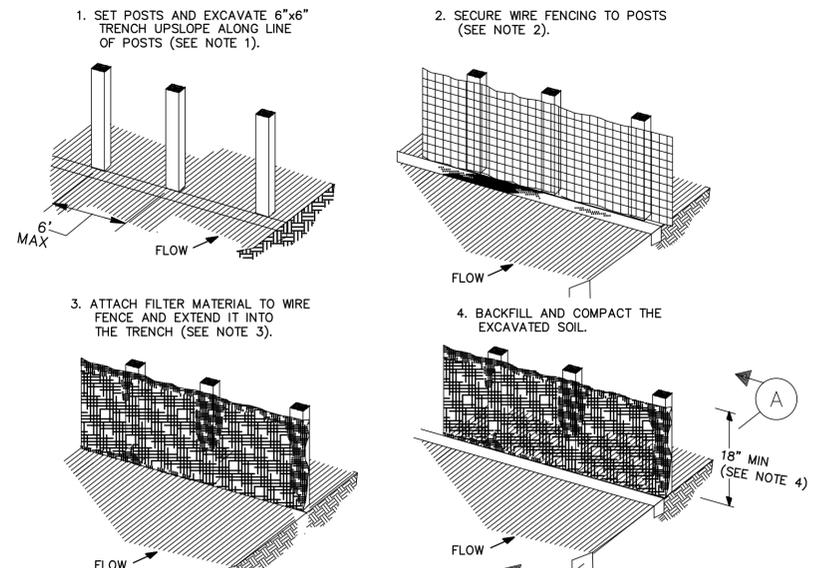


- NOTES:**
1. BOTTOM MANHOLE SECTION TO BE SET 6" INTO CONCRETE BASE WHILE WET. BASE TO BE CLASS A CONCRETE PER SPECIFICATIONS.
 2. MANHOLE BASE TO BE SET ON 12" MIN COMPACTED CEMENT STABILIZED SAND IN NORMAL CONDITIONS. SEE CRUSHED STONE MANHOLE SUPPORT OR MANHOLE PILE SUPPORT FOR WET AND UNSTABLE CONDITIONS.

TABLE "A"			
BASE SLAB REINFORCING AND THICKNESS			
MANHOLE BASE DIAMETER FEET	DEPTH TO INVERT (FT)	BASE THICKNESS	REINFORCING BARS EACH WAY TOP AND BOTTOM
8	≤ 20	1'-0"	#6 @ 10"
	≤ 25	1'-2"	#6 @ 8"
	≤ 30	1'-4"	#6 @ 7"
	≤ 40	1'-6"	#6 @ 6"
	≤ 50	1'-8"	#6 @ 6"
6	≤ 15	1'-0"	#5 @ 8"
	≤ 20	1'-0"	#5 @ 8"
	≤ 25	1'-2"	#5 @ 7"
	≤ 30	1'-2"	#5 @ 6"
	≤ 40	1'-2"	#6 @ 8"
	≤ 50	1'-4"	#6 @ 8"
	≤ 60	1'-4"	#6 @ 7"



