

CITY OF BROKEN ARROW

STANDARD CONSTRUCTION SPECIFICATIONS

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Approved by the City Manager on August 19, 1999

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Oklahoma Department of Transportation (ODOT) Standard Drawings Adopted by the City of Broken Arrow: The City of Broken Arrow adopts the ODOT Standard Drawings for streets, drainage structures, traffic control, temporary traffic control, signals, pavement marking, signage, and erosion control unless modified by a City of Broken Arrow Standard Drawing listed in these specifications.

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SECTION 100 - GENERAL

INFORMATION

101 PURPOSE (05/16/94): The purpose of these specifications is to establish, where applicable, minimum acceptable standards or a range of acceptable results for construction of utilities in the City of Broken Arrow.

102 INTENT (05/16/94): It is the intent of these specifications that the contractor be solely responsible for producing an acceptable end product. In producing this end product, the contractor shall exercise control of the project. The City of Broken Arrow personnel, except as specifically provided for in these specifications, will make inspections for the City to document that an acceptable product is being produced.

103 INTERPRETATION (05/16/94): These specifications will be interpreted in such a manner as to allow the contractor to control the project and produce an acceptable end product. These specifications will not be interpreted in a manner that allows a contractor to produce an unacceptable end product or endanger the public. When disputes arise over interpretation of the specifications, the general provisions of the contract will govern. Only projects in substantial conformance with plans and specifications will be accepted by the City of Broken Arrow.

104 ORGANIZATION/FORMAT (05/16/94): The specifications are organized by topic. Section 100 provides general information for use of the specifications. Sections 200 through 500 are devoted to specific types of work. Section 600 provides minimum acceptable standards for materials. Section 700 provides required plan notes and approved standard details. Section 800 provides information necessary for vertical construction in the City of Broken Arrow. Section 900 provides other information necessary for construction in the City of Broken Arrow.

104.01 WORK TYPE SPECIFICATION FORMAT (08/19/99):

a. **Street Construction:** The City of Broken Arrow has adopted the Oklahoma State Department of Transportation Standard Specifications for Highway Construction, with all approved supplements, for street construction. The ODOT format will be used for street construction. Requirements for street construction that are Broken Arrow specific, are found in Section 200 of these specifications.

b. **Other Work Type Specifications:** The format for all other work types will be as follows:

1. Description: A short description of the work covered under the specific specification.
2. Materials: Description of the materials covered by the specification or a reference to the Section 600 specifications for the materials covered by the specification.
3. Construction Methods: A description of acceptable methods for accomplishing the work covered by the specification. This description of methods is not all inclusive and contractors may use other methods as long as the required end product is produced.
4. Special Requirements: A description of special actions required for this specification. For example, a specification for water lines may require that a City Inspector observe all tie-ins to the existing distribution system.
5. Method of Measurement: A description of how the work will be measured.
6. Basis of Payment: A description of the units for which the contractor will be paid.
7. Standard Drawings: A list of City of Broken Arrow Standard Drawings that apply to the specification.

104.02 MATERIAL SPECIFICATION FORMAT (05/16/94):

a. **Street Construction:** The City of Broken Arrow has adopted the Oklahoma State Department of Transportation Standard Specifications for Highway Construction for street construction. The ODOT format will be used for materials used in street construction.

b. **Other Material Specifications:** The format for material specifications is as follows:

1. Description: A description of the materials covered by the specification.
2. Criteria: A description of the criteria by which the material will be measured.
3. Manufacturers: A list of manufacturers that provide acceptable materials of the type covered by the specification, is provided for information only. This is not a complete list and "or equal" manufactures are acceptable.

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105 APPLICABILITY:

105.01 CONTRACTORS WORKING FOR THE CITY OF BROKEN ARROW (05/16/94): All applicable portions of these specifications will apply to all contractors working for the City of Broken Arrow.

105.02 PUBLIC WORKS DEPARTMENT CONSTRUCTION (05/16/94): All applicable portions of these specifications will apply except for method of measurement and basis of payment to all projects constructed by the Public Works Department of the City of Broken Arrow.

105.03 PRIVATE CONTRACTORS CONSTRUCTING UTILITIES THAT WILL BE TRANSFERRED TO THE CITY OF BROKEN ARROW (05/16/94): All applicable portions of these specifications will apply except for method of measurement and basis of payment to all projects constructed by a private contractor that will be transferred to the City of Broken Arrow. At the discretion of the developer, the method of measurement and basis of payment may be used.

106 MATERIALS NOT LISTED IN THESE SPECIFICATIONS (05/16/94): Materials listed in these specifications are those materials normally used by the City of Broken Arrow. This does not preclude the use of other materials by developers, engineers, or contractors. When a material not listed in these specifications is to be used in a project, the engineer designing the project will provide to the City Engineer, a draft specification for approval. Once the draft specification is approved, the material may be used in the project.

107 INSPECTION OF UTILITY WORK (05/16/94): All utility inspections will be conducted in accordance with City of Broken Arrow Administrative Regulation 11.15

108 TESTING REQUIREMENTS:

108.01 APPLICATION OF TEST REQUIREMENTS (08/19/99):

a. **General:** Unless otherwise specified, testing of projects constructed using these specifications will be tested in accordance with this section. Unless otherwise specified, the contractor will provide the equipment, materials, and labor necessary to conduct the required tests. The contractor will coordinate with the Utility Inspector for appropriate test dates and the inspector will observe tests as required. Where tests are conducted off site or by a testing laboratory, the contractor will provide the Utility Inspector with certified copies of the test results. If a project or portion of a project fails to meet the required test results, the contractor will take appropriate corrective action and the test shall be conducted again on the corrected work. Corrections to work in place and additional testing shall be at the contractor's expense.

b. **Testing Philosophy:** The City of Broken Arrow shall require only those tests necessary to ensure that the construction meets the minimum standards. To meet this goal the testing specifications have been established with a minimum testing requirement and a maximum testing requirement. The City Utility Inspectors will start each project requiring the minimum number or frequency of tests established in this section. If site conditions, initial test results, or contractor performance, warrants additional testing, the inspector at his/her discretion may require up to the maximum number or frequency of tests set forth in this section. If in the opinion of the developer or contractor the number of tests required, above the minimum number or frequency, is unreasonable, the developer or contractor may appeal the requirement to the Public Works Director. If the developer or contractor does not agree with the Public Works Director's decision the normal process for appealing City decisions will be followed.

c. **Normal Testing Requirements:**

1. Concrete Streets: Sections 108.09, 108.10, and 108.12
2. Asphaltic Concrete Streets: Sections 108.09, 108.11, and 108.12
3. Storm Sewers: Sections 108.02, 108.03 (If the line crosses a street), 108.08, 108.10, and 108.14.
4. Water Lines: Sections 108.02, 108.03 (If the line crosses a street), and 108.04.
5. New Sanitary Sewer Lines: Sections 108.02, 108.03 (If the line crosses a street), 108.06, 108.07, 108.08, and 108.10.
6. Replacement Sanitary Sewer Lines: Sections 108.02, 108.03 (If the line crosses a street), 108.06, 108.07, 108.08, and 108.10.

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7. Other Utility Lines: Sections 108.02, and 108.03 (If the line crosses a street).
8. Concrete Structures: Sections 108.09 and 108.10.

108.02 TRENCH COMPACTION TESTING (05/16/94):

a. **Required For:**

1. Initial Backfill: These standards will be met for construction of water lines, sewer lines, and storm sewers.
2. Final Backfill: These standards will be met for construction of water lines, sewer lines, storm sewers, and other utility trenches when there is not sufficient time to allow for natural trench settlement before adjacent construction starts or the work is in an area that is already developed.

b. **Test Preparation:** The contractor shall have the backfill materials tested in accordance with ASTM D 1557, Method D. The contractor shall then establish a backfilling procedure for the trench and use that procedure until the site conditions require a change to the procedure. Prior to requesting testing of compaction the contractor will have the inspector view backfill operations to ensure that they are being conducted in accordance with the established procedure.

c. **Minimum Frequency:**

- (1) Initial Test: The initial compaction tests will be conducted in the first 300 feet of trench backfilled.
- (2) Subsequent Tests: The Inspector will call for one set of tests once every 4,000 feet of line for cross country pipelines and once every 2,000 feet for pipelines inside of built up areas.

d. **Maximum Frequency:** Tests will be conducted each time the backfill material changes. The Inspector will call for one set of tests once every 2,000 feet of line for cross country pipelines and once every 1,000 feet for pipelines inside of built up areas.

e. **Test Procedure:** Tests may be conducted either during the compaction process or by spot excavating the trench and taking the tests. In place density tests will be conducted in accordance with ASTM D 1556 or ASTM D 2922. When ASTM D 2922 is used, ASTM D 3017 will be used to determine the moisture content of the soil. One compaction test will be taken at:

1. Initial Backfill (Area from trench bottom to 1 foot over the top of the pipe is reached)
2. One test for each three (3) foot of depth of final backfill.

f. **Required Test Results:**

1. Initial Backfill: 90 percent maximum standard proctor density for cohesionless soils.
2. Final Backfill: 85 percent maximum standard proctor density for cohesive soils.

g. **Inspection Requirements:** The Utility Inspector will be on site to observe all testing. The contractor's testing laboratory shall provide written copies of the testing results to the Utility Inspector within three working days after the tests are completed. The work will not be accepted until these results are received.

108.03 STREET CROSSING/PAVED AREA COMPACTION TESTING (08/19/99):

a. **Required For:** Water lines, Sewer Lines, Storm Sewers, and Other Utility Trenches crossing streets.

b. **Test Preparation:** The contractor shall have the backfill materials tested in accordance with ASTM D 1557, Method D. The contractor shall then establish a backfilling procedure for the trench and use that procedure until the site conditions require a change to the procedure. Prior to requesting testing of compaction the contractor will have the inspector view backfill operations to ensure that they are being conducted in accordance with the established procedure.

c. **Minimum Frequency:** One (1) set of compaction tests at each cut and cover street crossing.

d. **Maximum Frequency:** One (1) set of compaction tests for each lane of traffic, at each cut and cover street crossing.

e. **Test Procedure:** Tests may be conducted either during the compaction process or by spot excavating the trench and taking the tests. In place density tests will be conducted in accordance with ASTM D 1556 or ASTM D 2922. When

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ASTM D 2922 is used, ASTM D 3017 will be used to determine the moisture content of the soil. One compaction test will be taken at:

1. Initial Backfill (Area from trench bottom to 1 foot over the top of the pipe is reached)
2. One test for each three (3) foot of depth of final backfill.

f. Required Test Results:

1. Initial Backfill: 95 percent maximum standard proctor density for cohesionless soils / 90 percent maximum standard proctor density for cohesive soils.
2. Final Backfill: 95 percent maximum standard proctor density for cohesionless soils.
3. **NOTE: No compaction testing is required if flowable fill or washed rock is used to backfill street cuts.**

g. Inspection Requirements: The Utility Inspector will be on site to observe all testing. The contractor's testing laboratory shall provide written copies of the testing results to the Utility Inspector within three working days after the tests are completed. The work will not be accepted until these results are received.

108.04 WATER LINE PRESSURE, LEAKAGE, AND BACTERIA TESTING (08/19/99):

a. Required For: Water lines

b. Test Preparation: The contractor may pressure test the distribution line without the taps installed. If this option is selected, the line will be pressure tested again after the taps have been installed and flushed. To the maximum extent possible, sample points shall be service taps. Prior to starting the test the Contractor will flush the line of all dirt and air. This will be coordinated with the Utility Inspector and the Utilities Division of the Public Works Department. All sample points will be clean and marked to allow the Utility Inspector to take samples from them.

c. Minimum Frequency: One pressure and leakage test for a distribution system. Bacteria tests will be as required by State regulations. The first test will be paid for by the City. Any retests required because of a test failure will be at the contractor's expense.

d. Maximum Frequency: Tests may be conducted on any section of the line that can be valved off from the portion of the line that has not been tested. The number of sections tested will be limited to the smallest number feasible to reduce testing costs. The number of sections to be tested will be coordinated with the Utility Inspector. Only lines that have passed the pressure test will be tested for bacteria.

e. Test Procedure:

1. The Contractor shall flush, fill, and bring the line up to test pressure and the line must maintain that pressure for the required time period with less than the specified pressure drop.
2. If the line does not make the pressure test, then the contractor must repair the lines so that it will meet the test requirements.
3. Upon passing the pressure test, the line will be leak tested by placing it at normal operating pressure and measuring the leakage for a two (2) hour period.
4. Following completion of the pressure and leak tests the Contractor shall add additional chlorine if necessary to sanitize the line.
5. The Contractor will flush the chlorine out of the line.
6. Once the line is flushed the Inspector will check the chlorine count to insure that it is in the range from 0 to 2.0 parts per million.
7. The line will be allowed to set for a period of 48 hours without adding additional chlorine or flushing water through the system.
8. The Inspector will take water samples after the 48 hour period for two (2) consecutive days and turn in the samples to the Department of Environmental Quality for testing.
9. If the samples from the line do not pass the Contractor will flush the line and add additional chlorine. Once this is done, the process of checking the line will start again at Paragraph 108.04 b.3.
10. If the samples in the line pass then the Contractor will flush the line completely and make sure that all valves are open.
11. The Contractor will then remove all sample points from the line and backfill it in preparation for acceptance.
12. Test water shall be disposed of, by the contractor, in accordance with guidance from the Utility Inspector.

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f. **Required Test Results:**

1. Pressure (Special Lines): Hold pressure specified by designer for 30 minutes with a drop of 5 PSI or less.
2. Pressure (Normal): Hold 150 Psi for 30 minutes with a drop of 5 PSI or less.
3. Leakage: Meet the requirements of the Table in Section 901.
4. Bacteria: All samples must pass the required Department of Environmental Quality test.

g. **Inspection Requirements:** The Utility Inspector will be on site to observe all pressure testing. The Utility inspector will take samples for Department of Environmental Quality testing. The cost of Department of Environmental Quality testing will be paid by the City.

108.05 SANITARY SEWER FORCE MAIN PRESSURE TESTING (05/16/94):

a. **Required For:** Sanitary Sewer Force Mains

b. **Test Preparation:** Prior to starting the test the Contractor will flush the line of all dirt and air. This will be coordinated with the Utility Inspector and the Utilities Division of the Public Works Department.

c. **Minimum Frequency:** One test will be conducted for the complete force main unless otherwise specified.

d. **Maximum Frequency:** Tests will be conducted for the complete force main until the line passes.

e. **Test Procedure:**

1. The Contractor will bring the line up to test pressure and the line must maintain that pressure for a period of 30 minutes with not more than a 5 PSI drop.
2. If the line does not pass the pressure test, then the contractor must repair the lines so that it will meet the test requirements.

f. **Required Test Results:** Hold 1.5 times the working pressure of the line for 30 minutes with a drop of 5 PSI or less.

e. **Inspection Requirements:** The Utility Inspector will be on site to observe all pressure testing.

108.06 SANITARY SEWER LINES LAMPING, MANDREL, AND PRESSURE TESTING (08/19/99):

a. **Required For:** New installations of gravity sanitary sewer lines

b. **Test Preparation:** The Contractor will ensure that the line is clean and all debris has been removed from manholes. The Contractor will coordinate with the Utility Inspector to have the lines lamped and tested with a mandrel prior to pressure testing.

c. **Minimum Frequency:** Each line from manhole to manhole will be lamped, tested with a mandrel and pressure tested.

d. **Maximum Frequency:** Each line from manhole to manhole will be lamped, tested with a mandrel and pressure tested until the line passes.

e. **Test Procedure:**

1. Lamping: The contractor will provide the necessary personnel to assist the Utility Inspector in lamping the line. Lamping will consist of shinning a light source from one end of the line while the Utility Inspector observes from the other end.

2. Mandrel Test (Required on PVC lines only): The contractor will have personnel pull the required size mandrel through the line while the Utility Inspector Observes. This test will be conducted 30 days or longer after the line has been installed unless otherwise coordinated with the Utility Inspector.

3. Pressure Test:

(a) The Contractor will plug both ends of the line and pressure the line to 4 PSI.

(b) When the line is at pressure the Utility Inspector will observe the pressure gage for the specified period.

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- (c) If the line does not meet test requirements, the contractor will make necessary repairs and retest.
- (d) When the test is completed, the contractor will remove all plugs and ensure the line is clear.

f. Required Test Results:

1. Lamping must show a clear circle of light with no dips or obstructions.
2. The Mandrel must pass through the line.
3. The line must hold 4 PSI of air pressure for 7 minutes.

g. Inspection Requirements: The Utility Inspector will be on site to observe all lamp, mandrel and pressure testing.

h. Alternative Inspections: In special circumstances and with the prior approval of the Public Works Director, the following alternative tests may be substituted for the pressure test detailed above.

1. Joint Testing: On 24 inch and larger diameter lines, as detailed in Section 911.
2. Exfiltration Test: Conducted in accordance with standard industry practices.
3. Infiltration Test: Conducted in accordance with standard industry practices.
4. The contractor may substitute having the line inspected with a TV camera for lamping and mandrel testing. The contractor will provide the inspector with a copy of the TV tape (in VHS format) of the line.

108.07 VACUUM TESTING OF MANHOLES (08/19/99):

a. Required For: Any manhole that, in the opinion of the inspector, requires more extensive testing than is provided in section 108.08.

b. Test Preparation: The Contractor will ensure that the manhole is clean and all debris has been removed.

c. Minimum Frequency: Each manhole as required.

d. Maximum Frequency: Each manhole as required.

e. Test Procedure:

1. The contractor will plug the lines in the manhole and induce a vacuum of 4 PSI in the manhole.
2. When the manhole is at vacuum the Utility Inspector will observe the pressure gage for the specified period.
3. If the manhole does not meet test requirements, the contractor will make necessary repairs and retest.
4. When the test is completed, the contractor will remove all plugs and ensure the manhole is clear.

f. Required Test Results: The manhole must hold a vacuum of 4 PSI for 7 minutes.

g. Inspection Requirements: The Utility Inspector will be on site to observe all pressure testing.

108.08 MANHOLE INSPECTION/TESTING (05/16/94):

a. Required For: Sanitary sewer and storm sewer manholes.

b. Test Preparation: The contractor will ensure that the manholes to be inspected are clean, properly grouted, and that the appropriate rings and lids have been installed.

c. Minimum Frequency: All manholes will be visually inspected for compliance with specifications.

d. Maximum Frequency: The Utility Inspector may request that a manhole that does not appear to meet specifications be tested by either vacuum testing for new installations or dye testing for replacement projects.

e. Test Procedure:

1. The Inspector will visually inspect each manhole for compliance with the specifications.
2. If a vacuum test is required it will be conducted in accordance with industry standard practices.
3. If a dye test is required it will be prepared in the same manner as a line test except:
 - (a) The dye injection will be at 4 equally spaced locations around the manhole.

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(b) Dye will be injected until, in the opinion of the Utility Inspector, the area is saturated.

(c) The Utility Inspector will observe the manhole for 30 minutes and if dye appears on the walls of the manhole, the manhole has failed the test. If the manhole fails the test, the contractor will make necessary repairs and retest.

f. Required Test Results:

1. The manhole must pass the visual inspection.
2. If required the manhole must pass the vacuum test.
3. If a dye test is required no dye shall appear on the sides of the manhole in 30 minutes.

g. Inspection Requirements: The Utility Inspector will be on site to observe all testing.

108.09 STREET SUBGRADE AND BASE COMPACTION TESTING (05/16/94):

a. Required For: All street construction involving subgrade and/or base work.

b. Test Preparation: The contractor shall have the subgrade/base materials tested in accordance with ASTM D 1557, Method D. The contractor shall prepare the subgrade and/or base in accordance with the plans and specifications. Prior to testing the contractor shall coordinate with the Utility Inspector for the Inspector to observe the testing. Tests shall be conducted at the locations designated by the inspector.

c. Minimum Frequency:

1. One test every 1,000 feet of 13 foot wide lane for subgrade.
2. One test every 1,000 feet of 13 foot wide lane for base.

d. Maximum Frequency:

1. One test every 350 feet of 13 foot wide lane for subgrade.
1. One test every 350 feet of 13 foot wide lane for base.

e. Test Procedure: In place density tests will be conducted in accordance with ASTM D 1556 or ASTM D 2922. When ASTM D 2922 is used, ASTM D 3017 will be used to determine the moisture content of the soil. The contractor's testing laboratory shall conduct a test in each area at the location specified by the inspector. If the Inspector is concerned about the stability of the subgrade and/or base, he/she may require the contractor to proof roll the subgrade with a 50 ton roller or other suitably loaded piece of equipment such as a scraper.

f. Required Test Results: The subgrade and/or base must meet the density and moisture content required in the plans and specifications. The subgrade and/or base must also be stable and show no sign of pumping under proof rolling.

g. Inspection Requirements: The Utility Inspector will be on site to observe all testing. The contractor's testing laboratory shall provide written copies of the testing results to the Utility Inspector within three working days after the tests are completed. The work will not be accepted until these results are received.