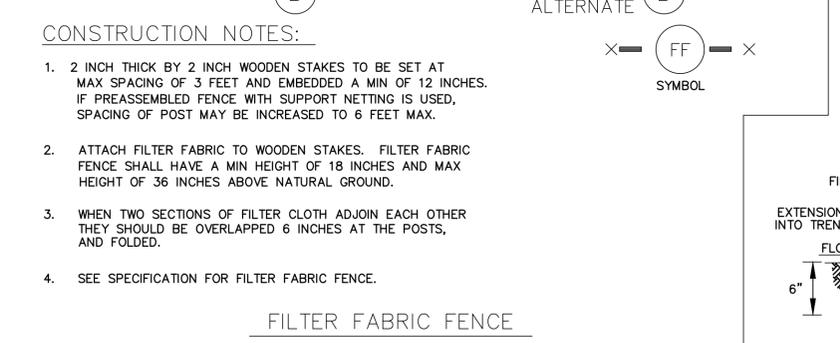
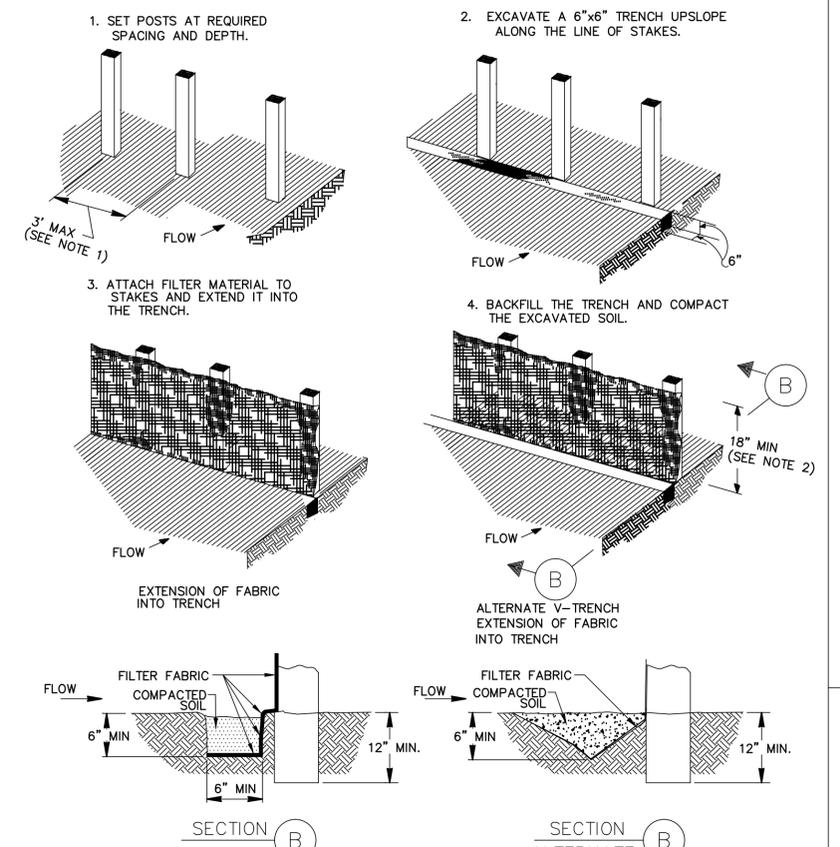
- NOTES:**
1. CLEANOUTS (INCL. CONCRETE PAD) SHALL BE INSTALLED AT THE RIGHT OF WAY OR EASEMENT LINE FOR ALL SERVICE LINE REPLACEMENTS (NO SEPARATE PAY).
 2. CLEANOUT PLUG (CAP) LOCATED UNDER NATURAL GROUND SHALL BE PLASTIC. CLEANOUT PLUG (CAP) IN THE PAVEMENT (STREET, ALLEYS (INCL. CRUSHED STONE), DRIVEWAYS, SIDEWALKS) SHALL BE BRASS.



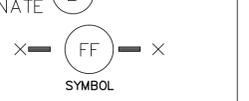
- CONSTRUCTION NOTES:**
1. SET 2 INCH BY 2 INCH WOODEN STAKES SPACED A MAX OF 6 FEET APART AND EMBEDDED A MIN OF 12 INCHES.
 2. WOVEN WIRE FENCE TO BE FASTENED SECURELY TO FENCE POSTS WITH STAPLES.
 3. FILTER CLOTH TO BE FASTENED SECURELY TO WOVEN WIRE FENCE, WITH TIES SPACED EVERY 24 INCHES AT TOP AND MIDSECTION.
 4. MINIMUM HEIGHT OF FILTER SHOULD BE 18 INCHES AND A MAXIMUM OF 36 INCHES ABOVE NATURAL GROUND.
 5. WHEN TWO SECTIONS OF FILTER CLOTH ADJOIN EACH OTHER THEY SHALL BE OVERLAPPED 6 INCHES AT THE POSTS, AND FOLDED.
 6. SEE SPECIFICATION FOR FILTER FABRIC BARRIER.