108.10 CONCRETE TESTING (05/16/94):

a. Required For: Curb and Gutter, Paving, Drainage Structures, and Structural Concrete.

b. Test Preparation: Prior to placing concrete the contractor shall have the base tested and accepted, required forms constructed, and required reinforcing steel installed and approved. The contractor shall coordinate with the Utility Inspector for the Inspector to be on site to observe the concrete placement and testing.

c. Minimum Frequency:

1. Slump Test: The contractor shall have a slump test conducted on one of the first five (5) loads of concrete delivered to the site.
2. The contractor shall have a minimum of three (3) test cylinders taken for each day that concrete is placed. Normal requirement will be three (3) test cylinders per 100 cubic yards.

d. Maximum Frequency:

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1. Slump Test: The Utility Inspector may require a slump test be conducted on any load of concrete that appears to not meet the specifications.
2. The Utility Inspector may require up to six (6) test cylinders be taken for every 100 cubic yards of concrete placed.

e. Test Procedure:

1. Slump Test: Slump tests shall be conducted in accordance with the standard procedure. If the contractor does not have the slump test equipment, he/she can coordinate with the Utility Inspector for the use of the City's slump testing cone. The Utility Inspector will train the contractor personnel in the proper use of the slump test equipment, if necessary.
2. Test Cylinders: Each set of three (3) test cylinders shall be made and stored in accordance with the "Standard Method of Making and Curing Concrete Compression and Flexure Test Specimens in the Field", ASTM Designation C31, and shall be tested in accordance with the requirements relating to making compression tests on concrete test specimens as given in the "Method of Test for Compressive Strength of Molded Concrete Cylinders", ASTM Designation C39. All test specimens shall be kept as near to the point of sampling as possible and yet receive the same protection from the elements as is given to portions of the structure being built. Specimens shall be protected from injury. They shall be sent to a testing laboratory approved by the City not more than seven days prior to the time of the test and while in the laboratory shall be kept in the ordinary air at a temperature of approximately 70° F until tested. One (1) of the cylinders from each set shall be subjected to compression testing at seven (7) days and the written results forwarded to the Utility Inspector. A second test cylinders shall be subjected to compression testing at 28 days and the written results forwarded to the Utility Inspector. Based on the results of the first two (2) tests, the Utility Inspector may or may not elect to have the remaining cylinder tested. The Contractor shall furnish to the Utility Inspector certified reports on these tests and shall pay all expense of making the tests and of furnishing the concrete for preparing and testing the cylinders.

f. Required Test Results: The test results must meet or exceed the specified slump and strength requirements.

g. Inspection Requirements: The Utility Inspector will be on site to observe all testing. The contractor's testing laboratory shall provide written copies of the testing results to the Utility Inspector within three working days after the tests are completed. The work will not be accepted until these results are received.

108.11 ASPHALTIC CONCRETE TESTING (05/16/94):

a. Required For: Asphaltic Concrete Paving

b. Test Preparation: Prior to placing asphaltic concrete the contractor shall have the base tested and accepted. He/she shall coordinate with the Utility Inspector for the Inspector to be on site during paving operations.

c. Minimum Frequency:

1. Temperature: The Utility Inspector shall take the temperature of at least one (1) of the first ten (10) loads to be placed.
2. Density: The contractor shall have a compaction test conducted for every 1,000 feet of 13 foot wide lane of asphaltic concrete placed.
3. Hveem Stability Test: The contractor shall have a minimum of one (1) Hveem stability test conducted for each day asphaltic concrete is placed. Normal requirement shall be one (1) Hveem Stability test taken for every 200 tons of asphaltic concrete placed.

d. Maximum Frequency:

1. Temperature: The Utility Inspector may take the temperature of all loads to be placed.
2. Density: The Utility Inspector may require a compaction test be conducted for every 350 feet of 13 foot wide lane of asphaltic concrete placed.
3. Hveem Stability Test: The Utility Inspector may require two (2) Hveem Stability tests taken for every 200 tons of asphaltic concrete placed.

e. Test Procedure:

1. Temperature Testing: The Utility Inspector shall take the temperature of the asphalt just behind the laydown machine.
2. Density Testing: In place density tests will be conducted in accordance with ASTM D 1556 or ASTM D 2922.
3. Hveem Stability Testing: During placement operations the contractor's testing laboratory or supplier shall pull

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sufficient asphaltic concrete to conduct the Hveem Stability test from two separate loads at least 30 minutes apart.

f. Required Test Results:

1. Temperature: The asphaltic concrete must meet the temperature parameters in the appropriate ODOT specification.
2. Density: The asphaltic concrete must have a density of not less than 94% and not more than 98%.
3. Hveem Stability: The Hveem stability must be not less than 40%.

g. Inspection Requirements: The Utility Inspector will be on site to observe all testing. The contractor's testing laboratory and/or supplier shall provide written copies of the testing results to the Utility Inspector within three working days after the tests are completed. The work will not be accepted until these results are received.

108.12 CORE SAMPLES (05/16/94):

a. Required For: Asphaltic Concrete and Concrete Streets

b. Test Preparation: Preparation for taking and repairing core sample sites shall be in accordance with ODOT Specification Section 411.04 for asphaltic concrete and ODOT Specification Section 414.04 for concrete.

c. Minimum Frequency: One (1) core sample every 26,000 square feet. The contractor shall coordinate exact sample locations with the Utility Inspector.

d. Maximum Frequency: One core sample every 10 feet to determine the extent of a deficiency.

e. Test Procedure:

1. Core samples shall be taken on the completed roadway.
2. The contractor and Utility Inspector shall mark the locations for coring.
3. The contractor's testing laboratory shall core each area at the location specified by the inspector. The laboratory shall evaluate the core samples and provide the samples and a written report to the Utility inspector.
4. The contractor shall repair the roadway after samples have been removed.

e. Required Test Results: The core samples must meet the requirements of the plans and specifications. If the samples do not meet the specifications then the ODOT specifications will govern on action to be taken.

f. Inspection Requirements: The Utility Inspector will be on site to observe all testing. The contractor's testing laboratory shall provide written copies of the testing results to the Utility Inspector within three working days after the tests are completed. The work will not be accepted until these results are received.

108.13 STORM SEWER PIPE INSPECTION/TESTING (08/19/99):

a. Required For: Storm sewer pipe

b. Test Preparation: The Contractor will ensure that the line is clean and all debris has been removed from manholes and drop inlets. The Contractor will coordinate with the Utility Inspector to have the lines lamped and tested with a mandrel prior to pressure testing.

c. Minimum Frequency: Each line from manhole to manhole or drop inlet will be lamped and tested with a mandrel if PVC or HDPE is used.

d. Maximum Frequency: Each line from manhole to manhole or drop inlet will be lamped and tested with a mandrel if PVC or HDPE is used. If the inspector suspects a portion of the line was not properly installed, a dye test of that portion of the line may be required.

e. Test Procedure:

1. Lamping: The contractor will provide the necessary personnel to assist the Utility Inspector in lamping the line. Lamping will consist of shining a light source from one end of the line while the Utility Inspector observes from the other end.

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2. Mandrel Test (Required on PVC and HDPE lines only): The contractor will have personnel pull the required size mandrel through the line while the Utility Inspector observes. This test will be conducted 30 days or more after the line has been installed unless otherwise coordinated with the Utility Inspector.

3. If a dye test is required it will be prepared in the same manner as a sewer line test except:

(a) The dye injection will be at equally spaced locations around the section in question.

(b) Dye will be injected until, in the opinion of the Utility Inspector, the area is saturated.

(c) The Utility Inspector will observe the line for 30 minutes and if dye appears in the line, the line has failed the test.

If the line fails the test, the contractor will make necessary repairs and retest.

f. Required Test Results:

1. Lamping must show a clear circle of light with no dips or obstructions.

2. The Mandrel must pass through the line.

g. Inspection Requirements: The Utility Inspector will be on site to observe all lamp, mandrel and dye testing, if required.

108.14 STORM SEWER DROP INLETS AND JUNCTION BOXES INSPECTION/TESTING (05/16/94):

a. Required For: Storm sewer Drop Inlets and Junction Boxes

b. Test Preparation: The contractor will ensure that the drop inlets and junction boxes to be inspected are clean, properly grouted, and that the grates or rings and lids have been installed.

c. Minimum Frequency: All drop inlets and junction boxes will be visually inspected for compliance with specifications.

d. Maximum Frequency: The Utility Inspector may request that a drop inlet or junction box that does not appear to meet specifications be tested by dye testing.

e. Test Procedure:

1. The Inspector will visually inspect each drop inlet and junction box for compliance with the specifications.

2. If a dye test is required it will be prepared in the same manner as a line test except:

(a) The dye injection will be at 4 equally spaced locations around the drop inlet or junction box.

(b) Dye will be injected until, in the opinion of the Utility Inspector, the area is saturated.

(c) The Utility Inspector will observe the drop inlet or junction box for 30 minutes and if dye appears on the walls of the drop inlet or junction box, the drop inlet or junction box has failed the test. If the drop inlet or junction box fails the test, the contractor will make necessary repairs and retest.

f. Required Test Results: The drop inlet or junction box must meet specifications and if dye testing is required then no dye shall enter the drop inlet or junction box.

g. Inspection Requirements: The Utility Inspector will be on site to observe all testing.

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108.15 MATERIALS (05/16/94):

a. **Test Preparation and Frequency:** As required by the materials specifications.

b. **Test Procedure:** As required by the materials specifications.

c. **Required Test Results:** As required by the materials specifications.

d. **Inspection Requirements:** Certified copies of materials tests will be provided to the Utilities Inspector before the material is used on the project. Concrete strength tests are the exception to this requirement. They will be provided to the Inspector as required by Section 330.

109 SUBMITTALS (05/16/94): Submittals will be provided to the Contract Administrator or Utilities inspector as required by the specifications or during the pre-construction conference. The submittals will be reviewed and approved or returned for additional information within two weeks after receipt. The following guidelines will apply unless the contractor is notified otherwise:

109.01 MATERIALS: Material submittals will be made before the material is installed.

109.02 WORKING DRAWINGS: Prior to starting work on the items covered by the drawings.

109.03 COMPACTION AND CONCRETE: Test results within three (3) days after testing is completed.

110 ABBREVIATIONS (05/16/94): Wherever the following abbreviations are used in Contracts, Proposals, these Specifications or on Plans, they are to be construed the same as the respective expressions represented:

AASHTO	American Association of State Highway and Transportation Officials
AIA	American Institute of Architects
ANSI	American National Standards Institute (United States of America Standards Institute)
ASA	American Standards Association
ASCE	American Society of Civil Engineers
ASTM	American Society of Testing and Materials
AWPA	American Wood Preservers Association
AWWA	American Water Works Association
AWS	American Welding Society
NEC	Nations Electrical Code
NEMA	National Electrical Manufacturers Association
ODOT	Oklahoma Department of Transportation
UL	Underwriter's Laboratory

111 DEFINITIONS (05/16/94):

111.01 BASE COURSE: The layers of selected material of a designated thickness placed on a subbase or a subgrade to support a surface course.

111.02 CALENDAR DAY: Any day shown on the calendar beginning and ending at midnight.

111.03 CHANGE ORDER: A written order issued by the City to the Contractor, covering changes within the scope of the Contract and establishing the basis of payment and time adjustments for the work affected by the changes.

111.04 CHANNEL: A natural or artificial water course.

111.05 CONTRACT: The written agreement between the City and the Contractor setting forth the obligations of the parties thereunder, including, but not limited to, the performance of the work, the furnishing of labor and materials, and the basis of payment. The contract includes the Invitation for Bids, Proposal, Contract Form, all Contract Bonds, Specifications, Supplemental Specifications, Special Provisions, all Plans, and the Work Order, also any Change Orders and Supplemental Agreements that are required to complete the construction of the work in an acceptable manner, including authorized extensions.

111.06 CONTRACT ADMINISTRATOR: The contract administrator is the City employee assigned responsibility for coordination with the contractor and administration of the contract.

111.07 COMPLETION DATE: The date on which the Contract work is completed.

111.08 CONTRACT ITEM (PAY ITEM): A specifically described unit of work for which a price is provided in the

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Contract.

111.09 CONTRACT TIME: The number of work days or calendar days allowed for completion of the Contract, including authorized time extensions.

111.10 CONTRACTOR: The individual, partnership, joint venture, firm or corporation contracting with the City for performance of prescribed work.

111.11 CULVERT: Any structure under the roadway with a clear opening of twenty (20) feet or less measured along the center of the roadway.

111.12 DRAINAGE DITCH: An open excavation or ditch constructed for the purpose of carrying off surface water.

111.13 EASEMENT: A grant of the right of use of property of an owner for a certain purpose at the will of the grantee.

111.14 ENGINEER: The City Engineer and such Assistants or Representatives as authorized by the City Manager while acting within the scope of their assigned duties or vested authority.

111.15 EQUIPMENT: All machinery, tools and apparatus necessary for the proper construction and acceptable completion of work.

111.16 FINAL ACCEPTANCE DATE: The date upon which the completed work is accepted by the City without exception or reservation.

111.17 HOLIDAYS: Any day proclaimed a holiday by the City.

111.18 HVEEM STABILITY TEST: Asphaltic concrete test that measures the asphaltic concrete mix's resistance to lateral displacement under vertical loading.

111.19 LABORATORY: The official testing laboratory of the City or any other testing laboratory which may be designated by the City Engineer.

111.20 MATERIALS: Any substances used in the construction of the project and its appurtenances.

111.21 NOTICE TO PROCEED: Written notice to the Contractor to proceed with the Contract work not later than the date specified.

111.22 PAVEMENT STRUCTURE: The combined subbase, base and surface courses placed on the subgrade to support the traffic load and distribute it to the roadbed.

111.23 PIPE BEDDING: Material placed in the bottom of the excavation which serves as the base for the pipeline.

111.24 PLANS: The approved plans, profiles, typical sections, cross sections, working drawings and supplemental drawings, or exact reproductions thereof, which show the location, character, dimensions, and details of the work to be done.

111.25 PROJECT INSPECTOR: An authorized Representative of the City assigned to make detailed inspections of Contract performance.

111.26 PROJECT: The specific pipelines, facilities, and all appurtenances and construction to be performed under the Contract.

111.27 RIGHT-OF-WAY: A general term denoting land, property, or an interest therein, acquired for highway purposes.

111.28 SELECT BACKFILL: The material placed around a pipeline from the top of the bedding material to 18" over the top of the pipe.

111.29 SIDEWALK: That portion of the Right-of-Way constructed for the use of pedestrians.

111.30 SPECIAL PROVISIONS: Additions and revisions to the Standard and Supplemental Specifications.

111.31 SPECIFICATIONS: The compilation of provisions and requirements for the performance of prescribed work.

111.32 STANDARD SPECIFICATIONS: The book of Specifications approved for general application and repetitive use.

111.33 STRUCTURE: Bridge, culvert, catch basin, drop inlet, retaining wall, cribbing, manhole, endwall, headwall, building, sewer, service pipe, underdrain, and foundation drain and other features which may be encountered in the work and not otherwise Classified.

111.34 SUBBASE: The layer or layers of selected material of a designed thickness placed on a subgrade to support a base course.

111.35 SUBGRADE: The top surface of a roadbed upon which the pavement structure and shoulders are constructed.

111.36 SUBMITTALS: Those items which must be submitted and approved by the City prior to work on an item or during work on an item. This may include working drawings, supplier certifications, test results, and other types of information.

111.37 SUPERINTENDENT: The representative of the Contractor present at all times during progress of the work, capable of supervising the work effectively and authorized to make binding decisions for the Contractor.

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111.38 SURFACE COURSE: One or more layers of a pavement structure designed to accommodate the traffic load, the top layer of which resists skidding, traffic abrasion, and the disintegrating effects of climate. The top layer is sometimes called the "Wearing Course."

111.39 WATER LINES (DISTRIBUTION): The water lines used to transport water from one area of the City to another area. These lines are normally larger than 12" and are normally tapped only to main water lines.

111.40 WATER LINES (MAIN): The water lines sized 4" to 12" that are used to distribute water to various users in the City.

111.41 WATER LINES (RETURN): The 4" water lines used on dead end lines to loop the dead end line back into the system. These lines are not tapped and are abandoned when the dead end line is extended.

111.42 WORK: Work shall mean the furnishing of all labor, materials, equipment, and other incidentals necessary to the successful completion of the project and the carrying out of all the duties and obligations imposed by the Contract.

111.43 WORKING DAY: Every day shown on the calendar, exclusive of Saturdays, Sundays and holidays on which weather and other conditions not under the control of the Contractor will permit construction operations to proceed for a minimum of six hours with normal working forces engaged in performing the controlling item or items of work. Saturdays, Sundays and holidays on which the Contractor's forces engage in regular work, requiring the presence of an inspector, will be considered as working days.

111.44 WORKING DRAWINGS: Stress sheets, shop drawings, erection plans, false-work plans, framework plans, cofferdam plans, bending diagrams for reinforcing steel, or any other supplementary plans or similar data which the Contractor is required to submit to the Engineer for approval.

112 CORRECTIONS AND UPDATES: The City of Broken Arrow will update these specifications, as necessary, on a quarterly basis. If you have a suggested improvement or addition to these specifications please forward them to the Public Works Director, P. O. Box 610, Broken Arrow, Oklahoma 74013. All proposed changes will either be included in the next scheduled update or the person submitting the proposed change will be informed, in writing, of the reasons the change was not made.

SECTION 200 - STREETS

201 ADOPTION OF ODOT STANDARD SPECIFICATIONS (05/16/94): The City of Broken Arrow, Oklahoma, hereby adopts the Oklahoma Department of Transportation Standard Specifications for Highway Construction, Section 101 and Sections 200 through 800 for use in construction of City streets and drainage structures.

202 CHANGES TO ODOT STANDARD SPECIFICATIONS (05/16/94): The following changes are incorporated into the ODOT Standard Specifications:

202.01 REFERENCES TO AGENCY CONTRACTING FOR THE WORK: Where references are made to ODOT as the agency contracting for the work, the reference will be read as "City of Broken Arrow" for City of Broken Arrow contracts.

202.02 REFERENCES TO ENGINEER (ALL TYPES): References to Engineer will be read as Contract Administrator for City of Broken Arrow contracts.

202.03 OTHER REFERENCES REQUIRING CLARIFICATION: If there is a reference that requires clarification and it is not covered in the Special Provisions of the contract, the Contract Administrator will provide the contractor with a written clarification upon request.

203 PROCEDURE FOR USING ODOT STANDARD SPECIFICATIONS IN CITY CONTRACTS (05/16/94):

203.01 REQUIRED ADDITIONS TO THE SPECIAL PROVISIONS : The following Statements will be added to the Special Provisions of the contract: "The Oklahoma Department of Transportation Standard Specifications for Highway Construction, Sections 200 through 800 are included by reference. Specifications listed in the contract as ODOT XXX.XX Description, where XXX.XX represents a specification number, refer to the current ODOT Standard Specification with the same number. Where references are made to ODOT as the agency contracting for the work, the reference will be read as "City of Broken Arrow" for City of Broken Arrow contracts. References to Engineer will be read as Contract Administrator for City of Broken Arrow contracts."

203.02 OPTIONAL ADDITIONS TO THE SPECIAL PROVISIONS: When an ODOT Standard Specification requires more clarification than the information in 203 a. above, the person preparing the contract will provide additional clarification by referencing the specification by number and description and then providing the required clarification.

203.03 LISTING ODOT SPECIFICATIONS: ODOT specifications will be listed in the format ODOT XXX.XX Description where XXX.XX represents the standard specification number.

204 SPECIAL CITY REQUIREMENTS (05/16/94):

204.01 TESTING REQUIREMENTS:

- a. **Materials Testing:** Materials testing shall be as specified in the ODOT Standard Specifications.
- b. **Construction Testing:** Testing of completed construction shall be as specified in the ODOT Standard Specifications and Section 108 of these specifications.

204.02 SUBGRADE:

- a. **Preparation:**
 1. When preparing the subgrade, all roots and plant material shall be removed and the excavation refilled with suitable backfill.
 2. When working the subgrade all soft, yielding, or other unsuitable materials, shall either be removed and replaced, or stabilized in place.
- b. **Stability Testing:**
 1. When preparing subgrades the subgrade will be checked for stability, even though it may meet the compaction

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requirements.

2. The check for stability shall be proof rolling with a large roller or loaded scraper and visual observation to insure that there is no pumping of the subgrade.

c. Correction of Unstable Subgrade:

1. A pumping subgrade shall be treated or replaced until it is stable.
2. Subgrade drainage shall be considered when a subgrade pumping problem is encountered. When subgrade drainage is not installed, the engineer shall inform the City Engineer, in writing, of the reasons for not installing subgrade drainage.

d. Testing Requirements: See Section 108.09.

204.03 BASE:

a. Treated Base: When the base consists of treating the top eight (8) inches or more of the subgrade, the provisions of section 204.02 will apply.

b. Aggregate Base: The use of crushed aggregate base is strongly encouraged in areas where subgrade strength is low, subsurface water conditions exist, and subgrade stability is questionable.

c. Base Drainage: Where groundwater or surface water ponding present a threat to base stability a drainage system as shown in ST08 is recommended.

d. Additional City Testing Requirements: See Section 108.09.

e. Standard Drawings: ST03, ST04, ST08, and ST21

204.04 CONCRETE PAVING:

a. Concrete Street General:

1. Concrete streets shall be constructed of Class BA1 concrete and shall be in accordance with Standard Drawings ST03 and ST05 and the plans and specifications.
2. Curb and gutter may be placed separate of the pavement.
3. Concrete shall be cured with white curing compound.

b. Longitudinal Joints:

1. Longitudinal cracking joints will normally be sawed into the finished pavement to a depth of one-fourth of the pavement thickness.
2. Longitudinal cracking joints shall be placed at intervals not to exceed every 12 feet. The exception to this rule is on 26 foot wide residential streets where the curb is integral to the pavement. For this type of street, one longitudinal cracking joint down the center of the pavement is acceptable.
3. Longitudinal construction joints on residential minor and residential high density minor streets may, at the option of the design engineer, be butt type joints without a tiebar.
4. Longitudinal construction joints on residential collector streets may, at the option of the design engineer, be butt type joints with a tiebar or keyway type without a tiebar.
5. Longitudinal construction joints on all other streets shall be keyway type with a tiebar.

c. Transverse Joints:

1. Transverse cracking joints will normally be sawed into the finished pavement to a depth of one-fourth of the pavement thickness
2. Transverse cracking joints shall be placed at intervals equaling two (2) times the pavement thickness in inches converted to feet (ie. $2 \times 6" = 12"$ which converts to a 12 foot spacing of transverse cracking joints) but, not to exceed every 15 feet.
3. Transverse construction joints on residential minor and residential high density minor streets may, at the option of the design engineer, be butt type joints without a tiebar.
4. Transverse construction joints on residential collector streets may, at the option of the design engineer, be butt type joints with a tiebar or keyway type without a tiebar.

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5. Transverse construction joints on all other streets shall be keyway type with a tiebar.

d. Expansion Joints:

1. Expansion joints shall be placed at all street intersection radius and at the last joint before a cul-de-sac.
2. Distance between expansion joints shall not exceed 105 feet.
3. Expansion joints shall have a tiebar when the street being constructed requires a tiebar or keyway for a construction joint.

e. **Joint Sealing:** All joints will be cleaned and sealed.

f. **Additional City Testing Requirements:** See Section 108.10 and 108.12.

g. **Standard Drawings:** ST03, ST07, ST09, ST11, ST12, ST13, ST14, ST15, ST16, ST18, ST19, ST20, and ST21.

204.05 CURB AND GUTTER:

a. Curb and Gutter General:

1. Curb and gutter shall be constructed of Class BA1 concrete and shall be in accordance with Standard Drawings ST03, ST04, and ST05 and the plans and specifications.
2. Curb and gutter may be placed separate of the pavement.
3. Concrete shall be cured with white curing compound.

b. Transverse Joints:

1. Transverse cracking joints will normally be sawed into the finished curb and gutter to a depth of one-fourth of the pavement thickness
2. Transverse cracking joints shall be placed at intervals equaling the spacing used for the street.
3. Transverse construction joints on curb and gutter shall match the type of joint required for the type of street being constructed.

c. Expansion Joints:

1. Expansion joints shall be placed at all street intersection radius and at the last joint before a cul-de-sac.
2. Distance between expansion joints shall not exceed 105 feet.
3. Expansion joints shall have a tiebar when the street being constructed requires a tiebar or keyway for a construction joint.

d. **Joint Sealing:** The joints in the gutter up to one (1) inch above the flow line will be sealed. The vertical face crack joints shall not be sealed.

e. **Additional City Testing Requirements:** See Section 108.10.

f. **Standard Drawings:** ST05, ST06, ST10, ST11, ST12, ST13, and ST23.

204.06 ASPHALT PAVING (08/19/99):

a. **Additional City Testing Requirements:** See Section 108.09 and 108.12.

b. **Density Requirements:** Any asphalt paving placed at a density of less than 94 percent, as defined in the ODOT standard specifications, will not be accepted. The asphalt must be removed and replaced with properly compacted asphaltic concrete.

c. **Standard Drawings:** ST04, ST07, ST09, ST10, ST14, ST15, ST17, ST18, ST19, ST20, and ST21.

204.07 SIDEWALKS:

a. **Materials:** Sidewalks shall be constructed of Class BA1 concrete.

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b. **Alignment and Drainage:** Alignment and drainage shall be as detailed in Section 7.2g of The City of Broken Arrow Land Subdivision Code. All sidewalks shall meet the requirements of the American's with Disabilities Act (ADA).

c. **Sidewalk Base Preparation:**

1. When constructing sidewalks the concrete shall be laid on a firm, smooth surface at an average depth below finish grade equal to the thickness of the sidewalk.
2. All soft and yielding or other unsuitable materials shall be removed and replaced with suitable material before construction of the sidewalk.

d. **Finish and Joints:**

1. Sidewalks shall have a non-slip broomed surface.
2. Expansion joints shall be placed at all intersections with curbs and not more than 30 feet apart.
3. Transverse cracking joints will normally be tooled or sawed into the finished sidewalk to a depth of one (1) inch.
4. Transverse cracking joints shall be placed at intervals not to exceed every 6 feet.

e. **Additional City Testing Requirements:** See Section 108.15.

f. **Standard Drawings:** ST06 and ST12.

204.08 STORM SEWER:

a. **Concrete Storm Sewer Pipe Joint Seals:** Concrete storm sewer pipe will be furnished with either Omni-flex or Forsheda seals or approved equal.

b. **Smooth Wall Corrugated Polyethylene Pipe:**

1. Authorized Use: Smooth wall corrugated polyethylene pipe in diameters from 15 inches to 48 inches may be used in storm drainage systems in the City of Broken Arrow.
2. Materials Specification: Smooth wall corrugated polyethylene pipe shall be manufactured from high density polyethylene HDPE virgin compounds and shall conform to AASHTO M-294 (latest edition). A certificate of compliance shall be furnished, by the contractor, for each type of polyethylene pipe used. Water tight joints capable of holding 2 psi of pressure, under hydrostatic testing, shall be required.
3. Construction Specifications: Construction of smooth wall corrugated polyethylene pipe storm sewers shall be in accordance with the manufacture's recommended construction specifications or the applicable ODOT specifications whichever is more restrictive.
4. Design Limitations: Design shall be in accordance with AASHTO Section 18 (Design of Soil - Thermoplastic Pipe interaction Systems). Minimum cover for all installations shall be specified at two (2) feet. The maximum conveyance factor shall be based on a Manning "n" value of 0.012.

c. **Precast Inlets:** Precast storm drain inlets and boxes may be used. When used these items will be placed on a four (4) inch thick 3,500 psi concrete working slab that extends one (1) foot past the walls of the structure. Shop drawings will be submitted and approved before any precast items are installed.

d. **Joint Wrapping With Geotextile:** When allowed by the Land Subdivision Code and required by the City Engineer or Utility Inspector, the contractor shall wrap storm sewer joints with a geotextile fabric meeting the requirements in AASHTO M-288 for separation with a medium survivability level. This wrapping shall extend for 2 feet on each side of the joint, it shall make a minimum of two (2) complete wraps around the pipe and shall be held securely in place by an approved band while the storm sewer is backfilled.

e. **Additional City Testing Requirements:** See Section 108.08, 108.13, 108.14, and 108.15.

f. **Standard Drawings:** ST01, ST02, and ST12.

SECTION 300 - GENERAL CONSTRUCTION SPECIFICATIONS

301 MOBILIZATION (05/16/94):

301.01 DESCRIPTION: This work shall consist of the pre-construction conferences, initial contact with property owners, establishing a project office, and moving equipment and materials necessary to start construction of the project onto the construction site.

301.02 MATERIALS: N/A

301.03 CONSTRUCTION METHODS: N/A

301.04 SPECIAL REQUIREMENTS:

a. **Pre-Construction Conference:** Prior to starting work on the project, the contractor will participate in a pre-construction conference called by the Public Works Department. This conference will be used to coordinate all activities associated with the contract and introduce all key personnel involved in the project.

b. **Landowner Notification:** Prior to starting work the contractor will provide the contract administrator with a letter certifying that all involved landowners have been contacted.

301.05 METHOD OF MEASUREMENT: When this item is included as a pay item in the contract it will be measured by the lump sum for the project.

301.06 BASIS OF PAYMENT: Mobilization, measured as provided above, will be paid for by the lump sum and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. This item will be paid as a separate bid item and payment will be made upon completion of mobilization. When this item is included in a contract it will be listed as follows:

BA 301 MOBILIZATION

LUMP SUM

301.07 STANDARD DRAWINGS: N/A

302 OPERATIONS MANUALS AND AS-BUILT DRAWINGS (05/16/94):

302.01 DESCRIPTION: This work shall consist of providing required operations manuals and as-built-drawings.

302.02 MATERIALS: Operations manuals will consist of properly indexed, 8 1/2" by 11" printed material provided in three ring binders. As-built drawings will consist of one set of plans with all modifications to the plans shown in red line. Appropriate notes will be placed on the plans to explain all red line changes.

302.03 CONSTRUCTION METHODS: N/A

302.04 SPECIAL REQUIREMENTS: The contractor will maintain one set of plans for the as-built drawings on the construction site at all times. When a deviation to the plans is required, the contractor will note the deviation and sign and date the change to the plans. The contractor will have either the City Inspector or contract administrator approving the deviation also sign and date the change on the plans.

302.05 METHOD OF MEASUREMENT: When this item is included as a pay item in the contract it will be measured by the lump sum for the project.

302.06 BASIS OF PAYMENT: Operations manuals and as-built drawings, measured as provided above, will be paid for by the lump sum and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. This item will be paid as a separate bid item and payment will be made on the basis of 50 percent upon receipt of the draft manuals and/or plans and 50 percent upon acceptance of the final manuals and/or plans. When this item is included in a contract it will be listed as follows:

BA 302 OPERATIONS MANUALS AND AS-BUILT DRAWINGS

LUMP SUM

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302.07 STANDARD DRAWINGS: N/A

310 RIGHT-OF-WAY CLEARING AND RESTORING (08/19/99):

310.01 DESCRIPTION: This work shall consist of the removal and reconstruction or replacement of all obstructions (Obstructions include, but are not limited to trees, brush, fences, retaining walls, patios, trash burners, signs, mail boxes, outbuildings, landscaping, etc.) affected by the construction of the project, with the exception of sidewalk, curb, street, parking lot, road, alley surfaces, gravel and oiled surfaces which will be removed and repaired under Section 315 Pavement Cut and Repair. Any obstructions which are not to be reconstructed are so designated on the plans. It shall also include compliance with the erosion control plan prepared by the design engineer and maintenance of erosion control facilities until final cover is full established on the site. This includes planting and watering of final cover.

310.02 MATERIALS:

a. **Waste Material:** All waste material and debris resulting from the cleaning operation or occurring within the right-of-way shall be disposed of in such a manner that air pollution regulations and solid waste disposal regulations are not violated and private or public property is not injured or endangered. Permission in writing from the property owner must be obtained by the contractor if waste material is placed on private property. A copy of this permission shall be furnished to the Contract Administrator before the final estimate will be paid. In no case will debris or extra material be left in the right-of-way.

b. **Plant Material to be Replaced:** Shrubs or trees in the right-of way that are to be replaced will be replaced with like type shrubs or trees. When these items are encountered they shall be removed, preserved, replaced or the contractor may make arrangements with the property owner to replace them. Grass cover on disturbed sites shall be as stated on the plans. If the type of grass cover is not specified, it shall be rye in the winter months, fescue in the spring and fall, and Bermuda in the summer. Unless otherwise stated, disturbed areas of front yards will be sodded and side and back yards will be seeded. Arrangements with property owners shall be in writing and the Contract Administrator shall be furnished a copy prior to payment of the final estimate.

c. **Salvaged Material:** Material such as bricks, signs, manhole frames and covers, etc., which may, in the opinion of the Contract Administrator be suitable for use by the City shall be the property of the City, and shall be neatly stacked or removed to such places along the site of the work as the Contract Administrator may direct. This will be done at no additional cost to the City.

310.03 CONSTRUCTION METHODS:

a. **General:** The contractor shall clear and remove from the construction site all trees marked for removal, brush, roots, stumps, hedges, fences, rock, rubbish, and any other objectionable materials within or over-hanging the right of way as directed by the Contract Administrator.

b. Clearing:

1. **Tree Removal/Protection:** No trees shall be removed, even though listed for removal until specifically marked by the Contract Administrator. Trees to be removed shall be felled in such a manner as not to injure other trees which are to remain, either on the right-of-way or adjacent thereto. Trees or plants which are to remain in place and which may be in danger of injury by construction operations or equipment shall be suitably boxed, fenced or otherwise protected. Boxing and fencing shall be constructed and removed at the direction of the Contract Administrator. The contractor shall repair all injuries to bark, trunk limbs, and roots of remaining trees and shrubs by proper dressing, cutting and painting according to approved methods, using only approved tools and materials.

2. **Obstruction Removal:** All obstructions in the designated right-of-way shall be removed and disposed of by the Contractor in a method that is suitable for the obstruction.

c. **Maintaining Access:** Passable surfaces across or along the construction site shall be maintained at all times with gravel, steel mat or plate, or temporary bituminous surfacing material where a sidewalk, driveway, parking lot, street, road, or alley previously existed.

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d. **Maintaining Streets:** The contractor will be responsible for preventing his trucks from scattering debris, mud, and/or soil on public roads. If this occurs the contractor will clean-up debris as required by the Contract Administrator.

e. **Reconstruction:**

1. General: All obstructions to be replaced or reconstructed shall be restored to substantially the same condition as existed prior to the construction. The contractor shall remove and dispose of all debris, restore the surface of the earth to the grade existing prior to construction and upon completion of the work shall leave the site in a neat clean and orderly condition, as nearly as it was prior to construction as may reasonably be done.

2. Sodding: When the area being worked crosses the front or side yard of an existing residence or commercial establishment, the disturbed area will be sodded upon completion of other restoration activities. When sodding is required in backyards it will be called for on the plans.

3. Seeding: This will include seeding all disturbed areas with grass and establishing an initial growth on the seeded areas. During the normal growing season the areas will be seeded with grasses that match the surrounding grasses. During the winter months either rye or winter wheat will be used to establish ground cover.

310.04 SPECIAL REQUIREMENTS:

a. **Notification of Landowners:**

1. Privately Held Land: It shall be the contractor's responsibility to notify all landowners prior to entering onto their property. If an owner has an obstruction that will be affected, they will be notified sufficiently in advance of construction operations so that they may make such arrangements as they may desire for the protection, removal or relocation of property in advance of construction.

2. Public Owned Land or Utilities: If an obstruction is of public ownership, the Contractor shall notify the appropriate agency, and obtain any necessary permit or license, forty-eight hours before beginning any operations affecting the obstruction. All work shall conform to the current standard and specifications of the agency, and shall be approved by the agency before the work is started. At the contractor's request, the Contract Administrator will furnish information as to what licenses or permits are required.

b. **Clearing Limits:** The contractor shall limit the clearing operation to not over one mile ahead of the construction operation and shall follow up with restoration immediately after completion of construction.

c. **Protection of Areas Outside of Construction:** Areas outside of the construction area shall be preserved in their natural state. If the contractor damages an area outside of the construction area, the damage will be repaired to its original condition at no additional cost to the City.

d. **Compliance with Easements:** A copy of all easements associated with this contract are included in the Special Provisions to the contract. The contractor shall take all actions necessary to comply with the requirements of these easements and the cost of this compliance shall be included in this item.

310.05 METHOD OF MEASUREMENT: When this item is included as a pay item in the contract it will be measured by the lump sum for the project.

310.06 BASIS OF PAYMENT: Right-of-way clearing and restoration, measured as provided above, will be paid for by the lump sum and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. This item will be paid as a separate bid item and payment will be made on the basis of 50 percent upon clearing of right-of-way and 50 percent upon restoration of right-of-way. For pipelines this will be based on the number of linear feet of pipeline completed divided by the total number of linear feet in the project. For all other projects it will be based on the area completed divided by the total area. When this item is included in a contract it will be listed as follows:

BA 310 RIGHT-OF-WAY CLEARING AND RESTORING

LUMP SUM

310.07 STANDARD DRAWINGS: N/A

311 EXCAVATION (05/16/94):

311.01 DESCRIPTION: This work shall consist of the excavation as shown on the plans or directed by the Contract

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Administrator.

311.02 MATERIALS:

a. **Common Excavation:** Common excavation shall consist of all excavation not included as rock excavation.

b. **Rock Excavation:** Rock excavation shall consist of removal of rock which can not be excavated without blasting or the use of special rock teeth, and all boulders or detached stones having a volume of 1.0 cubic yard or more. Any old concrete structures more than one-half (1/2) cubic yard in volume encountered to be removed will be classified as rock excavation. Shales that can be excavated with normal equipment will be classified as common excavation.

311.03 CONSTRUCTION METHODS:

a. **General:**

1. Execution of The Work: The Contractor shall excavate in accordance with the lines and grades shown on the Plans or given by the Contract Administrator. In carrying out this work, the contractor will be required to follow the excavation as rapidly as possible with construction and backfilling. The Contract Administrator shall have the right to limit the amount of excavation that can be left open at one time to avoid inconvenience to the public or a safety hazard. All materials excavated shall be placed to interfere as little as possible with public travel and construction activities. Streets must be kept open in every case possible; exceptions are to be made only by order of the Contract Administrator.

2. Classification of Excavation: Common excavation shall comprise all materials, wet or dry, to be excavated and removed, other than those meeting the definition of rock excavation.

3. Use of Explosives: Where the use of explosives is necessary, the Contractor shall observe all requirements of City Ordinance No. 543. All blasting shall be done by experienced personnel to avoid danger to life or property. Blasts shall be covered so that no debris or other material is discharged into the air, proper danger signals given before firing, and then be fired only at such times as may be permitted. The number and sizes of the charges shall be reduced whenever directed and no claims, for loss or delay will be allowed on this account. All explosives to be used shall be subject to the approval of the City Engineer. Where rock is to be excavated near existing pipelines or structures, blasting shall be done with light charges of dynamite as directed by the City Engineer. The Contractor shall take all necessary precautions in the use of explosives and the Contractor shall be liable for any damage resulting from blasting operations.

b. **Trench Excavation:**

1. Trench Shape: Wherever possible, trench excavations shall be made with vertical sides of a width not more than 3 times the nominal pipe diameter for 12" pipe or under. For pipe over 12 inches in diameter, the trench width shall be the width given in the table in 311.05 Method of Measurement. In all cases the trench must have no more than this maximum width and vertical sides from one (1) foot above the top of the pipe to the bottom of the trench. Where necessary, trenches will be braced to obtain this result. The bottom of the trench for all types of pipelines shall be carefully and truly graded, formed and aligned according to the grades and directions furnished by the Engineer, and must be approved by the Contract Administrator before any pipe is laid. The trench bottom or bedding material, shall be graded to support the pipe joint throughout its entire length. Bell holes shall be cut in the bedding material as required. Bedding requirements for each type of pipe are included in the specifications for the specified pipe.

2. Trench Depth: The contractor shall excavate the pipe trench to grade or four inches (4") below grade if bedding is required. If the material at the bottom of the trench is not suitable for supporting the pipe, the contractor will notify the Contract Administrator. The Contract Administrator will obtain required engineering assistance and provide the contractor directions on how to proceed.

3. Trench Width: The trench shall be excavated to a width necessary to the proper laying and joining of pipes and to allow for proper tamping around the pipes after laying. Trenches shall not exceed a width of not more than 3 times the nominal pipe diameter for 12" pipe or under, or that given in the table in 311.05 Method of Measurement for pipe over 12" in diameter.

4. Over Excavation: When a trench is excavated below grade at any place, except as shown on the plans or written instructions from the Contract Administrator, it shall be refilled to grade with bedding materials and thoroughly compacted by tamping, without any extra compensation to the Contractor.

5. Bracing, Shoring, and Dewatering: When necessary, sides of the excavation shall be braced and held secure until the pipe has been laid. The contractor shall adequately shore, or sheet, and brace the excavation, or shall slope the sides in accordance with the State of Oklahoma Department of Labor requirements. The contractor will take the necessary actions to dewater the trench during laying of the pipeline. This requirement does not extend to replacement of a gravity sanitary sewer in place. All bracing, draining, well pointing and pumping shall be done at the Contractor's expense.

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6. Existing Underground Utilities in the Construction Site: The plans provide the approximate locations of known underground utilities in the construction site. Before any excavation is started the contractor will contact "Call OKIE" to have all utilities marked and flagged. Care shall be taken to avoid disturbing or injuring underground pipe and structures which may be encountered in the excavation. The payment for underground utility crossings will be under Section 340 Underground Utility Crossings.

7. Rock Excavation:

(a) General: Every trench in rock shall be fully opened at least fifty feet (50') in advance of the place where pipe is being laid or concrete or masonry work is in progress.

(b) Trench Depth: The rock shall be excavated at least four inches (4") below the bottom of the pipe and the trench shall be brought to grade with well compacted bedding material before the pipe is laid. Excavation for bell locations shall be of sufficient depth to provide four (4) inches of bedding under the bell.

8. Open Trench: The contractor shall not have trench open that exceeds the amount of line that can be constructed and backfilled in two (2) working days. The Contract Administrator may limit the amount that can be left open for safety reasons.

c. **Excavation Structures:** Excavation for all structures shall be carried down with vertical sides and shall be of such dimensions and depths as to permit the construction of the appurtenances in accordance with the plans. When necessary, sides of the excavation shall be braced and held secure until the structure has been placed. The contractor shall adequately shore, or sheet, and brace the excavation, or shall slope the sides in accordance with the State of Oklahoma Department of Labor requirements. The contractor will take the necessary actions to dewater the excavation during construction of the structure. This requirement does not extend to replacement of a gravity sanitary sewer in place. All bracing, draining, well pointing and pumping shall be done at the Contractor's expense.

311.04 SPECIAL REQUIREMENTS:

a. **Location of Underground Utilities:** The contractor will notify the Contract Administrator when "Call OKIE" has been notified and excavation will not start until after the utilities have been flagged.

b. **Rock Excavation Notification:** When the contractor encounters rock that he considers to be covered under the rock excavation payment item, he must notify the contract administrator and have the site inspected within one (1) hour of encountering the rock. This notification is required for measurement for payment.