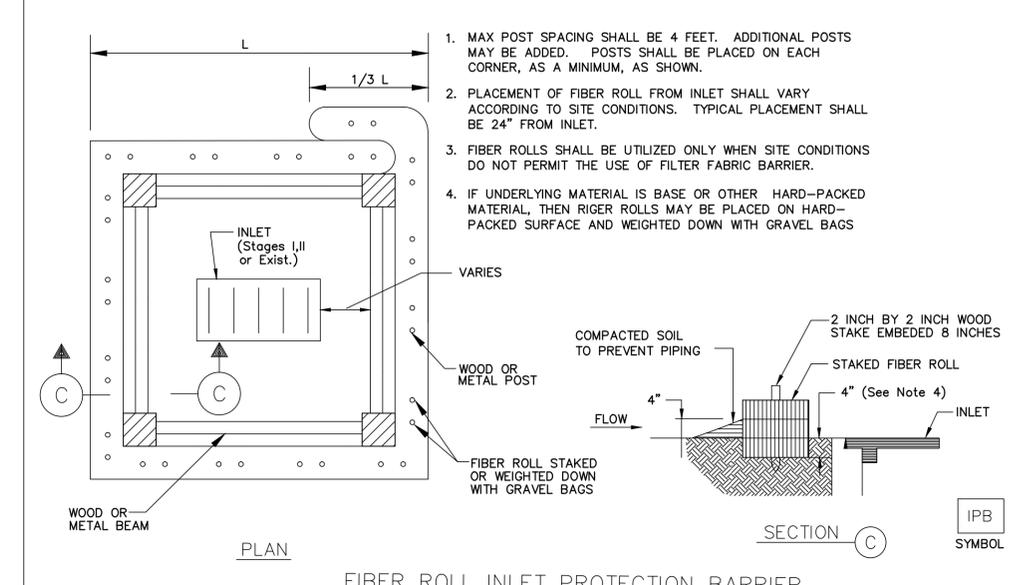
REINFORCED FILTER FABRIC BARRIER



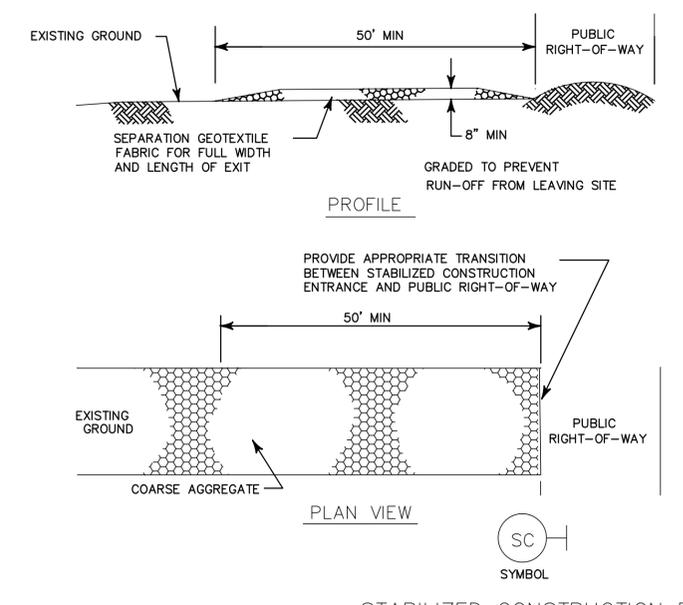
- CONSTRUCTION NOTES:**
1. 2 INCH THICK BY 2 INCH WOODEN STAKES TO BE SET AT MAX SPACING OF 3 FEET AND EMBEDDED A MIN OF 12 INCHES. IF PREASSEMBLED FENCE WITH SUPPORT NETTING IS USED, SPACING OF POST MAY BE INCREASED TO 6 FEET MAX.
 2. ATTACH FILTER FABRIC TO WOODEN STAKES. FILTER FABRIC FENCE SHALL HAVE A MIN HEIGHT OF 18 INCHES AND MAX HEIGHT OF 36 INCHES ABOVE NATURAL GROUND.
 3. WHEN TWO SECTIONS OF FILTER CLOTH ADJOIN EACH OTHER THEY SHOULD BE OVERLAPPED 6 INCHES AT THE POSTS, AND FOLDED.
 4. SEE SPECIFICATION FOR FILTER FABRIC FENCE.