311.05 METHOD OF MEASUREMENT:

a. **Common Excavation (Trench):** When this item is included as a pay item in the contract it will be measured by the cubic yard (CY) as a trench with vertical sides. The authorized width of trench shall be three times the nominal diameter of the pipe for pipe 12 inches in diameter and smaller. For pipe larger than 12 inches in diameter the authorized width will be as given in the table in 311.05 e. The end areas of common excavation to be paid for under this item will be measured, regardless of the width actually excavated, by multiplying the authorized vertical depth, in feet, from the surface of the original ground to the bottom of the earth trench, including the four inches (4") below the bottom of the pipe, if bedding is required, by the authorized trench width. The length of excavation will be measured horizontally along the pipe. The quantity of excavation will be computed by the average end area method in cubic yards.

b. **Rock Excavation (Trench):** When this item is included as a pay item in the contract it will be measured by the cubic yard (CY) as a trench with vertical sides. The authorized width of trench shall be as given in the table in 311.05 e. for the sizes of pipes shown, and the depth of trench will be computed at all times from the top of the rock as determined in the field by the Contract Administrator, at the time of excavation, to four inches (4") below the bottom of the pipe. The end areas of rock excavation paid for under this item will be measured, regardless of the width actually excavated, by multiplying the authorized vertical depth, in feet, of rock or shale encountered in the excavation, including the four inches (4") below the bottom of the pipe, by the authorized trench width. The volume of excavation will be computed by the average end area method in cubic yards.

c. **Common Excavation (Structure):** When this item is included as a pay item in the contract it will be measured by the cubic yard (CY) as an excavation with vertical sides. Excavation for structures and appurtenances will be measured by multiplying the total authorized vertical depth of earth excavation by the area one foot (1') outside the neat lines of the structure.

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d. **Rock Excavation (Structure):** When this item is included as a pay item in the contract it will be measured by the cubic yard (CY) as an excavation with vertical sides. Excavation for structures and appurtenances will be measured by multiplying the actual vertical depth of rock excavation, as determined in the field by the Contract Administrator, by the area one foot (1') outside the neat lines of the structure.

e. **Trench Width Table:** Except where otherwise specified the width of the trench to be paid for in computing rock excavation shall be that given in the following table, regardless of the type of pipe to be constructed:

PIPE SIZE INSIDE DIAMETER-INCHES	WIDTH OF TRENCH-INCHES
6	30
8	32
10	34
12	36
15	39
18	42
21	45
24	48
30	54
36	60

The excavation of any rock outside of the width of trench given above and any rock excavated more than four inches (4") below the bottom of the pipe will be at the Contractor's own expense.

311.06 BASIS OF PAYMENT: Pipeline and appurtenant structure excavation, measured as provided above, will be paid for by the cubic yard and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. This item will be paid as a separate bid item. When this item is included in a contract it will be listed as follows:

BA 311A COMMON EXCAVATION (TRENCH)	CUBIC YARD
BA 311B ROCK EXCAVATION (TRENCH)	CUBIC YARD
BA 311C COMMON EXCAVATION (STRUCTURE)	CUBIC YARD
BA 311D ROCK EXCAVATION (STRUCTURE)	CUBIC YARD

311.07 STANDARD DRAWINGS: N/A

312 COMMON BACKFILL AND COMPACTION (05/16/94):

312.01 DESCRIPTION: This work shall consist of the backfill and compaction of excavations as shown on the plans or directed by the Contract Administrator.

312.02 MATERIALS:

a. **Satisfactory Materials:** Satisfactory materials shall consist of any material classified by ASTM D 2487 as GW, GP, GC, GM, SW, SP, SM, SC, CL, and CH.

b. **Select Materials:** Select backfill materials are those materials listed in Materials Specifications 602 Pipe Bedding and 603 Select Backfill.

c. **Unsatisfactory Materials:** Unsatisfactory materials shall be materials that do not comply with the requirements for satisfactory materials. Unsatisfactory materials include but are not limited to those materials containing roots and other organic matter, trash, debris, frozen materials and stones larger than three (3) inches, and materials classified in ASTM D 247 as PT, OH, OL, MI and MH.

d. **Unstable Materials:** Unstable material shall consist of materials too wet to properly support the utility pipe, or appurtenant structure.

312.03 CONSTRUCTION METHODS:

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a. **General:** Backfill material shall consist of satisfactory material or select materials as required. Backfill shall be placed in layers not exceeding six (6) inches loose thickness for compaction by hand operated machine compactors, and eight (8) inches loose thickness for other than hand operated machine compactors, unless otherwise specified. Unless otherwise specified, each layer shall be compacted to at least 95 percent maximum density for cohesionless soils and 90 percent maximum density for cohesive soils.

b. **Special Note:** Compaction requirements defined below are subject to the following modifications based on requirements of the specific site and contract. If the natural compaction method on final backfill is used it will be so noted on the plans and contract documents.

1. **Initial Backfill (Bedding, Haunching, and Initial Backfill):** These standards will be met for construction of water lines, sewer lines, and storm sewers.

2. **Final Backfill:** These standards will be met for construction of water lines, sewer lines, storm sewers, and other utility trenches when there is not sufficient time to allow for natural trench settlement before adjacent construction starts or the work is in an area that is already developed. When sufficient time for natural settlement is available, the trench will be backfilled and mounded a minimum of one foot over the trench to allow for settlement. The contractor will maintain the trench by adding additional fill until it has settled. This process will normally take 3 or 4 good rains.

c. **Pipe and Structure Bedding:** When bedding is specified, it will be paced in the required thickness on the bottom of the excavation and compacted in accordance with the appropriate standard drawing. Where required recesses for pipe bells or structures will be cut into the compacted bedding material. The contractor will establish the method for compaction of bedding and have the Utility Inspector approve of the method. Once the compaction tests have verified the compaction method, it will be used on the remainder of the project.

d. **Pipe Haunching:** Pipe haunching will be paced on the sides of the pipe in layers of appropriate thickness and compacted in accordance with the appropriate standard drawing. The process will be repeated until the haunching material reaches the appropriate depth. The contractor will establish the method for compaction of pipe haunching and have the Utility Inspector approve of the method. Once the compaction tests have verified the compaction method, it will be used on the remainder of the project or until the material being used changes.

e. **Initial Pipe Backfill:** Initial pipe backfill will be paced on the sides of the pipe in layers of appropriate thickness and compacted in accordance with the appropriate standard drawing. The process will be repeated until the initial pipe backfill reaches the appropriate depth. The contractor will establish the method for compaction of initial pipe backfill and have the Utility Inspector approve of the method. Once the compaction tests have verified the compaction method, it will be used on the remainder of the project or until the material being used changes.

f. **Selected Backfill:** Select backfill will be paced in layers of appropriate thickness and compacted in accordance with the appropriate standard drawing. The process will be repeated until the select backfill reaches the appropriate depth. The contractor will establish the method for compaction of select backfill and have the Utility Inspector approve of the method. Once the compaction tests have verified the compaction method, it will be used on the remainder of the project or until the material being used changes.

g. **Final Backfill (Paved Areas):** Final backfill under paved areas will be paced in layers of appropriate thickness and compacted in accordance with the appropriate standard drawing. The process will be repeated until the final backfill reaches the appropriate depth. The contractor will establish the method for compaction of final backfill under paved areas and have the Utility Inspector approve of the method. Once the compaction tests have verified the compaction method, it will be used on the remainder of the project or until the material being used changes.

h. **Final Backfill (Non-paved Areas):** Final backfill under non-paved areas will be paced in layers of appropriate thickness and compacted in accordance with the appropriate standard drawing. The process will be repeated until the final backfill reaches the appropriate depth. The contractor will establish the method for compaction of final backfill under non-paved areas and have the Utility Inspector approve of the method. Once the compaction tests have verified the compaction method, it will be used on the remainder of the project or until the material being used changes.

312.04 SPECIAL REQUIREMENTS:

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a. **Disposal of Excess, Unsatisfactory, or Unsuitable Material:** The Contractor shall dispose of all excess, unsatisfactory, or unsuitable material shall be disposed of in such a manner that air pollution regulations and solid waste disposal regulations are not violated and private or public property is not injured or endangered. Permission in writing from the property owner must be obtained by the contractor if excess, unsatisfactory, or unsuitable material is placed on private property. A copy of this permission shall be furnished to the Contract Administrator before the final estimate will be paid. In no case will excess, unsatisfactory, or unsuitable material be left in the right-of-way.

b. **Compaction Testing:**

1. Compaction testing for paved areas will be accomplished under Section 108.03.
2. Compaction testing for non-paved areas will be accomplished under Section 108.02.

312.05 METHOD OF MEASUREMENT: When this item is included as a pay item in the contract it will be measured by the cubic yard (CY).

a. **Trench Backfill:** The authorized width of trench shall be three times the nominal diameter of the pipe for pipe 12 inches in diameter and smaller. For pipe larger than 12 inches in diameter the authorized width will be as given in the table in 311.05 e. The end areas of backfill to be paid for under this item will be measured, regardless of the width actually excavated, by multiplying the authorized vertical depth, in feet, from the surface of the original ground to the bottom of the earth trench, by the authorized trench width. The cross sectional area of the pipe used will be subtracted from the end area to obtain the final end area used for volume calculations. The length of backfill will be measured horizontally along the pipe. The quantity of backfill will be computed by the average end area method in cubic yards. The volume of all select material for bedding, haunching, initial fill, and select fill for the pipeline will be subtracted from this quantity to determine the final payment quantity.

b. **Structure Backfill:** When this item is included as a pay item in the contract it will be measured by the cubic yard (CY). Backfill for structures and appurtenances will be measured by multiplying the total authorized vertical depth of earth excavation by the area one foot (1') outside the neat lines of the structure and subtracting the volume of the structure. The volume of all select material for structures and appurtenances will be subtracted to determine the final payment quantity.

312.06 BASIS OF PAYMENT: Common backfill and compaction, measured as provided above, will be paid for by the cubic yard and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. This item will be paid as a separate bid item and payment will be made upon acceptance of the backfilled area. When this item is included in a contract it will be listed as follows:

BA 312 COMMON BACKFILL AND COMPACTION

CUBIC YARD

312.07 STANDARD DRAWINGS: ST01, W01, W20, SS01, SS02, SS03, SS04, SS05, SS13, and SS14

313 SELECT BACKFILL AND COMPACTION (05/16/94):

313.01 DESCRIPTION: This work shall consist of furnishing, placing and compacting select backfill as shown on the plans or directed by the Contract Administrator.

313.02 MATERIALS: Select backfill materials are those materials listed in Materials Specifications 602 Pipe Bedding and 603 Select Backfill.

313.03 CONSTRUCTION METHODS: Placing and compaction of select backfill shall be accomplished in accordance with Section 312.

313.04 SPECIAL REQUIREMENTS:

a. **Materials Tickets:** The Contractor will provide the Contract Administrator with copies of materials tickets for select materials before payment for these items will be made.

b. **Compaction Testing:**

1. Compaction testing for paved areas will be accomplished under Section 108.03.

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2. Compaction testing for non-paved areas will be accomplished under Section 108.02.

313.05 METHOD OF MEASUREMENT: When this item is included as a pay item in the contract it will be measured by the cubic yard (CY).

a. **Pipe Bedding:** The authorized width of trench shall be three times the nominal diameter of the pipe for pipe 12 inches in diameter and smaller. For pipe larger than 12 inches in diameter the authorized width will be as given in the table in 311.05 e. The end areas of pipe bedding to be paid for under this item will be measured, regardless of the width actually excavated, by multiplying the thickness of pipe bedding, in feet (0.33 feet unless otherwise specified), by the authorized trench width. That portion of the pipe cross sectional area of the pipe, in the bedding will be subtracted from the end area to obtain the final end area used for volume calculations. The length of pipe bedding will be measured horizontally along the pipe. The quantity of pipe bedding will be computed by the average end area method in cubic yards.

b. **Haunching:** The authorized width of trench shall be three times the nominal diameter of the pipe for pipe 12 inches in diameter and smaller. For pipe larger than 12 inches in diameter the authorized width will be as given in the table in 311.05 e. The end areas of haunching to be paid for under this item will be measured, regardless of the width actually excavated, by multiplying the thickness of haunching, in feet by the authorized trench width. That portion of the pipe cross sectional area of the pipe, in the haunching will be subtracted from the end area to obtain the final end area used for volume calculations. The length of haunching will be measured horizontally along the pipe. The quantity of haunching will be computed by the average end area method in cubic yards.

c. **Initial Backfill:** The authorized width of trench shall be three times the nominal diameter of the pipe for pipe 12 inches in diameter and smaller. For pipe larger than 12 inches in diameter the authorized width will be as given in the table in 311.05 e. The end areas of initial backfill to be paid for under this item will be measured, regardless of the width actually excavated, by multiplying the authorized thickness of initial backfill, in feet, by the authorized trench width. That portion of the pipe cross sectional area of the pipe, in the initial backfill will be subtracted from the end area to obtain the final end area used for volume calculations. The length of initial backfill will be measured horizontally along the pipe. The quantity of initial backfill will be computed by the average end area method in cubic yards.

d. **Select Backfill:** The authorized width of trench shall be three times the nominal diameter of the pipe for pipe 12 inches in diameter and smaller. For pipe larger than 12 inches in diameter the authorized width will be as given in the table in 311.05 e. The end areas of select backfill to be paid for under this item will be measured, regardless of the width actually excavated, by multiplying the thickness of select backfill, in feet (1.0 feet unless otherwise specified), by the authorized trench width. The length of select backfill will be measured horizontally along the pipe. The quantity of select backfill will be computed by the average end area method in cubic yards.

e. **Select Structure Backfill:** When this item is included as a pay item in the contract it will be measured by the cubic yard (CY). Select backfill for structures and appurtenances will be measured by multiplying the total authorized vertical depth of select backfill by the area one foot (1') outside the neat lines of the structure less the area of the structure.

313.06 BASIS OF PAYMENT: Select backfill and compaction, measured as provided above, will be paid for by the cubic yard and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. This item will be paid as a separate bid item and payment will be made upon acceptance of the backfilled area. When this item is included in a contract it will be listed as follows:

BA 313A SAND BACKFILL AND COMPACTION	CUBIC YARD
BA 313B LIMESTONE SCREENINGS BACKFILL AND COMPACTION	CUBIC YARD
BA 313C 3/8" LIMESTONE CHIPS BACKFILL AND COMPACTION	CUBIC YARD
BA 313D 3/4" CRUSHED LIMESTONE BACKFILL AND COMPACTION	CUBIC YARD
BA 313E CRUSHED FOUNDATION STONE BACKFILL AND COMPACTION	CUBIC YARD
BA 313F FLOWABLE FILL	CUBIC YARD

313.07 STANDARD DRAWINGS: ST01, W01, SS01, SS02, SS03, SS04, SS05, SS13, and SS14.

314 BORED STREET CROSSINGS (05/16/94):

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314.01 DESCRIPTION: This work shall consist of the installation of railroad, street, or other crossings by boring or tunneling as shown on the plans or directed by the Contract Administrator.

314.02 MATERIALS:

- a. **Cement Grout:** Section 601 Concrete
- b. **Backfill Material:** Sections 602 Pipe Bedding and Sections 603 Select Backfill
- c. **Conduit:** Section 604 Conduit

314.03 CONSTRUCTION METHODS:

a. **General:** The conduit pipe shall be installed to the line and grades given. Conduit shall be installed using approved boring, or tunneling procedures. A minimum clearance of at least two (2) inches between the inner wall of the conduit and maximum outside diameter of the pipe and joint shall be provided. The Contractor shall submit the plan of his proposed installation procedures for approval. The plan shall include pipe guides, jack positions, jacking head, conduit, jointing methods, and other specifics pertinent to the procedure selected. The approval of this plan by the City does not relieve the Contractor from his responsibility to obtain the specified results.

b. **Boring:** The boring shall proceed from a pit provided for the boring equipment and workmen. Excavation for pits and installation of shoring shall be as required to maintain a safe work area and meet all local, state, and federal safety regulations. The location of the pit shall meet the approval of the Contract Administrator. The holes are to be bored mechanically. The boring shall be done using a pilot hole. By this method an approximate 2 inch pilot hole shall be bored the entire length of the crossing and shall be checked for line and grade on the opposite end of the bore from the work pit. This pilot hole shall serve as the centerline of the larger diameter hole to be bored. Excavated material will be placed near the top of the working pit and disposed of as required. The use of water or other fluids in connection with the boring operation will be permitted only to the extent to lubricate cuttings; jetting will not be permitted. In unconsolidated soil formations, a gel-forming colloidal drilling fluid consisting of at least ten (10) percent of high grade carefully processed bentonite may be used to consolidate cuttings of the bit, seal and walls of the hole, and furnish lubrication for subsequent removal of cuttings and installation of conduit immediately thereafter. Over cutting in excess of one (1) inch shall be remedied by pressure grouting the entire length of the installation.

c. **Tunneling:** Where the characteristics of the soil would make the use of tunneling more satisfactory than boring, a tunneling method may be used. The lining of the tunnel shall be of steel of sufficient strength to support the overburden. The Contractor shall submit his proposed liner method to the Contract Administrator for approval. Approval by the City shall not relieve the Contractor of the responsibility for the adequacy of the liner method. The space between the liner plate and the limits of excavation shall be pressure-grouted or mudjacked. Access holes for placing concrete shall be spaced at maximum intervals of ten (10) feet.

d. **Pipe Installation:** The pipe shall be installed on the approved casing spacers and all joints inside the conduit shall be lock type joints to allow removal of the entire section of pipeline. The space between the outside of the carrier pipe and the conduit shall be left open and the ends of the casing shall be capped with flowable fill.

314.04 SPECIAL REQUIREMENTS:

a. **Submission of Boring/Tunneling Plan:** Prior to starting work the Contractor shall submit the plan of his proposed installation procedures for approval. The plan shall include pipe guides, jack positions, jacking head, conduit, jointing methods, and other specifics pertinent to the procedure selected.

b. **Site Approval:** The Contractor shall contact the Contract Administrator prior to starting boring or tunneling operations for approval of the pit site.

314.05 METHOD OF MEASUREMENT: When this item is included as a pay item in the contract it will be measured by the linear foot of bored or tunneled crossing. The length of boring /tunneling will be measured horizontally

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along the pipe.

314.06 BASIS OF PAYMENT: Bored street crossings, measured as provided above, will be paid for by the linear foot and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. This item will be paid as a separate bid item and payment will be made upon acceptance of the crossing. When this item is included in a contract it will be listed as follows:

BA 314 BORED STREET CROSSING

LINEAR FOOT

314.07 STANDARD DRAWINGS: UL02

315 CUT AND COVER STREET CROSSINGS (05/16/94):

315.01 DESCRIPTION: This work shall consist of the installation of street or other crossings, where conduit is required, by cut and cover construction as shown on the plans or directed by the Contract Administrator.

315.02 MATERIALS:

a. **Backfill Material:** Sections 602 Pipe Bedding and Sections 603 Select Backfill

b. **Conduit:** Section 604 Conduit

315.03 CONSTRUCTION METHODS:

a. **General:** A minimum clearance of at least two (2) inches between the inner wall of the conduit and maximum outside diameter of the pipe and joint shall be provided. When possible the conduit will be placed through one half of the roadway at a time. This will allow the road to remain open during the construction. The Contractor shall submit the plan of his proposed installation procedures for approval. The plan shall include pipe guides, jack positions, jacking head, conduit, jointing methods, and other specifics pertinent to the procedure selected. The approval of this plan by the City does not relieve the Contractor from his responsibility to obtain the specified results.

b. **Pavement Cut:** To be accomplished in accordance with Section 316 Pavement Cut and Repair.

c. **Trench Excavation:** To be accomplished in accordance with Section 311 Excavation.

d. **Conduit Placement:** The conduit pipe shall be installed to the line and grades given.

e. **Backfill of Conduit:** The conduit shall be haunched and filled to 18 inches over the top of the pipe with flowable fill. Backfill to be accomplished in accordance with Section 313 Select Backfill and Compaction.

f. **Pavement Repair:** To be accomplished in accordance with Section 316 Pavement Cut and Repair.

g. **Pipe Installation:** The pipe shall be installed on the approved pipe guides and all joints inside the conduit shall be lock type joints to allow removal of the entire section of pipeline. The space between the outside of the carrier pipe and the conduit shall be filled with sand.

315.04 SPECIAL REQUIREMENTS:

a. **Submission of Installation Plan:** Prior to starting work the Contractor shall submit the plan of his proposed installation procedures for approval. The plan shall include pipe guides, jack positions, jacking head, conduit, jointing methods, and other specifics pertinent to the procedure selected.

b. **Site Approval and Traffic Control:** The Contractor shall contact the Contract Administrator a minimum of 24 hours prior to cutting the roadway for approval to open the roadway and traffic control requirements.

315.05 METHOD OF MEASUREMENT: When this item is included as a pay item in the contract it will be

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measured by the linear foot of cut and cover crossing. The length of the crossing will be measured horizontally along the pipe.

315.06 BASIS OF PAYMENT: Cut and cover crossings, measured as provided above, will be paid for by the linear foot and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. This item will be paid as a separate bid item and payment will be made upon acceptance of the crossing. When this item is included in a contract it will be listed as follows:

BA 315 CUT AND COVER STREET CROSSING

LINEAR FOOT

315.07 STANDARD DRAWINGS: ST01, ST02, ST07, W01, and SS01

316 PAVEMENT CUT AND REPAIR (05/16/94):

316.01 DESCRIPTION: This work shall consist of pavement cut and repair of any pavement whether in parking lots, highways, streets, driveways, or sidewalks, necessary for construction as shown on the plans or directed by the Contract Administrator. This item includes curb and gutter, concrete pavement, asphaltic concrete pavement, and double bituminous surfaces. Surfaces containing only gravel shall be replaced Section 313 Select Backfill and Compaction.

316.02 MATERIALS: See ODOT Section 700 for required materials.

316.03 CONSTRUCTION METHODS:

a. **General:** Pavement cut and repair includes the work from the bottom of the base course to the top of the surface course. The pavement shall be replaced with materials equal to or better than the existing materials. Specifications for replacement are found in ODOT Section 300 bases and ODOT Section 400 Surface Courses. This item includes the protection of the street crossings between the time the street is cut and when it is replaced.

b. **Traffic Control:** The contractor will not be permitted to close streets to traffic at crossings. Crossings shall be made by trenching no more than one half (1/2) of the street at one time or by providing adequate detours, approved by the Contract Administrator, adjacent to the street. The contractor shall maintain a passable surface on the detour at all times. This item includes the protection of the street crossings between the time the street is cut and when it is replaced.

c. **Pavement Cut:** Pavement shall be saw cut to at least two feet (2') outside the top edge of the trench on each side in order to provide a firm foundation for replacement of the pavement. Any pavement settlement or failure shall be immediately replaced by the contractor. The contractor shall remove and replace curb and gutter where it is required.

d. **Pavement Repair:** The pavement repair shall be accomplished with like materials to the materials in the existing pavement. The repair shall be a full depth repair matching or exceeding the strength of the materials in each layer.

e. **Finish Tolerance:** The finished surfaces of patched areas shall meet the grade of the adjoining pavements and shall not deviate more than 1/8-inch from a true plan surface within the patched area.

f. **Pavement Protection:** The Contractor shall protect the patched areas against damage prior to final acceptance of the work by the City. Traffic shall be excluded from the patched areas by erecting and maintaining barricades and signs until the completion of the curing period.

316.04 SPECIAL REQUIREMENTS: The Contractor shall contact the Contract Administrator a minimum of 24 hours prior to cutting the roadway for approval to open the roadway and traffic control requirements.

316.05 METHOD OF MEASUREMENT: When this item is included as a pay item in the contract it will be measured by the linear foot of pavement cut and repair. The length of the cut and repair will be measured horizontally along the excavation.

316.06 BASIS OF PAYMENT: Pavement cut and repair, measured as provided above, will be paid for by the linear foot and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. This item will be paid as a separate bid item and payment will be made upon acceptance

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of the pavement repair. When this item is included in a contract it will be listed as follows:

BA 316 PAVEMENT CUT AND REPAIR

LINEAR FOOT

316.07 STANDARD DRAWINGS: ST07

317 UNDERGROUND UTILITY CROSSINGS (08/19/99):

317.01 DESCRIPTION: This work shall consist of the location of underground utilities, protection of underground utilities during construction, utility crossings, and/or relocation of utilities as shown on the plans or directed by the Contract Administrator.

317.02 MATERIALS:

- a. **Water Lines:** Sections 620 to 649
- b. **Sanitary Sewer:** Sections 650 to 699
- c. **Other Utilities:** As required by the Utility Owner.

317.03 CONSTRUCTION METHODS:

a. **General:** General locations of all known lines other than services that might interfere with construction are shown on the plans. However, exact locations and elevations are not known in all cases. The contractor shall do necessary exploratory work in advance of construction to determine exact utility locations and elevation or that no interference exists. If any of these lines or structures conflict with the proposed construction, the Contractor shall notify the Contract Administrator in order to resolve the conflict by moving the existing facility or by revising the construction alignment. Except for services, if facilities other than those shown on the plans are encountered, the contractor will be reimbursed for the extra cost of crossing these lines under the unit price for the type of underground utility crossing encountered. Known meter locations for utility services are shown, but the locations of utility service lines are not shown on the Plans. The contractor shall assume that service lines serving individual properties do exist and shall, under this item, protect them at crossings and shall be responsible for making necessary revisions or repairs as required by the particular utility company or other owner involved. If any utility service is interrupted as a result of the contractor's operations, the contractor shall promptly notify the Contract Administrator and the owner of the utility, and shall be responsible for restoring service as quickly as possible.

b. **Storm Sewers and Culverts:** Storm sewers and culverts may be removed at the time of crossing or may be adequately braced and held in position while the new line is placed beneath them. If the storm sewer or culvert is removed, it shall be replaced with new pipe of the same type and size as that removed, and it shall be rejoined to the undisturbed line with a joint satisfactory to the Contract Administrator. Backfill over the new line up to and around the storm sewer or culvert shall be placed in accordance with Section 314 Select Backfill and Compaction.

c. **Water Mains:** The proposed new line shall pass under all water lines, except where noted on the Plans. The Contractor shall not remove any existing water lines and shall adequately brace and protect them from damage during construction.

d. **Gas Mains:** Before crossing of any gas main, the contractor shall notify the owner of the main in order that the owner may have a service man available at the time of any crossing. The Contractor shall not remove any gas main without permission of the owner and shall adequately brace and protect gas mains from damage. Any mains which are damaged shall be replaced or repaired to the satisfaction of the owner and the Contract Administrator.

e. **Sanitary Sewers and Services:** Where the water lines crosses sanitary sewers the sanitary sewer line will be replaced or encased as specified below.

1. Where the water line crosses under sanitary sewers, the sewer shall be PVC C900 for a distance of ten (10) feet horizontally, measured at right angles to the water line, on either side of the crossing. The sewer shall also be concrete encased.

2. Where the water line crosses over sanitary sewers with a clearance of two (2) feet or less, the sewer shall be PVC

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C900 for a distance of ten (10) feet horizontally, measured at right angles to the water line, on either side of the crossing.

f. **Buried Telephone, Electrical Conduits, and Cable TV:** All buried cable and conduits to be crossed by the new line shall be protected in accordance with directions of the utility company owning the cables. The contractor shall notify the companies and obtain their permission before making a crossing. Any buried cables or conduits damaged by the Contractor shall be replaced at his expense to the satisfaction of the owning company and the Contract Administrator.

g. **Cross Country Pipelines:** Before crossing of any cross country pipelines, the contractor shall notify the owner of the pipeline in order that the owner may have a service man available at the time of any crossing. The Contractor shall not remove any pipeline without permission of the owner and shall adequately brace and protect pipelines from damage. Any pipelines which are damaged shall be replaced or repaired to the satisfaction of the owner and the Contract Administrator.

h. **Service Line Crossings (Water, Sewer, Gas, Electrical, Telephone, and Cable TV):** The contractor shall place the new line under all service lines. The contractor shall protect service lines and shall not remove them except with permission of the Contract Administrator and the owner. If permission is given to remove services and the contractor shall give the property owner adequate notice. Service lines which are removed or damaged shall be replaced to the satisfaction of the owner and the Contract Administrator.

i. **Damaged Water or Sewer Lines:** Any existing water or sewer lines previously accepted by the City which are damaged by the contractor's operations will be repaired by the City's maintenance forces. The contractor shall notify the City immediately of any damage to existing water or sewer lines. Repairs will be made at the contractor's expense.

317.04 SPECIAL REQUIREMENTS:

a. **Notification of Additional Crossing:** When the Contractor determines that a utility crossing will be required that is not shown on the plans, the Contract Administrator will be notified prior to installing the crossing.

b. **Notification of Interruption of Service:** When the Contractor interrupts service of a utility, the utility will be notified immediately and the Contract Administrator will be notified and told what action has been taken to restore service.

317.05 METHOD OF MEASUREMENT: N/A

317.06 BASIS OF PAYMENT: This item is considered part of the line installation and is included only for information on how to deal with underground utility crossings.

314.07 STANDARD DRAWINGS: UL01 and UL02

330 CONCRETE PLACEMENT (05/16/94):

330.01 DESCRIPTION: This work shall consist of concrete placement as shown on the plans or directed by the Contract Administrator.

330.02 MATERIALS: Section 601 Concrete

330.03 CONSTRUCTION METHODS:

a. **Cement Storage and Use:** Unless otherwise permitted, the Contractor shall use only one brand of cement in the work, and under no conditions shall he use more than one brand of cement in the same structure. Cement which for any reason has become partially set or contains lumps or cakes will be rejected and shall be removed from the site of the work. The acceptance or rejection of cement shall rest with the Engineer and any cement failing to meet the requirements specified herein may be rejected at his discretion. All rejected cement shall be plainly marked for identification, shall be immediately removed from the work, and shall not be offered again for inspection. Cement kept in storage for several months may be subject to repeated tests, if required. Bulk cement shall be delivered by tank truck especially designed for cement transport and handling. The Contractor shall provide, at the site of the work, suitable silos or weather tight

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buildings, for the storage of cement. The building, or silo, shall be large enough to prevent delays or interruptions to the work which might be due to the lack of cement. Bagged cement shall be stored in such a manner to permit easy access for the proper inspection and identification of each shipment. Cement in bags shall not be piled to a height in excess of seven feet (7'). Suitable accurate scales shall be provided by the Contractor for weighing the cement. After it has been delivered to the job, the Contractor will not be permitted to remove any of the cement to any other job or dispose of any of this cement in any way without the consent of the Contract Administrator. At the beginning of operations and at all other times while cement is required, the Contractor shall have, at the site of the work, an ample supply of acceptable cement and shall carefully guard against possible shortage on account of rejection, irregular deliveries, or any other cause.

b. Concrete Strength and Proportion: The concrete shall have the specified compressive strength but not less than two thousand four hundred (2,400) pounds per square inch, as determined from test cylinders at twenty-eight (28) days, made, cured and broken as hereinafter specified. The concrete shall be designed by the absolute volume method and shall contain not less than quantity of cement per cubic yard specified in Section 601.02. With the approval of the Contract Administrator, admixtures may be added in order to increase workability.

c. Responsibility for Strength: It is the intent of these specifications that the Contractor shall guarantee that concrete of the specified compressive strength is incorporated in the structures and that the responsibility for producing the required grades of concrete is assumed by the Contractor. Should the average strengths shown by test cylinders fall below the strengths required, the City Engineer will require any or all of the following changes: amount of cement; grading of aggregate, or ratio of the water to the cement used. If the tests disclose that the strength of the concrete is insufficient for the structure as built, the City Engineer may condemn the part of any structure in which concrete of insufficient strength has been placed and the Contractor, at his cost, shall remove and replace such concrete with concrete meeting these specifications.

d. Experimental Concrete Mixes: The Contractor shall make experimental mixes prior to the placing of the concrete and at any time during the progress of the work when necessary to demonstrate that the concrete will meet these specifications. Materials for making experimental mixes shall be furnished by the contractor and these materials shall be identical with those intended for use in the work. The cost of the materials, as well as the costs of crushing test specimens made from the experimental mix, shall be borne by the Contractor and shall be included in the price bid for concrete.

e. Mixing: The concrete shall be mixed in an approved batch machine or mixer. The ingredients shall be accurately measured by weight, unless measurement by volume is permitted by the City Engineer, before being placed in the mixer. Measuring boxes or other approved measuring apparatus shall be such that the proportions can be accurately determined. The quantity of water to be added, which will vary with the degree of dryness of the material and with the weather conditions, shall be accurately measured for each batch of concrete. Means shall be provided by which a measured quantity of water can be introduced at any stage of the process. The mixing shall be done in a thorough and satisfactory manner and shall continue until every particle of aggregate is completely covered with mortar. The mixing time for each batch of two (2) cubic yards or less shall be not less than one and one half (1½) minutes after the materials are in the mixer. The mixing time shall be increased fifteen (15) seconds for each additional cubic yard or fraction thereof. The entire contents of the drum shall be discharged before recharging. Re-tempering of concrete which has partly hardened will not be permitted.

f. Consistency: All reinforced concrete which is required to be spaded or puddled in forms or around reinforcing steel shall be of such consistency that:

1. All aggregates will float uniformly throughout the mass without settling or segregation;
2. When dropped directly from the discharge chute of the mixer, it will flatten out at the center of the pile but will stand up at the edges, the piling spreading from internal expansion and not by flowing;
3. It will flow sluggishly when tamped or spaded;
4. It can be readily puddled into corners and angles of forms and around reinforcing steel;
5. It can be readily spaded to the bottom of the pour or to a depth of several feet at any time within thirty (30) minutes after placing.
6. A desirable consistency is one which results in a very slight accumulation of water at the top of a layer several feet in thickness, but without segregation or accumulation of laitance. If, through accident, intention or error in mixing, any concrete shall, in the opinion of the Contract Administrator, vary materially from the consistency specified, such concrete

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shall not be incorporated in the work but shall be discharged as waste material.

g. **Placing Concrete:** Before beginning a run of concrete, surfaces of the forms, reinforcing steel and concrete previously placed shall be thoroughly wetted or oiled. Sub-grades shall be sprinkled or sealed in a manner that will prevent the removal of water from the concrete. Concrete shall be placed in the forms immediately after mixing. It shall be so deposited that the aggregates are not separated. Dropping the concrete any considerable distance, generally in excess of five feet (5') depositing large quantities any point and running or working it along the forms, or any other practice tending to cause segregation of the ingredients will not be allowed. It shall be compacted by vibration or continuous tamping, spading or slicing. Care shall be taken to fill every part of the forms, to work the coarser aggregate back from the face, and to force the concrete under and around the reinforcement without displacing it. All concrete shall be thoroughly vibrated, except where specifically excepted in the specifications. The concrete shall be deposited in continuous horizontal layers and whenever practicable, concrete in structure shall be deposited continuously for each monolithic section of the work. Chutes and tremmies used for conveying concrete shall be mortar-tight. Work shall be arranged in order that each part of the work shall be placed as a unit if this is possible. Where necessary to stop placing concrete, the work shall be brought up in level courses and against a vertical stop board. The placing of concrete under water, where permitted, must be done by special approved methods.

h. **Placing Concrete in Cold Weather:** No concrete shall be placed without the specific permission of the Contract Administrator when the air temperature is at or below 35°F. If concreting in freezing weather is permitted by the City Engineer, care shall be taken to prevent the use of any frozen material. In addition to adequate provisions for protecting the concrete against chilling or freezing, the Contractor shall heat the water and aggregate in order that when deposited in the forms, the concrete will have a temperature of not less than 50°F, nor more than 80°F. Heated water and aggregate shall be combined in the mixer before cement is added. Cement shall not be added to mixtures of water and aggregate when the temperature of the mixture is greater than 100°F. The concrete shall be adequately protected in order to maintain this temperature for a minimum of seventy two (72) hours after it has been placed and a temperature above 32°F for a period of two additional days. The work shall be done entirely at the Contractor's risk. No chemicals or other foreign matter shall be added to the concrete for the purpose of preventing freezing.

i. **Ready Mixed Concrete:** Ready-mixed concrete may be used on the work, when the mix design is approved during the submittal process. The contractor must demonstrate that the concrete can be furnished in accordance with these specifications and that delivery can be made at a rate that will ensure the continuity of any pour. All mixer trucks shall be equipped with water meters. Additional water shall be added at the job site only with the specific approval of the project manager. He/she will notify the Contract Administrator of the location of placements with added water.

j. **Construction Joints:** Construction joints shall be located as shown on the plans and at other points as may be necessary during construction provided that the location and nature of additional joints shall be approved by the City Engineer. In general, joints shall be located at points of minimum shear, shall be perpendicular to the principal lines of stress, and shall have suitable keys having areas of approximately one-third (1/3) of the area of the joints. When placing against a construction joint, the surface of the concrete previously placed shall be thoroughly cleaned of dirt, scum, laitance or other soft material, and shall be roughened. The surface shall then be thoroughly washed with clean water and covered with at least one half inch (1/2") of cement mortar, after which concreting may proceed. Mortar shall be placed in a manner that will not splatter forms and reinforcing steel.

k. **Finish of Concrete Surfaces:** All surfaces exposed to view shall be free from conspicuous lines, affects or other irregularities caused by defects in the forms. If for any reason this requirement is not met, or if there are any conspicuous honeycombs, the Contract Administrator may require a correction of the defects by rubbing with carborundum bricks and water until a satisfactory finish is obtained. Immediately after removing the forms, all wires or other exposed metal shall be cut back of the concrete surface and the depressions thus made and all honeycomb and other defects shall be painted with mortar and then rubbed smooth. If the City Engineer deems any honeycomb or other defect to require such treatment, the defective concrete shall be cut out to a depth sufficient to expose the reinforcement and to afford a key for the concrete replacing the cut out.

l. **Curing Concrete:** Exposed surfaces of concrete shall be protected by approved methods from premature drying for a period of at least seven (7) days. Curing compounds, when approved by the City Engineer, shall be applied according to the manufacturer's recommendations and shall not be used on any surface against which additional concrete is to be bonded, nor on surfaces which will be painted. In dry, hot weather, forms shall be removed as early as practicable and

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curing started immediately.

The Contract Administrator may require the frequent wetting of the concrete and the use of means to protect it from the direct rays of the sun.

m. **Placing Reinforcement:** All reinforcement, when placed, shall be free from mill scale, loose or thick rust, dirt, paint, oil or grease, and shall present a clean surface. Bends and splices shall be accurately and neatly done, and shall conform to the American Concrete Institute Manual of Standard Practice for Detailing Reinforced Concrete Structures. All reinforcing shall be placed in the exact position shown on the plans and shall be held firmly in position by means of approved spacers and supports, by wiring to the forms, and by wiring the bars together at intersections with approved wire ties in order that the reinforcement will not be displaced during the depositing and compacting of the concrete. When the concrete surface will be exposed to the weather in the finished structure or where rust would impair the appearance, the portions of all accessories in contact with the form work shall be galvanized steel or plastic. The placing and fastening of reinforcement in each section of the work shall be approved by the City Engineer before any concrete is deposited in the section. Care shall be taken not to disturb the reinforcement after the concrete has taken its initial set.

n. **Forms:** Forms shall be so designed and constructed that they may be removed without injuring the concrete. The material to be used in the forms for exposed surfaces shall be sized and dressed lumber or metal in which all bolt and rivet heads are countersunk. In either case, a plain, smooth surface of the desired contour must be obtained. Undressed lumber may be used for backing or other unexposed surfaces, except inside faces of conduits. The forms shall be built true to line and braced in a substantial and unyielding manner. They shall be mortar tight and, if necessary to close cracks due to shrinkage, shall be thoroughly soaked in water. Forms for re-entrant angles shall be filleted and for corners shall be chamfered. Dimensions affecting the construction of subsequent portions of the work shall be carefully checked after the forms are erected and before any concrete is placed. The interior surfaces of the forms shall be adequately oiled with a non-staining mineral oil to ensure the non-adhesion of mortar. Form lumber which is to be used a second time shall be free from bulge or warp and shall be thoroughly cleaned. The forms shall be inspected immediately preceding the placing of concrete; any building or warping shall be remedied and all dirt, sawdust, shavings or other debris within the form shall be removed. No wood device of any kind used to separate forms will be permitted to remain in the finished work. Temporary openings shall be placed at the bottom of the column and wall forms and at other points where necessary to facilitate cleaning and inspection immediately before depositing concrete.

o. **Removal of Forms:** Forms shall be removed in such manner as to ensure the complete safety of the structure. No forms shall be removed except with the express approval of the Engineer. In general, this approval will be based on the following:

1. Forms on ornamental work, railings, parapets and vertical surfaces which do not carry loads and which will be exposed in the finished work shall be removed within twenty-four (24) hours to forty-eight (48) hours after placing, depending upon weather conditions.
2. Girder, beam and joist sides only, column, pier, abutment and wall forms may be removed within twenty-four (24) hours to forty-eight (48) hours after placing, depending upon weather conditions. No backfill shall be placed against wall, piers or abutments unless they are adequately supported or have reached the required strength.
3. Girder, beam and joint soffit forms shall remain in place with adequate shoring underneath, and no construction load shall be supported upon nor any shoring removed from any part of the structure under construction until that portion of the structure has attained sufficient strength to support safely its weight and the loads placed thereon.

p. **Concrete Thrust Blocks:** Thrust blocks or other restraint devices shall be adequate to prevent movement of the line at 150 PSI pressure, unless otherwise specified. Thrust blocks shall be placed against undisturbed soil in the trench. The thrust block shall have sufficient surface area to transmit the thrust to the undisturbed soil. The thickness, width, and length shall be sufficient to carry the required load. The minimum thickness, width, and length for thrust blocks shall be one (1) foot. Concrete placed for thrust blocks shall be consolidated to ensure that no voids remain in the block. Thrust blocks will be of unreinforced concrete unless otherwise specified.

q. **Concrete Encasement of Pipelines:**

1. General: Concrete encasement of pipelines shall be a minimum of 6 inches thick at the thinnest point. Encasement shall be plain concrete with no reinforcement, unless otherwise specified. All encasement will be placed as a monolithic placement.
2. Water Lines: Water lines shall be encased where the cover over the line is not sufficient to spread surface loading where trench widths are more than the maximum as shown on the Standard Details.

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3. Sanitary Sewer Lines: Sanitary sewers shall be encased when the depth of cut from the original ground elevation to the flow line of the pipe is four feet (4') or less. Sanitary sewer lines will be encased where they cross water lines, as shown on the plans. Concrete encasement necessitated by trench widths more than the maximum as shown on the Standard Details shall be placed as directed by the City Engineer. All concrete encasement required because of excessive trench width shall be placed at the expense of the contractor.