FILTER FABRIC FENCE



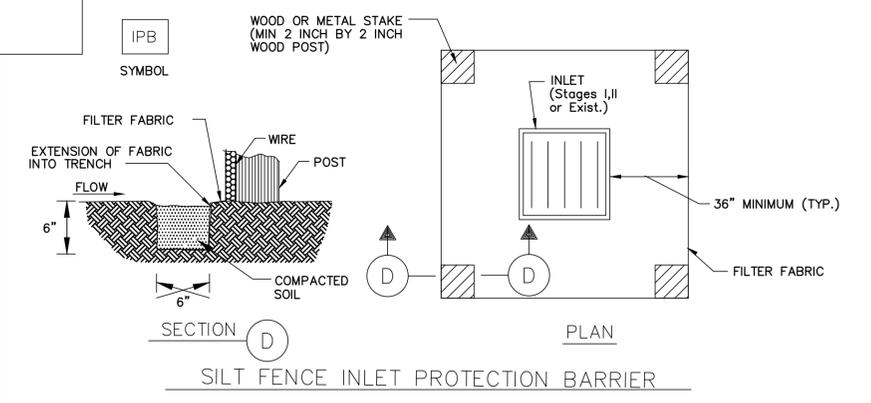
FIBER ROLL INLET PROTECTION BARRIER



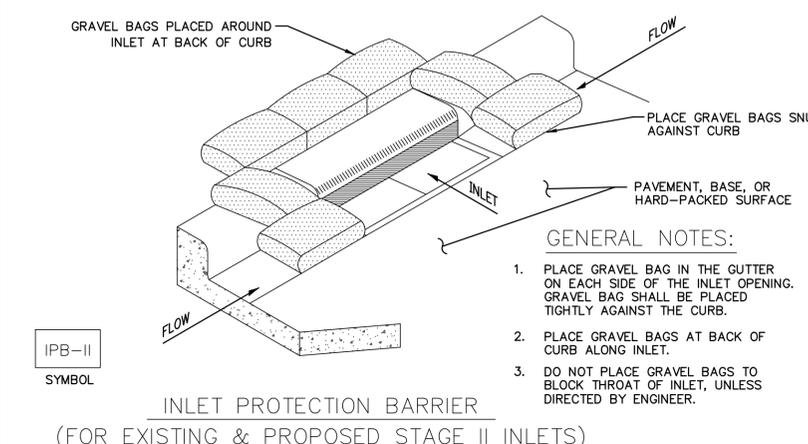
STABILIZED CONSTRUCTION EXIT

- CONSTRUCTION NOTES:**
1. LENGTH SHALL BE AS SHOWN ON THE CONSTRUCTION DRAWINGS, BUT NOT LESS THAN 50 FEET.
 2. THICKNESS SHALL BE NOT LESS THAN 8 INCHES.
 3. WIDTH SHALL BE NOT LESS THAN FULL WIDTH OF ALL POINTS OF INGRESS OR EGRESS.
 4. STABILIZATION FOR OTHER AREAS SHALL HAVE THE SAME AGGREGATE THICKNESS AND WIDTH REQUIREMENTS AS THE STABILIZED CONSTRUCTION EXIT, UNLESS OTHERWISE SHOWN ON THE CONSTRUCTION DRAWINGS.
 5. STABILIZED AREA MAY BE WIDENED OR LENGTHENED TO ACCOMMODATE A TRUCK WASHING AREA. AN OUTLET SEDIMENT TRAP MUST BE PROVIDED FOR THE TRUCK WASHING AREA.
 6. SEE SPECIFICATION FOR STABILIZED CONSTRUCTION EXIT.
 7. STABILIZED CONSTRUCTION EXIT SHALL BE MAINTAINED FREE OF SEDIMENT FOR THE DURATION OF THE PROJECT.

- CONSTRUCTION NOTE:**
1. MAX. POST SPACING SHALL BE 4 FEET. ADDITIONAL POSTS MAY BE ADDED. POSTS SHALL BE PLACED ON EACH CORNER, AS A MINIMUM, AS SHOWN.
 2. PLACEMENT OF FILTER FABRIC BARRIER FROM INLET SHALL VARY ACCORDING TO SITE CONDITIONS. TYPICAL PLACEMENT SHALL BE 36\"/>



SILT FENCE INLET PROTECTION BARRIER



INLET PROTECTION BARRIER (FOR EXISTING & PROPOSED STAGE II INLETS)

- GENERAL NOTES:**
1. PLACE GRAVEL BAG IN THE GUTTER ON EACH SIDE OF THE INLET OPENING. GRAVEL BAG SHALL BE PLACED TIGHTLY AGAINST THE CURB.
 2. PLACE GRAVEL BAGS AT BACK OF CURB ALONG INLET.
 3. DO NOT PLACE GRAVEL BAGS TO BLOCK THROAT OF INLET, UNLESS DIRECTED BY ENGINEER.

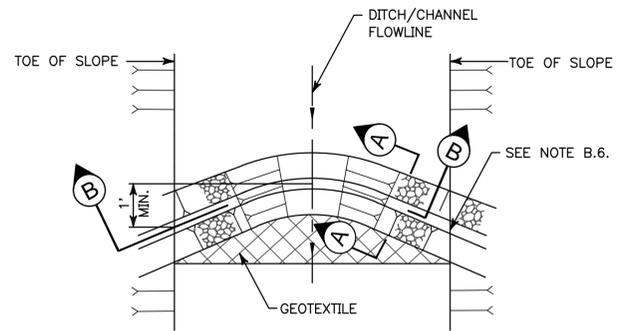
City of Humble, Texas

City Standard Details

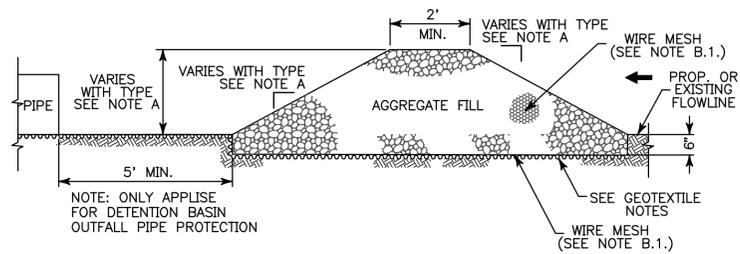
Storm Water Pollution Prevention Details 1 of 2