4. Other Utility Lines: Where other utility lines require concrete encasement, the owner of the utility shall specify the method and thickness of encasement.

r. **Concrete Slab Protection for Pipelines:** This item will be installed only as shown on the plans or at the direction of the City Engineer. Where pipelines are within two (2) feet of the surface or two (2) feet of another pipeline, they will be covered with a 12 inch reinforced concrete slab. This slab will be placed in such a manner as to prevent accidental excavation into the pipeline. This slab shall be placed on a two (2) inch thick rock bed over the pipeline. The excavation shall then be filled to ground level.

s. **Concrete Cradle for Pipelines:** Concrete cradle of pipelines shall be a minimum of 6 inches thick at the thinnest point on the sides and bottom of the pipe. Cradle shall be plain concrete with no reinforcement, unless otherwise specified. All cradle will be placed as a monolithic placement. For sanitary sewers, a standard concrete cradle is required at any location where the depth of cut to the flow line of the pipe is sixteen feet (16') or more. Concrete cradle necessitated by trench width more than the maximum as shown on the Standard Details shall be placed as directed by the Contract Administrator. All concrete cradle required because of excessive trench width shall be placed at the expense of the contractor.

t. **Reinforced Concrete Piers for Pipelines:** Piers shall be located and constructed as shown on the plans and Standard Details. Forms shall be made to conform to the shape of the pier and securely braced. Reinforcing steel shall be bent as detailed and securely tied in place. Bearing area for the pipe shall be made to fit the outside diameter of the pipe and shall support the pipe at the proper grade. Steel strapping and bolts shall be installed and painted with one heavy coat of coal tar or asphalt paint after bolting in place. Any honeycomb or other unevenness in the concrete shall be patched with cement mortar immediately after form removal.

330.04 SPECIAL REQUIREMENTS:

a. Required Minimum Concrete Strength:

1. Streets and Structures: 3,500 PSI
2. Thrust Blocks and Encasement: 2,500 PSI

b. **Pipe Thrust Table:** Thrust blocks shall be constructed to restrain not less than the larger of the thrust indicated in the plans or the table in Section 903.

330.05 METHOD OF MEASUREMENT: When this item is included as a pay item in the contract it will be measured by the cubic yard. The method of measurement for each type of concrete placement is as follows:

a. **Structural Concrete:** Structural concrete will be computed by computing the concrete volume, in cubic yards, of the vertical reinforced concrete structure being built. This type of structure includes all structures that require forming on at least four (4) sides and the forms are higher than 18 inches. Examples include wet wells, headwalls, cast in place vaults, cast in place manholes, piers, etc.

b. **Reinforced Concrete:** Reinforced concrete will be computed by computing the concrete volume, in cubic yards, of the horizontal reinforced concrete structure being built. This type of structure includes all structures that require forming on at least four (4) sides and the forms are 18 inches or lower. Examples include manhole bases, pipeline protection slabs, vault bases, etc.

c. **Plain Concrete:** Plain concrete does not require reinforcing steel unless otherwise specified.

1. Thrust Blocks: Computing the size of a thrust block is site dependant and in most cases, the quantity of concrete actually used will be the accepted quantity of concrete for the thrust block. When the contractor over excavates a thrust block site, the maximum quantity for a thrust block will be calculated and that quantity will be paid regardless of the amount used by the contractor. The maximum volume of concrete paid for in a thrust block will be computed as a rectangle with the required surface area for pipe support serving as the thickness and width of the rectangle and the trench

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width serving as the length.

2. Concrete encasement: Concrete encasement shall be computed by taking the authorized trench width, times the authorized encasement length, times the exterior width of the pipe plus one (1) foot, and subtracting the volume of the pipe in the encasement.

3. Concrete Cradle: Concrete cradle shall be computed by taking the authorized trench width, times the authorized cradle length, times the one half the exterior width of the pipe plus six (6) inches, and subtracting the one half of the volume of the pipe in the cradle.

4. Formed Plain Concrete: Formed plain concrete will be computed based on the authorized volume of the formed area less the volume of any penetrations.

d. **Reinforcing Steel:** Reinforcing steel shall be measured by the pound.

330.06 BASIS OF PAYMENT: Concrete and reinforcing steel, measured as provided above, will be paid for by the cubic yard and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. This item will be paid as a separate bid item and payment will be made upon acceptance of the concrete placement. When this item is included in a contract it will be listed as follows:

BA 330A STRUCTURAL CONCRETE	CUBIC YARD
BA 330B REINFORCED CONCRETE	CUBIC YARD
BA 330C PLAIN CONCRETE	CUBIC YARD
BA 330D REINFORCING STEEL	POUND

330.07 STANDARD DRAWINGS: ST03

340 MATERIALS FURNISHED BY CONTRACTOR/INSTALLED BY CITY (05/16/94):

340.01 DESCRIPTION: This work shall consist of providing materials as shown on the plans or directed by the Contract Administrator.

340.02 MATERIALS: See Materials requirement for the items being furnished.

340.03 CONSTRUCTION METHODS: The Contractor shall provide the required materials at the time and location specified by the Contract Administrator. For installation specifications see construction requirements for the items being furnished.

340.04 SPECIAL REQUIREMENTS: See special requirements for the items being furnished.

340.05 METHOD OF MEASUREMENT: When this item is included as a pay item in the contract it will be measured by each item requested.

340.06 BASIS OF PAYMENT: Materials furnished by the contractor and installed by the City, measured as provided above, will be paid for by the lump sum and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. This item will be paid as a separate bid item and payment will be made upon delivery of the materials. When this item is included in a contract it will be listed as follows:

BA 340 MATERIALS FURNISHED BY CONTRACTOR/INSTALLED BY CITY	LUMP SUM
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340.07 STANDARD DRAWINGS: N/A

341 MATERIALS FURNISHED BY CITY/INSTALLED BY CONTRACTOR (05/16/94):

341.01 DESCRIPTION: This work shall consist of installing materials as shown on the plans or directed by the Contract Administrator.

341.02 MATERIALS: See Materials requirement for the items being furnished.

341.03 CONSTRUCTION METHODS: The City shall provide the required materials at the time and location specified by the Contractor. For installation specifications see construction requirements for the items being furnished.

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341.04 SPECIAL REQUIREMENTS: See special requirements for the items being furnished.

341.05 METHOD OF MEASUREMENT: When this item is included as a pay item in the contract it will be measured by each item requested.

341.06 BASIS OF PAYMENT: Materials furnished by the City and installed by the Contractor, measured as provided above, will be paid for by the lump sum and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. This item will be paid as a separate bid item and payment will be made upon installation of the materials. When this item is included in a contract it will be listed as follows:

BA 340 MATERIALS FURNISHED BY CITY/INSTALLED BY CONTRACTOR	LUMP SUM
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341.07 STANDARD DRAWINGS: N/A

SECTION 400 - WATER LINES

401 PVC PIPE INSTALLATION (08/19/99):

401.01 DESCRIPTION: This work shall consist of furnishing, hauling, placing, and jointing the pipe as shown on the plans or directed by the Contract Administrator.

401.02 MATERIALS:

a. **Pipe Materials:** Section 620 Water Line - PVC Pipe, Fittings, and Joints

b. **Bedding and Backfill Material Requirements for PCV Pipe:** See Standard Drawing W01 and Section 602.

401.03 CONSTRUCTION METHODS:

a. **Protection of Work:** During the progress of the work, the Contractor shall provide suitable barricades, fencing, signs, lighting, platforms, and/or scaffolding to protect the work during construction, to prevent damage to such work, and to protect the public from the work. At the close of each day's work, the open end of the pipelines shall be closed by suitable cover or plug, and shall not be reopened until the work recommences. Any obstructions which may occur in the line after being laid shall be removed by the Contractor at his own expense to the satisfaction of the Contract Administrator. The pipeline must be delivered free from dirt or other foreign matter.

b. **Laying of Pipe:** Pipe shall be laid true to the lines and grades shown on the plans and given in the field. Procedures for laying and joining the pipe will be in accordance with the manufactures recommendations. Each pipe shall be carefully laid to the line and grade given in the field with bells upstream, and the ends of adjoining pipes shall butt against each other in such manner that there will be no shoulder or unevenness of any kind. Special care shall be taken that the invert of the pipe shall be a smooth continuous surface. At each bell, a hole shall be excavated of a size to give ample working room for proper make-up of the joint. Unless expressly ordered by the Contract Administrator, each pipe shall be brought to the required grade as established from grade lines. The Contractor shall, at his own expense, furnish all tools, materials, and labor, and shall construct cross-frames or horses at such intervals as the Contract Administrator may order in the field. The Contractor shall furnish all other implements necessary to determine the proper setting of the pipes.

c. **Establishing Grade:** The grade line shown on the plans is the elevation of the invert or flow line of the pipeline. This section shall not apply when the plans only require a minimum of three (3) feet of cover and do not set an exact grade for the water line. The contractor shall verify the requirement for exact grade with the design engineer prior to starting construction. The grade line shall be established in the trench by one of the following methods:

1) Use of batter boards set at grade stakes not farther than fifty feet (50'). Not less than three (3) batter boards shall be maintained in correct position while pipe is being placed.

2) Use of level and philly rod with grade stakes not farther than 300 feet apart. When this method is used the invert elevation of each section shall be verified before the next section is placed.

3) Use of level and philly rod with grade stakes not farther than 300 feet apart to set a laser for establishing the grade line in the trench. When this method is used, the invert elevation of shall be verified every 100 feet or when the laser is moved.

d. **Jointing the Pipe:** Pipe shall assemble with bell and spigot joints having rubber gaskets which compress to form a water tight seal. Joints shall be assembled by bar and block, coupling pulleys or by backhoe. If the backhoe bucket is used to assembly the joint, a block of wood shall be placed between the end of the pipe and the bucket and care shall be taken to prevent damage to the pipe.

e. **Service Lines:** House services or road crossings shall be installed, in accordance with the appropriate sections of these specifications, before the pipeline is pressure tested and chlorinated.

f. **Interferences:** All known underground lines are shown on the plans. This does not necessarily mean that all such lines that may be encountered are shown. Where existing utility lines or other subsurface obstructions are shown on the drawings, they have been located as accurately as practicable by the City. Such obstructions are shown for the purpose of advising the Contractor that they may interfere with the work to be done hereunder but not for the purpose of indicating

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that the work can be performed without such interference. Elevations of underground obstructions and lines are shown as accurately as known on the profile sheets.

g. **Backfilling:** Backfilling of the trench shall be accomplished in accordance with Section 312 and Standard Drawing W01.

h. **Flushing:** The flushing velocity shall be at least 2.5 feet per second for small mains. The table in Section 904 lists required hydrant openings to obtain required flushing velocities. The flushing velocity for larger mains shall be as specified by the design engineer.

i. **Disinfection:** All new potable water mains shall be disinfected in accordance with "Standards for Public Water Supply System" OSDEQ Bulletin 589 or most current replacement. Water with 50 to 100 parts per million of chlorine shall be allowed to stand 48 hours and develop a residual of at least 10 parts per million of chlorine. The spent solution should be drained and replaced with potable water. As an alternate, either of the methods listed in the latest American Water Works Association specifications may be used. Safe bacteriological samples shall be obtained on two consecutive days before that portion of the line may be used. Mains shall be disinfected by the addition of chlorine as a liquid, a hypochlorite solution or hypochlorite tablets. The table in Section 905 indicates the number of 5-G hypochlorite tablets required for each size pipe up to 12 inches in diameter. For larger lines, the dosage for disinfection shall be in accordance with the manufactures recommendations and the state regulations.

j. **Testing:** Testing shall be accomplished in accordance with Section 108. Testing shall be at the Contractor's expense by a testing laboratory approved by the City, except for bacterial analysis which will be at the City's expense. Tests shall be taken at locations specified by the City.

k. **Connection to the System:** Connection to the system will not be made until after testing, flushing, and sterilization of the line, unless otherwise approved by the Engineer.

401.04 SPECIAL REQUIREMENTS:

a. **Restrained Joints:** When a water line is placed in conduit or in a creek without concrete encasement, the pipe will be installed with restrained joints to prevent separation of the pipe in these structures.

b. **Bridging of Trench:** When ordered by the City, the Contractor shall, at his own expense, construct suitable platforms to bridge the trench at street intersections, at driveways to properties abutting the line of the work and at such points as may be required to permit vehicle and/or pedestrian travel.

c. **Shop Tests:** The Contractor shall be responsible for obtaining tests of all materials as required by these specifications. The contractor shall furnish to the City, in the required number of copies, a certificate of shop tests on all pipe. These tests shall be witnessed by a reputable and established testing laboratory or firm, previously approved by the City.

d. **Locator Wire and Locator Tape :** All main water lines constructed of polyvinyl chloride, shall have a No. 8 bare copper conductor wire taped to the top surface of the pipe and connected at each end to the fire hydrant by attachment to an above ground bolt on the fire hydrant. Dig through locator tape as specified in section 627 shall be buried two (2) feet above the pipe.

e. **Aerial Crossings and Crossings with less than four (4) feet of Cover:** These crossings shall consist of 3/16ths of an inch thick smooth wall steel casing, welded to form a one piece crossing, on concrete piers with bolted steel straps. The crossing shall be conducted in accordance with standard drawing SS14. The concrete shall be 3,500psi and sonitube forms may be used. The crossing will be included in the price per foot for pipe installation unless otherwise stated.

f. **On Site Materials Storage:** PVC pipe shall not be exposed to sunlight for more than three (3) weeks. If on-site storage is required for a longer period of time, the pipe shall be covered with an opaque material.

401.05 METHOD OF MEASUREMENT: When this item is included as a pay item in the contract it will be measured by the linear foot, through all fittings and specials.

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401.06 BASIS OF PAYMENT: PVC pipe, measured as provided above, will be paid for by the linear foot and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. The price bid shall include all cost and expense of furnishing, hauling, laying and jointing the pipe, installing the protective materials, testing, flushing, sterilization and repairing of leaks. Excavation is paid under Section 311. Backfill and compaction are paid under either Section 312 or Section 313. This item will be paid as a separate bid item and payment will be made upon installation of the pipe. When this item is included in a contract it will be listed as follows:

BA 401 PVC PIPE INSTALLATION (WATER)

LINEAR FOOT

401.07 STANDARD DRAWINGS: W01, W06, and W07.

402 DUCTILE IRON PIPE INSTALLATION (08/19/99):

402.01 DESCRIPTION: This work shall consist of furnishing, hauling, placing, and jointing the pipe as shown on the plans or directed by the Contract Administrator.

402.02 MATERIALS:

a. **Pipe Materials:** Section 621 Water Line - Ductile Iron Pipe, Fittings, and Joints and Section 605 Polyethylene Wrap.

b. **Bedding and Backfill Material Requirements for Ductile Iron Pipe:** See Standard Drawing W01 and Section 602.

402.03 CONSTRUCTION METHODS:

a. **Protection of Work:** During the progress of the work, the Contractor shall provide suitable barricades, fencing, signs, lighting, platforms, and/or scaffolding to protect the work during construction, to prevent damage to such work, and to protect the public from the work. At the close of each day's work, the open end of the pipelines shall be closed by suitable cover or plug, and shall not be reopened until the work recommences. Any obstructions which may occur in the line after being laid shall be removed by the Contractor at his own expense to the satisfaction of the Contract Administrator. The pipeline must be delivered free from dirt or other foreign matter.

b. **Laying of Pipe:** Pipe shall be laid true to the lines and grades shown on the plans and given in the field. Each pipe shall be carefully laid to the line and grade given in the field with bells upstream, and the ends of adjoining pipes shall butt against each other in such manner that there will be no shoulder or unevenness of any kind. Procedures for laying and joining the pipe will be in accordance with the manufactures recommendations. Special care shall be taken that the invert of the pipe shall be a smooth continuous surface. Unless expressly ordered by the Contract Administrator, each pipe shall be brought to the required grade as established from grade lines. At each bell, a hole shall be excavated of a size to give ample working room for proper make-up of the joint. The Contractor shall, at his own expense, furnish all tools, materials, and labor, and shall construct cross-frames or horses at such intervals as the Contract Administrator may order in the field. The Contractor shall furnish all other implements necessary to determine the proper setting of the pipes. Ductile iron pipe shall be installed with polywrap. The polywrap shall be installed in accordance with the manufactures recommendations, with particular attention to joint overlap (minimum of one (1) foot), joint tape, and protection of polywrap to prevent tears or penetrations.

c. **Establishing Grade:** The grade line shown on the plans is the elevation of the invert or flow line of the pipeline. This section shall not apply when the plans only require a minimum of three (3) feet of cover and do not set an exact grade for the water line. The contractor shall verify the requirement for exact grade with the design engineer prior to starting construction. The grade line shall be established in the trench by one of the following methods:

1) Use of batter boards set at grade stakes not farther than fifty feet (50'). Not less than three (3) batter boards shall be maintained in correct position while pipe is being placed.

2) Use of level and philly rod with grade stakes not farther than 300 feet apart. When this method is used the invert elevation of each section shall be verified before the next section is placed.

3) Use of level and philly rod with grade stakes not farther than 300 feet apart to set a laser for establishing the grade

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line in the trench. When this method is used, the invert elevation of shall be verified every 100 feet or when the laser is moved.

d. **Jointing the Pipe:** Pipe shall assemble with bell and spigot joints having rubber gaskets which compress to form a water tight seal. Joints shall be assembled by bar and block, coupling pulleys or by backhoe. If the backhoe bucket is used to assembly the joint, a block of wood shall be placed between the end of the pipe and the bucket and care shall be taken to prevent damage to the pipe.

e. **Service Lines:** House services or road crossings shall be installed, in accordance with the appropriate sections of these specifications, before the pipeline is pressure tested and chlorinated.

f. **Interferences:** All known underground lines are shown on the plans. This does not necessarily mean that all such lines that may be encountered are shown. Where existing utility lines or other subsurface obstructions are shown on the drawings, they have been located as accurately as practicable by the City. Such obstructions are shown for the purpose of advising the Contractor that they may interfere with the work to be done hereunder but not for the purpose of indicating that the work can be performed without such interference. Elevations of underground obstructions and lines are shown as accurately as known on the profile sheets.

g. **Backfilling:** Backfilling of the trench shall be accomplished in accordance with Section 312 and Standard Drawing W01.

h. **Flushing:** The flushing velocity shall be at least 2.5 feet per second for small mains. The table in Section 904 lists required hydrant openings to obtain required flushing velocities. The flushing velocity for larger mains shall be as specified by the design engineer.

i. **Disinfection:** All new potable water mains shall be disinfected in accordance with "Standards for Public Water Supply System" OSDEQ Bulletin 589 or most current replacement. Water with 50 to 100 parts per million of chlorine shall be allowed to stand 48 hours and develop a residual of at least 10 parts per million of chlorine. The spent solution should be drained and replaced with potable water. As an alternate, either of the methods listed in the latest American Water Works Association specifications may be used. Safe bacteriological samples shall be obtained on two consecutive days before that portion of the line may be used. Mains shall be disinfected by the addition of chlorine as a liquid, a hypochlorite solution or hypochlorite tablets. The table in Section 905 indicates the number of 5-G hypochlorite tablets required for each size pipe up to 12 inches in diameter. For larger lines, the dosage for disinfection shall be in accordance with the manufactures recommendations and the state regulations.

j. **Testing:** Testing shall be accomplished in accordance with Section 108. Testing shall be at the Contractor's expense by a testing laboratory approved by the City, except for bacterial analysis which will be at the City's expense. Tests shall be taken at locations specified by the City.

k. **Connection to the System:** Connection to the system will not be made until after testing, flushing, and sterilization of the line, unless otherwise approved by the Engineer.

402.04 SPECIAL REQUIREMENTS:

a. **Restrained Joints:** When a water line is placed in conduit or in a creek without concrete encasement, the pipe will be installed with restrained joints to prevent separation of the pipe in these structures.

b. **Bridging of Trench:** When ordered by the City, the Contractor shall, at his own expense, construct suitable platforms to bridge the trench at street intersections, at driveways to properties abutting the line of the work and at such points as may be required to permit vehicle and/or pedestrian travel.

c. **Shop Tests:** The Contractor shall be responsible for obtaining tests of all materials as required by these specifications. The contractor shall furnish to the City, in the required number of copies, a certificate of shop tests on all pipe. These tests shall be witnessed by a reputable and established testing laboratory or firm, previously approved by the City.

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d. **Dig through Locator Tape:** Dig through locator tape as specified in section 627 will be buried two (2) feet above the pipe.

e. **Aerial Crossings and Crossings with less than four (4) feet of Cover:** These crossings shall consist of 3/16ths of an inch thick smooth wall steel casing, welded to form a one piece crossing, on concrete piers with bolted steel straps. The crossing shall be conducted in accordance with standard drawing SS14. The concrete shall be 3,500psi and sonitube forms may be used. The crossing will be included in the price per foot for pipe installation unless otherwise stated.

402.05 METHOD OF MEASUREMENT: When this item is included as a pay item in the contract it will be measured by the linear foot, through all fittings and specials.

402.06 BASIS OF PAYMENT: Ductile iron pipe, measured as provided above, will be paid for by the linear foot and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. The price bid shall include all cost and expense of furnishing, hauling, laying and jointing the pipe, installing the protective materials, testing, flushing, sterilization and repairing of leaks. Excavation is paid under Section 311. Backfill and compaction are paid under either Section 312 or Section 313. This item will be paid as a separate bid item and payment will be made upon installation of the pipe. When this item is included in a contract it will be listed as follows:

BA 402 DUCTILE IRON PIPE INSTALLATION (WATER) LINEAR FOOT

402.07 STANDARD DRAWINGS: W01, W06, and W07

403 PRESTRESSED CONCRETE PIPE INSTALLATION (08/19/99):

403.01 DESCRIPTION: This work shall consist of furnishing, hauling, placing, and joining the pipe as shown on the plans or directed by the Contract Administrator.