Job No.:	Scale:	SHEET
Date: March 2016	HORZ: N/A	15
Dwn By:	VERT: N/A	OF 16
Chkd By:	One Inch	

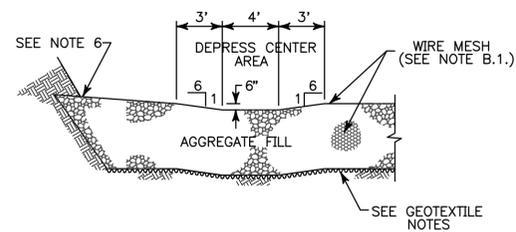
If above mark does not measure one inch, then this diag. not to scale.



PLAN
IN-CHANNEL FILTER DAM



SECTION A



SECTION B

ROCK FILTER DAM DETAIL

RFD

FILTER DAM NOTES:

- A.) TYPES OF FILTER DAMS
1. TYPE 1 (NON-REINFORCED)
 - a. HEIGHT - 18-24 INCHES. MEASURE VERTICALLY FROM EXISTING GROUND TO TOP OF FILTER DAM.
 - b. TOP WIDTH - 2 FEET (MINIMUM)
 - c. SLOPES - 2:1 (MAXIMUM).
 2. TYPE 2 (REINFORCED).
 - a. HEIGHT - 18-36 INCHES. MEASURE VERTICALLY FROM EXISTING GROUND TO TOP OF FILTER DAM.
 - b. TOP WIDTH - 2 FEET (MINIMUM).
 - c. SLOPES - 2:1 (MAXIMUM).
 3. TYPE 3 (REINFORCED)
 - a. HEIGHT - 36-48 INCHES. MEASURE VERTICALLY FROM EXISTING GROUND TO TOP OF FILTER DAM.
 - b. TOP WIDTH - 2 FEET (MINIMUM).
 - c. SLOPES - 3:1 (MAXIMUM).
 4. TYPE 4 (GABION)
 - a. HEIGHT - 30 INCHES (MINIMUM). MEASURE VERTICALLY FROM EXISTING GROUND TO TOP OF FILTER DAM.
 - b. TOP WIDTH - 2 FEET (MINIMUM).
 5. TYPE 5. AS SHOWN ON THE PLANS.
- B.) CONSTRUCT FILTER DAMS ACCORDING TO THE FOLLOWING CRITERIA UNLESS SHOWN OTHERWISE ON THE PLANS.
1. TYPE 2 AND 3 FILTER DAMS: SECURE WITH 20 GAUGE GALVANIZED WOVEN WIRE MESH WITH 1 INCH DIAMETER HEXAGONAL OPENINGS.
 2. GRANULAR FILL:
 - a. PLACE ON MESH TO HEIGHT AND SLOPES SHOWN ON PLANS OR AS SPECIFIED BY THE ENGINEER.
 - b. 3-5 INCHES FOR ROCK FILTER DAM TYPES 1,2, AND 4 & 4-8 INCHES FOR ROCK FILTER DAM TYPE 3. REFER TO GRANULAR FILL IN SPECIFICATION SECTION NO. 02378-RIPRAP AND GRANULAR FILL.
 3. WIRE MESH: FOLD AT UPSTREAM SIDE OVER GRANULAR FILL AND TIGHTLY SECURED TO ITSELF ON THE DOWNSTREAM SIDE USING WIRE TIES OR HOG RINGS.
 4. IN STREAMS: SECURE OR STAKE MESH TO STREAM BED PRIOR TO AGGREGATE PLACEMENT.
 5. SEE SPECIFICATION SECTION NO. 02364-FILTER DAMS.
 6. EMBED ONE FOOT MINIMUM INTO SLOPE AND RAISE ONE FOOT HIGHER THAN CENTER OF DEPRESSED AREA AT SLOPE.

City of Humble, Texas

City Standard Details
Storm Water Pollution Prevention Details 2 of 2

Job No.:	Scale:	SHEET
Date: March 2016	HORZ : N/A VERT : N/A	16
Dwn By:	One Inch	
Chkd By:	If above mark does not measure one inch, then this diag. not to scale.	