403.02 MATERIALS:

a. **Pipe Materials:** Section 622 Water Line - Prestressed Concrete Pipe, Fittings, and Joints

b. **Bedding and Backfill Material Requirements for Prestressed Concrete Pipe:** See Standard Drawing W01 and Section 602.

403.03 CONSTRUCTION METHODS:

a. **Protection of Work:** During the progress of the work, the Contractor shall provide suitable barricades, fencing, signs, lighting, platforms, and/or scaffolding to protect the work during construction, to prevent damage to such work, and to protect the public from the work. At the close of each day's work, the open end of the pipelines shall be closed by suitable cover or plug, and shall not be reopened until the work recommences. Any obstructions which may occur in the line after being laid shall be removed by the Contractor at his own expense to the satisfaction of the Contract Administrator. The pipeline must be delivered free from dirt or other foreign matter.

b. **Laying of Pipe:** Pipe shall be laid true to the lines and grades shown on the plans and given in the field. Procedures for laying and joining the pipe will be in accordance with the manufactures recommendations. It is important that a uniform bedding be prepared for the pipe immediately before laying. The Contractor shall use a laying-square or some other satisfactory tool to check the bedding before the pipe is laid. A small ditch may be dug across the trench below the grade at the mid-point of the pipe to be laid, to facilitate the removal of the cable sling used in handling the pipe. After the trench is prepared to receive the pipe, the pipe shall be lowered into the trench with machines of adequate capacity to safely handle the loads. Each pipe shall be carefully laid to the line and grade given in the field with bells upstream, and the ends of adjoining pipes shall butt against each other in such manner that there will be no shoulder or unevenness of any kind. Special care shall be taken that the invert of the pipe shall be a smooth continuous surface. Unless expressly ordered by the Contract Administrator, each pipe shall be brought to the required grade as established from grade lines. The Contractor shall, at his own expense, furnish all tools, materials, and labor, and shall construct cross-frames or horses at such intervals as the Contract Administrator may order in the field. The Contractor shall furnish all other implements necessary to determine the proper setting of the pipes.

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c. **Establishing Grade:** The grade line shown on the plans is the elevation of the invert or flow line of the pipeline. This section shall not apply when the plans only require a minimum of three (3) feet of cover and do not set an exact grade for the water line. The contractor shall verify the requirement for exact grade with the design engineer prior to starting construction. The grade line shall be established in the trench by one of the following methods:

1) Use of batter boards set at grade stakes not farther than fifty feet (50'). Not less than three (3) batter boards shall be maintained in correct position while pipe is being placed.

2) Use of level and philly rod with grade stakes not farther than 300 feet apart. When this method is used the invert elevation of each section shall be verified before the next section is placed.

3) Use of level and philly rod with grade stakes not farther than 300 feet apart to set a laser for establishing the grade line in the trench. When this method is used, the invert elevation of shall be verified every 100 feet or when the laser is moved.

d. **Joining the Pipe:** Pipe shall assemble with bell and spigot joints having rubber gaskets which compress to form a water tight seal. Joints shall be assembled by bar and block, coupling pulleys, or by backhoe. If the backhoe bucket is used to assembly the joint, a block of wood shall be placed between the end of the pipe and the bucket and care shall be taken to prevent damage to the pipe. Laying and joining pipe shall conform to the specifications for laying and joining concrete pipe in the "General Specifications for Prestressed Concrete Cylinder Pipe". The bell of the pipe already laid and the spigot of the pipe to be laid shall be cleaned just prior to joining the pipes and the rubber gasket shall be stretched over the spigot and placed in the annular spigot groove. The rubber gasket shall be thoroughly lubricated with a coating of vegetable soap before the gasket is placed in the spigot groove. Extreme care shall be taken in pushing or pulling the spigot of the pipe into the bell of the pipe already laid to prevent damaging the gasket. Concrete pipe joints for water shall be protected by filling both interior and exterior joints with mortar or by a method approved by the manufacturer and the City.

e. **Service Lines:** House services or road crossings shall be installed, in accordance with the appropriate sections of these specifications, before the pipeline is pressure tested and chlorinated.

f. **Interferences:** All known underground lines are shown on the plans. This does not necessarily mean that all such lines that may be encountered are shown. Where existing utility lines or other subsurface obstructions are shown on the drawings, they have been located as accurately as practicable by the City. Such obstructions are shown for the purpose of advising the Contractor that they may interfere with the work to be done hereunder but not for the purpose of indicating that the work can be performed without such interference. Elevations of underground obstructions and lines are shown as accurately as known on the profile sheets.

g. **Backfilling:** Backfilling of the trench shall be accomplished in accordance with Section 312 and Standard Drawing W01.

h. **Flushing:** The flushing velocity shall be at least 2.5 feet per second for small mains. The table in Section 904 lists required hydrant openings to obtain required flushing velocities. The flushing velocity for larger mains shall be as specified by the design engineer.

i. **Disinfection:** All new potable water mains shall be disinfected in accordance with "Standards for Public Water Supply System" OSDEQ Bulletin 589 or most current replacement. Water with 50 to 100 parts per million of chlorine shall be allowed to stand 48 hours and develop a residual of at least 10 parts per million of chlorine. The spent solution should be drained and replaced with potable water. As an alternate, either of the methods listed in the latest American Water Works Association specifications may be used. Safe bacteriological samples shall be obtained on two consecutive days before that portion of the line may be used. Mains shall be disinfected by the addition of chlorine as a liquid, a hypochlorite solution or hypochlorite tablets. The table in Section 905 indicates the number of 5-G hypochlorite tablets required for each size pipe up to 12 inches in diameter. For larger lines, the dosage for disinfection shall be in accordance with the manufactures recommendations and the state regulations.

j. **Testing:** Testing shall be accomplished in accordance with Section 108. Testing shall be at the Contractor's expense by a testing laboratory approved by the City, except for bacterial analysis which will be at the City's expense. Tests shall be taken at locations specified by the City.

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k. **Connection to the System:** Connection to the system will not be made until after testing, flushing, and sterilization of the line, unless otherwise approved by the Engineer.

403.04 SPECIAL REQUIREMENTS:

a. **Restrained Joints:** When a water line is placed in conduit or in a creek without concrete encasement, the pipe will be installed with restrained joints to prevent separation of the pipe in these structures.

b. **Bridging of Trench:** When ordered by the City, the Contractor shall, at his own expense, construct suitable platforms to bridge the trench at street intersections, at driveways to properties abutting the line of the work and at such points as may be required to permit vehicle and/or pedestrian travel.

c. **Shop Tests:** The Contractor shall be responsible for obtaining tests of all materials as required by these specifications. The contractor shall furnish to the City, in the required number of copies, a certificate of shop tests on all pipe. These tests shall be witnessed by a reputable and established testing laboratory or firm, previously approved by the City.

d. **Dig through Locator Tape:** Dig through locator tape as specified in section 627 will be buried two (2) feet above the pipe.

403.05 METHOD OF MEASUREMENT: When this item is included as a pay item in the contract it will be measured by the linear foot, through all fittings and specials.

403.06 BASIS OF PAYMENT: Prestressed concrete pipe, measured as provided above, will be paid for by the linear foot and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. The price bid shall include all cost and expense of furnishing, hauling, laying and jointing the pipe, installing the protective materials, testing, flushing, sterilization and repairing of leaks. Excavation is paid under Section 311. Backfill and compaction are paid under either Section 312 or Section 313. This item will be paid as a separate bid item and payment will be made upon installation of the pipe. When this item is included in a contract it will be listed as follows:

BA 403 PRESTRESSED CONCRETE PIPE INSTALLATION (WATER)	LINEAR FOOT
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403.07 STANDARD DRAWINGS: W01, W06, and W07.

410 FITTINGS(05/16/94):

410.01 DESCRIPTION: The term fittings is understood to mean bends, tees, crosses, sleeves, plugs, restrained joints, and other specified fittings. This work shall consist of furnishing, hauling, placing, and joining the fittings as shown on the plans or directed by the Contract Administrator.

410.02 MATERIALS: Section 620 Water Line - PVC Pipe, Fittings, and Joints; Section 621 Water Line - Ductile Iron Pipe, Fittings, and Joints; Section 622 Water Line - Prestressed Concrete Cylinder Pipe, Fittings, and Joints; and Section 605 Polyethylene Wrap.

410.03 CONSTRUCTION METHODS: Fittings shall be installed in accordance with the manufactures recommended procedures. Construction methods for fittings shall be the same as for the type of pipe corresponding to the fittings.

410.04 SPECIAL REQUIREMENTS:

a. **Polywrapping of Fittings:** All cast or ductile iron fittings shall be polywrapped in accordance with Section 402.03b.

b. **Thrust Blocks:** All bends, tees, crosses, and plugs shall be blocked with concrete under Section 439, except when the fittings have flanged, welded, or restrained joints, the Contract Administrator may, under certain conditions, delete the blocking. Blocking shall be placed so that joints are accessible for repair.

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410.05 METHOD OF MEASUREMENT: When this item is included as a pay item in the contract it will be measured by each type of fitting.

410.06 BASIS OF PAYMENT: Fittings, measured as provided above, will be paid for by the individual fitting and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. The price bid shall include all cost and expense of furnishing, hauling, laying, jointing, installing the protective materials, testing, flushing, sterilization and repairing of leaks. Excavation is paid under Section 311. Backfill and compaction are paid under either Section 312 or Section 313. This item will be paid as a separate bid item and payment will be made upon installation of the fitting. When this item is included in a contract it will be listed as follows:

BA 410A1* BEND (Enter bend deflection, pipe size, and type material)	EACH
*(Each different bend deflection, size, and type will have a separate listing. Numbers run from BA 410A1 to BA 410A99)	
BA 410B1* TEE (Enter pipe sizes, and type material)	EACH
*(Each tee size and type will have a separate listing. Numbers run from BA 410B1 to BA 410B99)	
BA 410C1* CROSS (Enter pipe size, and type material)	EACH
*(Each cross size and type will have a separate listing. Numbers run from BA 410C1 to BA 410C99)	
BA 410D1* SLEEVES (Enter pipe size, and type material)	EACH
*(Each sleeve size, and type will have a separate listing. Numbers run from BA 410D1 to BA 410D99)	
BA 410E1* PLUGS (Enter pipe size, and type material)	EACH
*(Each plug size, and type will have a separate listing. Numbers run from BA 410E1 to BA 410E99)	
BA 410F1* RESTRAINED JOINT (Enter pipe size, and type material)	EACH
*(Each restrained joint size and type will have a separate listing. Numbers run from BA 410F1 to BA 410F99)	
BA 410G1* SPECIAL FITTING (Enter description)	EACH
*(Each special fitting will have a separate listing. Numbers run from BA 410G1 to BA 410G99)	

410.07 STANDARD DRAWINGS: W06

411 CONNECTIONS (05/16/94):

411.01 DESCRIPTION: This work shall consist of furnishing, hauling, placing, and joining the fittings and valves as shown on the plans for connection to the existing water distribution system or directed by the Contract Administrator.

411.02 MATERIALS: Section 620 Water Line - PVC Pipe, Fittings, and Joints; Section 621 Water Line - Ductile Iron Pipe, Fittings, and Joints; Section 622 Water Line - Prestressed Concrete Cylinder Pipe, Fittings, and Joints; Section 625 Water Line - Valves; and Section 605 Polyethylene Wrap.

411.03 CONSTRUCTION METHODS: Fittings shall be installed in accordance with the manufactures recommended procedures. Construction methods for connections shall be the same as for the type of fittings involved in the connection. The contractor shall furnish and install connecting pipes, valve boxes, and fittings, including blind flanges or plugs, at the locations shown on the plans.

411.04 SPECIAL REQUIREMENTS:

a. **City Installed Taps:** Due to State Regulations, the City will always make the taps on active lines in the water distribution system. These taps will be made at the contractor's expense. The City will furnish and install tapping saddle and tapping valves. The Contractor shall escrow funds for the taps. The Public Works Department will determine the escrow amount for each tap.

b. **Coordination of Connections:** The Contractor shall have all material assembled and shall coordinate his work with the City in order to interrupt service for as short a time as possible. The contractor shall, under no circumstances, operate any of the City's valves.

411.05 METHOD OF MEASUREMENT: When this item is included as a pay item in the contract it will be measured by each type of connection.

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411.06 BASIS OF PAYMENT: Connections, measured as provided above, will be paid for by the individual connection and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. The price bid shall include all cost and expense of furnishing, hauling, installing the tapping saddle, installing the tapping valve, and tapping the line. Jointing the fittings, installing the protective materials, testing, flushing, sterilization, and repairing of leaks shall be paid under Section 410. Excavation is paid under Section 311. Backfill and compaction are paid under either Section 312 or Section 313. This item will be paid as a separate bid item and payment will be made upon installation of the connection. When this item is included in a contract it will be listed as follows:

BA 411A1* CONNECTION (Enter pipe size and type material)

EACH

*(Each type connection will have a separate listing. Numbers run from BA 411A1 to BA 411A9999.)

411.07 STANDARD DRAWINGS: W06

412 WATER SERVICE LINES (05/16/94):

412.01 DESCRIPTION: This work shall consist of furnishing and installation of Type K copper water services, copper meter setters, corporation cocks, angle cocks and all fittings necessary to complete the water service at the locations shown on the plans, and in accordance with Standard Drawing W08 or as directed by the Contract Administrator.

412.02 MATERIALS: Section 623 Water Line - Copper Service Line and Fittings.

412.03 CONSTRUCTION METHODS: Construction shall be in accordance with Standard Drawing W08 and Sections 311, 312, 313, 314, and 315. Individual service lines shall not be less than 3/4 inch in diameter. Water meters will be installed under Section 431 and meter boxes will be installed under Section 432. Corporation cocks shall be rotated 45 degrees from vertical as shown. Service line trenches shall be backfilled with fill sand to the level indicated and thoroughly compacted to 95% Standard Density within 2% of optimum moisture.

412.04 SPECIAL REQUIREMENTS: All service lines shall be installed prior to testing. However, service lines will not be connected to meters until the line has passed the test requirements.

412.05 METHOD OF MEASUREMENT: When this item is included as a pay item in the contract it will be measured by each type of service line.

412.06 BASIS OF PAYMENT: Water service lines, measured as provided above, will be paid for by the individual service line and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. The price bid shall include all cost and expense of furnishing and installing Type K copper service lines, corporation cocks, curb stops, angle cocks, copper meter setters, any other fittings required to complete the installation, installing the protective materials, testing, flushing, sterilization and repairing of leaks. Excavation is paid under Section 311. Backfill and compaction are paid under either Section 312 or Section 313. This item will be paid as a separate bid item and payment will be made upon installation of the service line. When this item is included in a contract it will be listed as follows:

BA 412A SERVICE LINE 3/4 INCH

EACH

BA 412B SERVICE LINE 1 INCH

EACH

BA 412C SERVICE LINE 1 1/2 INCH

EACH

BA 412D SERVICE LINE 2 INCH

EACH

412.07 STANDARD DRAWINGS: W08

413 SERVICE LINE TAPS (05/16/94):

413.01 DESCRIPTION: This work shall consist of furnishing and installing service line taps and all other items necessary to complete the tap at the locations shown on the plans or as directed by the Contract Administrator.

413.02 MATERIALS: Section 624 Water Line - Taps and Section 605 Polyethylene Wrap.

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413.03 CONSTRUCTION METHODS: Taps shall be installed in accordance with the manufactures recommended procedures. Construction methods for taps shall be the same as for the type of pipe being tapped.

413.04 SPECIAL REQUIREMENTS:

- a. **Tapping Saddles:** Tapping saddles shall be used for all taps unless otherwise specified.
- b. **Contractor Taps:** The contractor shall tap only new lines not yet in service. Tapping lines in service shall be accomplished only by City personnel.
- c. **Tap Protection:** All taps shall be polywrapped in accordance with Section 402.03b.
- d. **Pressure Testing:** All taps and service lines shall be in place prior to final pressure testing of the new line. The new line may be tested without taps if the contractor desires to do so.

413.05 METHOD OF MEASUREMENT: When this item is included as a pay item in the contract it will be measured by each service line tap, by type.

413.06 BASIS OF PAYMENT: Service line taps, measured as provided above, will be paid for by the individual tap and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. The price bid shall include all cost and expense of furnishing, hauling, installing, installing the protective materials, testing, flushing, sterilization and repairing of leaks. Excavation is paid under Section 311. Backfill and compaction are paid under either Section 312 or Section 313. This item will be paid as a separate bid item and payment will be made upon installation of the tap. When this item is included in a contract it will be listed as follows:

BA 413A1* SERVICE LINE TAPS (Enter description of tap) EACH
*(Each different tap will have a separate listing. Numbers run from BA 413A1 to BA 413A99)

413.07 STANDARD DRAWINGS: W10, W11, W12, W13, W14, W15, W16

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420 VALVES (05/16/94):

420.01 DESCRIPTION: This work shall consist of furnishing and installing valves and all other items necessary to complete the valve installation at the locations shown on the plans or as directed by the Contract Administrator.

420.02 MATERIALS: Section 625 Water Line - Valves and Section 605 Polyethylene Wrap.

420.03 CONSTRUCTION METHODS:

a. **Installation Requirements:** The AWWA Standard for the Installation of Cast Iron Water Main, AWWA Designation C600 shall govern the installation, as applicable. If the paint is damaged the valve shall be cleaned by wire-brushing and given two (2) coats.

b. **Stem Orientation:** Gate valves shall be set with the stems plumb. Ball valves shall be set with the handwheels horizontal. Air relief valves shall be set so that the square operating nut on the two (2) inch valve can be operated from the top. Check valves shall be horizontally. All others shall be coordinated with the Contract Administrator.

c. **Excavation and Backfill:** Shall be as set forth for the type of pipe being used on the project.

420.04 SPECIAL REQUIREMENTS:

a. **Valve Protection:** All buried valves shall be polywrapped in accordance with Section 402.03b.

b. **Valve Boxes:** All valves shall have valve boxes installed in accordance with Section 430.

420.05 METHOD OF MEASUREMENT: When this item is included as a pay item in the contract it will be measured by each valve, by type.

420.06 BASIS OF PAYMENT: Valves, measured as provided above, will be paid for by the individual valve and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. The price bid shall include all cost and expense of furnishing, hauling, installing, installing the protective materials, testing, flushing, sterilization and repairing of leaks. Excavation is paid under Section 311. Backfill and compaction are paid under either Section 312 or Section 313. Valve box is paid under Section 430. This item will be paid as a separate bid item and payment will be made upon installation of the valve. When this item is included in a contract it will be listed as follows:

BA 420A1* VALVE (Enter description of the valve)

EACH

*(Each different valve will have a separate listing. Numbers run from BA 420A1 to BA 420A99)

420.07 STANDARD DRAWINGS: N/A

421 OUTLET ASSEMBLIES (05/16/94):

421.01 DESCRIPTION: The term outlet assembly is understood to mean a stub line for future service from a twelve (12) inch or larger distribution main. The outlet assembly shall consist of a flanged stub constructed into a prestressed concrete line or a MJ X MJ X flanged tee in a ductile iron or PVC line, a flanged by MJ valve, and an MJ plug bolted to the valve. A valve box will be supplied under Section 430. This work shall consist of furnishing and installing outlet assemblies and all other items necessary to complete the outlet assembly installation at the locations shown on the plans or as directed by the Contract Administrator.

421.02 MATERIALS: Section 605 Polyethylene Wrap; Section 620 Water Line - PVC Pipe, Fittings, and Joints; Section 621 Water Line - Ductile Iron Pipe, Fittings, and Joints; Section 622 Water Line - Prestressed Concrete Cylinder Pipe, Fittings, and Joints; Section 623 Water Line - Copper Service Line and Fittings; and Section 625 Water Line - Valves.

421.03 CONSTRUCTION METHODS: Construction methods for outlet assemblies shall be the same as specified for the type of pipe, fittings, and valves included in the assembly.

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421.04 SPECIAL REQUIREMENTS:

- a. **Outlet Assembly Protection:** All outlet assemblies shall be polywrapped in accordance with Section 402.03b.
- b. **Valve Position:** Outlet assemblies shall be tested with the valves in the open position. Upon completion of the testing, all outlet assembly valves shall be closed.

421.05 METHOD OF MEASUREMENT: When this item is included as a pay item in the contract it will be measured by each outlet assembly, by type.

421.06 BASIS OF PAYMENT: Outlet assemblies, measured as provided above, will be paid for by the individual assembly and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. The price bid shall include all cost and expense of furnishing, hauling, installing, installing the protective materials, testing, flushing, sterilization and repairing of leaks. Excavation is paid under Section 311. Backfill and compaction are paid under either Section 312 or Section 313. This item will be paid as a separate bid item and payment will be made upon installation of the outlet assembly. When this item is included in a contract it will be listed as follows:

BA 421A1* OUTLET ASSEMBLY (Enter description) EACH
*(Each different outlet assembly will have a separate listing. Numbers run from BA 421A1 to BA 421A99)

421.07 STANDARD DRAWINGS: N/A

422 AIR AND/OR VACUUM VALVE ASSEMBLIES (05/16/94):

422.01 DESCRIPTION: It is understood that an air and/or vacuum valve assembly shall consist of the vault with lid, tap or outlet assembly, piping and bends, gate valve, air and/or vacuum valve, and all associated items required to complete the installation. This work shall consist of furnishing and installing air and/or vacuum valve assemblies, as shown on Standard Drawing W02, and all other items necessary to complete the air and/or vacuum valve assembly installation at the locations shown on the plans or as directed by the Contract Administrator.

422.02 MATERIALS: Section 601 - Concrete; Section 602 - Pipe Bedding; Section 603 - Select Backfill; Section 605 Polyethylene Wrap; Section 620 Water Line - PVC Pipe, Fittings, and Joints; Section 621 Water Line - Ductile Iron Pipe, Fittings, and Joints; Section 622 Water Line - Prestressed Concrete Cylinder Pipe, Fittings, and Joints; Section 623 Water Line - Copper Service Line and Fittings; Section 624 Water Line - Taps; and Section 625 - Water Line Valves.

422.03 CONSTRUCTION METHODS:

- a. **Excavation:** Shall be accomplished in accordance with Section 311 Excavation.
- b. **Backfill:** Shall be accomplished in accordance with Section 312 Common Backfill and Compaction and/or Section 313 Select Backfill and Compaction.
- c. **Concrete Work:** Shall be accomplished in accordance with Section 330 Concrete Placement.
- d. **Tap or Outlet:** Taps shall be accomplished in accordance with Section 413 Service Line Taps for twelve (12) inch and smaller lines. For lines larger than twelve (12) inches outlets shall be accomplished in accordance with Section 421 Outlet Assemblies.
- e. **Assembly:** Shall be accomplished in accordance with the section that applies to the pipe being used and according to the manufactures recommendations.
- f. **Vault Construction:** Shall be accomplished in accordance with Section 433 Meter or Valve Vaults.

422.04 SPECIAL REQUIREMENTS:

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- a. **Vertical Position:** The top of the vault shall be placed at ground level.
- b. **Testing:** All air and/or vacuum valves shall be in place prior to testing. Valve operation shall be checked during filling and draining of the line.

422.05 METHOD OF MEASUREMENT: When this item is included as a pay item in the contract it will be measured by each air and/or vacuum valve assembly, by type.

422.06 BASIS OF PAYMENT: Air and/or vacuum valve assemblies, measured as provided above, will be paid for by the individual assembly and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. The price bid shall include all cost and expense of furnishing, hauling, installing, installing the protective materials, testing, flushing, sterilization and repairing of leaks. Excavation is paid under Section 311. Backfill and compaction are paid under either Section 312 or Section 313. This item will be paid as a separate bid item and payment will be made upon installation of the air and/or vacuum valve assembly. When this item is included in a contract it will be listed as follows:

BA 422A1* AIR AND/OR VACUUM VALVE ASSEMBLY (Enter description) EACH
*(Each different air and/or vacuum valve assembly will have a separate listing. Numbers run from BA 422A1 to BA 422A99)

422.07 STANDARD DRAWINGS: W02

423 FIRE HYDRANT ASSEMBLY (05/16/94):

423.01 DESCRIPTION: It is understood that a fire hydrant assembly shall consist of the flanged tee, piping and bends, gate valve, valve box, fire hydrant, thrust block, and all associated items required to complete the installation. This work shall consist of furnishing and installing fire hydrant assemblies, as shown on Standard Drawing W09, and all other items necessary to complete the fire hydrant assembly installation at the locations shown on the plans or as directed by the Contract Administrator.

423.02 MATERIALS: Section 620 Water Line - PVC Pipe, Fittings, and Joints; Section 621 Water Line - Ductile Iron Pipe, Fittings, and Joints; Section 622 Water Line - Prestressed Concrete Cylinder Pipe, Fittings, and Joints; Section 625 - Water Line Valves; and Section 626 Fire Hydrants and Extensions.

423.03 CONSTRUCTION METHODS:

- a. **Excavation:** Shall be accomplished in accordance with Section 311 Excavation.
- b. **Backfill:** Shall be accomplished in accordance with Section 312 Common Backfill and Compaction and/or Section 313 Select Backfill and Compaction.
- c. **Concrete Work:** Shall be accomplished in accordance with Section 330 Concrete Placement.
- d. **Outlet Installation:** Shall be accomplished in accordance with Section 421 Outlet Assemblies.
- e. **Assembly:** Shall be accomplished in accordance with the section that applies to the pipe being used and according to the manufactures recommendations.
- f. **Valve Box Installation:** Shall be accomplished in accordance with Section 430 Valve Boxes.

423.04 SPECIAL REQUIREMENTS:

- a. **Valve Protection:** All valves shall be polywrapped in accordance with Section 402.03b.
- b. **Testing:** All fire hydrants shall be in place prior to testing. Valves shall be open during testing. Prior to acceptance all fire hydrants shall be flow tested.

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423.05 METHOD OF MEASUREMENT: When this item is included as a pay item in the contract it will be measured by the fire hydrant assembly.

423.06 BASIS OF PAYMENT: Fire Hydrant assemblies, measured as provided above, will be paid for by the individual assembly and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. The price bid shall include all cost and expense of furnishing, hauling, installing, installing the protective materials, testing, flushing, sterilization and repairing of leaks. Excavation is paid under Section 311. Backfill and compaction are paid under either Section 312 or Section 313. This item will be paid as a separate bid item and payment will be made upon installation of the fire hydrant. When this item is included in a contract it will be listed as follows:

BA 423A FIRE HYDRANT ASSEMBLY

EACH

423.07 STANDARD DRAWINGS: W09

430 VALVE BOXES (08/19/99):

430.01 DESCRIPTION: This work shall consist of furnishing and installing valves boxes, as shown on Standard Drawing W04 and all other items necessary to complete the valve box installation at the locations shown on the plans or as directed by the Contract Administrator.

430.02 MATERIALS: Section 606 Valve Boxes, Vaults, Pits, and Manholes

430.03 CONSTRUCTION METHODS:

- a. **Excavation:** Shall be accomplished in accordance with Section 311 Excavation.
- b. **Backfill:** Shall be accomplished in accordance with Section 312 Common Backfill and Compaction and/or Section 313 Select Backfill and Compaction.
- c. **Assembly:** Shall be accomplished in accordance with the manufactures recommendations. Based on the depth of the line one of the following configurations shall be used for valve boxes:
 1. **Type 1 Valve Box:** This type of valve box consisting of a top and bottom shall be used when the depth from top of valve to ground level is 26 inches or less. This will allow for 6 inches adjustment up or down.
 2. **Type 2 Valve Box:** This type of valve box consisting of a top, bottom, and one 17 inch extension shall be used when the depth from top of valve to ground level is 43 inches or less. This will allow for 6 inches adjustment up or down.
 3. **Type 2 Valve Box with PVC Extension:** This type of valve box consisting of a top, bottom, one 17 inch extension, and a 6 inch PVC pipe (C-900 DR18) extension of required length shall be used when the depth from top of valve to ground level is over 43 inches. The PVC extension will be cut to allow for 6 inches adjustment up or down.
- d. **Alignment:** Valve boxes shall be set in such a manner to ensure that the box is vertical and the operating nut is fully accessible with a valve wrench.
- e. **Elevation:** The top of the valve box shall be level with the finished elevation.
- f. **Concrete Collar:** The contractor shall place a two (2) foot by two (2) foot by four (4) inch thick concrete collar around all valve boxes not in the street surface. The contractor shall place a two (2) foot by two (2) foot by six (6) inch thick concrete collar around all valve boxes in residential asphalt streets. In other asphalt streets the thickness of the collar shall be equivalent to the street thickness.

430.04 SPECIAL REQUIREMENTS: The Utilities Inspector shall verify alignment on each valve box.

430.05 METHOD OF MEASUREMENT: When this item is included as a pay item in the contract it will be measured by each type valve box and the linear feet of 6 inch PVC extension.

430.06 BASIS OF PAYMENT: Valve boxes, measured as provided above, will be paid for by the individual valve

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box with and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. The price bid shall include all cost and expense of furnishing, hauling, installing, installing the protective materials, testing and repairing of problems. Excavation is paid under Section 311. Backfill and compaction are paid under either Section 312 or Section 313. This item will be paid as a separate bid item and payment will be made upon installation of the valve box. When this item is included in a contract it will be listed as follows:

BA 430A TYPE 1 VALVE BOX	EACH
BA 430B TYPE 2 VALVE BOX	EACH
BA 430C VALVE BOX EXTENSION 6 INCH PVC	LINEAR FOOT

430.07 STANDARD DRAWINGS: W04

431 WATER METERS (05/16/94):

431.01 DESCRIPTION: This work shall consist of furnishing and installing water meters and all other items necessary to complete the water meter installation, as shown on Standard Drawings W11 to W16, at the locations shown on the plans or as directed by the Contract Administrator.

431.02 MATERIALS: Section 628 Water Meters

431.03 CONSTRUCTION METHODS: Installation shall be in accordance with the manufacture's recommended procedures and the appropriate Standard Drawing.

431.04 SPECIAL REQUIREMENTS:

a. **Installation:** Only contractors with certified personnel will be allowed to install water meters. Installation by contractors will be only on replacement lines that are not in service. City personnel will install required meters on new lines and lines that are in service.

b. **Testing:** All water meters shall be in place prior to testing. Valves shall be open during testing. Prior to acceptance all water meters shall be flow tested.

431.05 METHOD OF MEASUREMENT: When this item is included as a pay item in the contract it will be measured by each water meter, by type.

431.06 BASIS OF PAYMENT: Water meters, measured as provided above, will be paid for by the individual water meter with and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. The price bid shall include all cost and expense of furnishing, hauling, installing, installing the protective materials, testing, flushing, sterilization and repairing of leaks. This item will be paid as a separate bid item and payment will be made upon installation of the water meter. When this item is included in a contract it will be listed as follows:

BA 431A1* WATER METER (Enter meter type)	EACH
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*(Each different meter will have a separate listing. Numbers run from BA 431A1 to BA 431A99)

431.07 STANDARD DRAWINGS: W11, W12, W13, W14, W15, and W16

432 WATER METER BOXES (05/16/94):

432.01 DESCRIPTION: This work shall consist of furnishing and installing meter boxes, as shown on Standard Drawing W11, and all other items necessary to complete the meter box installation at the locations shown on the plans or as directed by the Contract Administrator.

432.02 MATERIALS: Section 629 Water Meter Boxes

432.03 CONSTRUCTION METHODS:

a. **Excavation:** Shall be accomplished in accordance with Section 311 Excavation.

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b. **Backfill:** Shall be accomplished in accordance with Section 312 Common Backfill and Compaction and/or Section 313 Select Backfill and Compaction.

c. **Installation:** Shall be in accordance with the manufacture's recommended procedures and Standard Drawing W11.

432.04 SPECIAL REQUIREMENTS: Meter boxes shall be set with the top of the box level with the finished grade.

432.05 METHOD OF MEASUREMENT: When this item is included as a pay item in the contract it will be measured by each meter box.

432.06 BASIS OF PAYMENT: Water meter boxes, measured as provided above, will be paid for by the individual water meter box with and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. The price bid shall include all cost and expense of furnishing, hauling, installing, installing the protective materials, testing, flushing, sterilization and repairing of leaks. Excavation is paid under Section 311. Backfill and compaction are paid under either Section 312 or Section 313. This item will be paid as a separate bid item and payment will be made upon installation of the water meter box. When this item is included in a contract it will be listed as follows:

BA 432 WATER METER BOX

EACH

432.07 STANDARD DRAWINGS: W11

433 METER OR VALVE VAULT (08/19/99):

433.01 DESCRIPTION: This work shall consist of furnishing, hauling, placing and installing all materials and other items necessary for construction of meter or valve vaults, as shown on Standard Drawing W17, at the locations shown on the plans or as directed by the Contract Administrator.

433.02 MATERIALS: Section 630 Metal Castings

433.03 CONSTRUCTION METHODS:

a. **Excavation:** Shall be accomplished in accordance with Section 311 Excavation.

b. **Backfill:** Shall be accomplished in accordance with Section 312 Common Backfill and Compaction and/or Section 313 Select Backfill and Compaction.

c. **Concrete Work:** Shall be accomplished in accordance with Section 330 Concrete Placement.

d. **Precast Manhole Sections:** If used these items shall be set in accordance with Section 512.

e. **Culvert Pipe (Concrete, Galvanized Steel, HDPE):** With prior approval these items, in appropriate diameters, may be used as meter vaults. When these materials are used, they will have a concrete bottom and top corresponding to standard drawing W17.

f. **Manhole Ring and Lid Installation:** Shall be in accordance with the manufacture's recommended procedures.

433.04 SPECIAL REQUIREMENTS: Vault top shall be at the same elevation as the finish grade.

433.05 METHOD OF MEASUREMENT: When this item is included as a pay item in the contract it will be measured by each type of meter or valve vault.

433.06 BASIS OF PAYMENT: Meter or valve vaults, measured as provided above, will be paid for by the individual vault and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. The price bid shall include all cost and expense of furnishing, hauling, installing, installing the protective materials, testing, and repairing. Excavation is paid under Section 311. Backfill and compaction are paid under either Section 312 or Section 313. This item will be paid as a separate bid item and payment will be made

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upon installation of the meter or valve vault. When this item is included in a contract it will be listed as follows:

BA 433A1* METER OR VALVE VAULT (Enter type)

EACH

*(Each different vault will have a separate listing. Numbers run from BA 433A1 to BA 433A99)

433.07 STANDARD DRAWINGS: W17

434 SAMPLE POINTS (05/16/94):

434.01 DESCRIPTION: It is understood that a sample point shall consist of a tap, copper tubing, gate valves, fittings, and other items necessary to complete the sample point installation. This work shall consist of furnishing, installing, and removing sample points at the locations shown on the plans or as directed by the Contract Administrator.

434.02 MATERIALS: Section 623 Water Line - Copper Service Line and Fittings; Section 624 Water Line - Taps; and Section 625 - Water Line Valves.

434.03 CONSTRUCTION METHODS:

- a. **Excavation:** Shall be accomplished in accordance with Section 311 Excavation.
- b. **Backfill:** Shall be accomplished in accordance with Section 312 Common Backfill and Compaction and/or Section 313 Select Backfill and Compaction.
- c. **Installation:** Shall be in accordance with the manufacture's recommended procedures. Sample points shall be a minimum of 3/4 inch size and shall be constructed of type K copper. They shall extend at minimum 2 feet above the ground and be equipped with 2 gate valves separated by a 3 inch long nipple. The contractor shall use crossings, where available, as sample points.
- d. **Removal:** Shall be accomplished upon completion of testing. The contractor shall remove the sample point back to the main line or to the end of the crossing if used. When the sample point is removed back to the main line, the tapping saddle and corp stop shall be fully enclosed in polywrap in accordance with Section 402.03b.

434.04 SPECIAL REQUIREMENTS: A minimum of two (2) sample points shall be placed on any new line up to 3,000 feet in length. One (1) additional sample point will be for each additional 2,000 feet of water line or any part thereof.

434.05 METHOD OF MEASUREMENT: When this item is included as a pay item in the contract it will be measured as a lump sum for all required sample points.

434.06 BASIS OF PAYMENT: Sample points, measured as provided above, will be paid for by the lump sum and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. The price bid shall include all cost and expense of furnishing, hauling, installing, installing the protective materials, testing, and repairing. Excavation is paid under Section 311. Backfill and compaction are paid under either Section 312 or Section 313. This item will be paid as a separate bid item and payment will be made upon removal of the sample points. When this item is included in a contract it will be listed as follows:

BA 434 SAMPLE POINTS

LUMP SUM

434.07 STANDARD DRAWINGS: N/A

435 BLOW OFF ASSEMBLY (05/16/94):

435.01 DESCRIPTION: It is understood that a blow off assembly shall consist of the outlet assembly, piping and bends, gate valve, valve box, thrust block, splash block, and all associated items required to complete the installation. This work shall consist of furnishing and installing blow off assemblies, as shown on Standard Drawing W18, and all other items necessary to complete the blow off assembly installation at the locations shown on the plans or as directed by the Contract Administrator.

435.02 MATERIALS: Section 620 Water Line - PVC Pipe, Fittings, and Joints; Section 621 Water Line - Ductile

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Iron Pipe, Fittings, and Joints; Section 622 Water Line - Prestressed Concrete Cylinder Pipe, Fittings, and Joints; and Section 625 - Water Line Valves.

435.03 CONSTRUCTION METHODS:

- a. **Excavation:** Shall be accomplished in accordance with Section 311 Excavation.
- b. **Backfill:** Shall be accomplished in accordance with Section 312 Common Backfill and Compaction and/or Section 313 Select Backfill and Compaction.
- c. **Concrete Work:** Shall be accomplished in accordance with Section 330 Concrete Placement.
- d. **Outlet Installation:** Shall be accomplished in accordance with Section 421 Outlet Assemblies.
- e. **Assembly:** Shall be accomplished in accordance with the section that applies to the pipe being used and according to the manufactures recommendations.
- f. **Valve Box Installation:** Shall be accomplished in accordance with Section 430 Valve Boxes.

435.04 SPECIAL REQUIREMENTS:

- a. **Valve Protection:** All valves shall be polywrapped in accordance with Section 402.03b.
- b. **Testing:** All blow offs shall be in place prior to testing. Prior to acceptance all blow offs shall be flow tested.

435.05 METHOD OF MEASUREMENT: When this item is included as a pay item in the contract it will be measured by the blow off assembly.

435.06 BASIS OF PAYMENT: Blow off assemblies, measured as provided above, will be paid for by the individual assembly and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. The price bid shall include all cost and expense of furnishing, hauling, installing, installing the protective materials, testing, flushing, sterilization and repairing of leaks. Excavation is paid under Section 311. Backfill and compaction are paid under either Section 312 or Section 313. This item will be paid as a separate bid item and payment will be made upon installation of the blow off. When this item is included in a contract it will be listed as follows:

BA 435 BLOW OFF ASSEMBLY

EACH

435.07 STANDARD DRAWINGS: W18

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436 CONCRETE ENCASEMENT (05/16/94):

- 436.01 DESCRIPTION: See Section 330.
- 436.02 MATERIALS: See Section 330.
- 436.03 CONSTRUCTION METHODS: See Section 330.
- 436.04 SPECIAL REQUIREMENTS: See Section 330.
- 436.05 METHOD OF MEASUREMENT: See Section 330.
- 436.06 BASIS OF PAYMENT: See Section 330.

BA 436 CONCRETE ENCASEMENT

CY

- 436.07 STANDARD DRAWINGS: W07

437 CONCRETE SLAB PROTECTION FOR PIPELINES (05/16/94):

- 437.01 DESCRIPTION: See Section 330.
- 437.02 MATERIALS: See Section 330.
- 437.03 CONSTRUCTION METHODS: See Section 330.
- 437.04 SPECIAL REQUIREMENTS: See Section 330.
- 437.05 METHOD OF MEASUREMENT: See Section 330.
- 437.06 BASIS OF PAYMENT: See Section 330.

BA 437 CONCRETE SLAB PROTECTION FOR PIPELINES

CY

- 437.07 STANDARD DRAWINGS: N/A

438 CONCRETE CRADLE (05/16/94):

- 438.01 DESCRIPTION: See Section 330.
- 438.02 MATERIALS: See Section 330.
- 438.03 CONSTRUCTION METHODS: See Section 330.
- 438.04 SPECIAL REQUIREMENTS: See Section 330.
- 438.05 METHOD OF MEASUREMENT: See Section 330.
- 438.06 BASIS OF PAYMENT: See Section 330.

BA 438 CONCRETE CRADLE

CY

- 438.07 STANDARD DRAWINGS: W07

439 CONCRETE THRUST BLOCKS (05/16/94):

- 439.01 DESCRIPTION: See Section 330.
- 439.02 MATERIALS: See Section 330.
- 439.03 CONSTRUCTION METHODS: See Section 330.
- 439.04 SPECIAL REQUIREMENTS: See Section 330.
- 439.05 METHOD OF MEASUREMENT: See Section 330.
- 439.06 BASIS OF PAYMENT: See Section 330.

BA 439 CONCRETE THRUST BLOCKS

CY

- 439.07 STANDARD DRAWINGS: W06

440 REINFORCED CONCRETE PIERS (05/16/94):

- 440.01 DESCRIPTION: See Section 330.
- 440.02 MATERIALS: See Section 330.
- 440.03 CONSTRUCTION METHODS: See Section 330.
- 440.04 SPECIAL REQUIREMENTS: See Section 330.
- 440.05 METHOD OF MEASUREMENT: See Section 330.
- 440.06 BASIS OF PAYMENT: See Section 330.

BA 440 REINFORCED CONCRETE PIERS

CY

- 440.07 STANDARD DRAWINGS: N/A

SECTION 500 - SANITARY SEWER

501 PVC GRAVITY SEWER INSTALLATION (08/19/99):

501.01 DESCRIPTION: This work shall consist of furnishing, hauling, placing, jointing, and testing the pipe and connecting the new line to the existing system, if the connection is into an existing manhole, as shown on the plans or directed by the Contract Administrator.

501.02 MATERIALS:

- a. **Pipe Materials:** Section 650 Sanitary Sewer - PVC Pipe, Fittings, and Joints
- b. **Bedding and Backfill Material Requirements for PCV Pipe:** See Standard Drawing SS01 and Section 602.

501.03 CONSTRUCTION METHODS:

a. **Protection of Work:** During the progress of the work, the Contractor shall provide suitable barricades, fencing, signs, lighting, platforms, and/or scaffolding to protect the work during construction, to prevent damage to such work, and to protect the public from the work. At the close of each day's work, the open end of the pipelines shall be closed by suitable cover or plug, and shall not be reopened until the work recommences (This requirement does not apply if the sewer is a replacement that is being worked in a wet trench.). Any obstructions which may occur in the line after being laid shall be removed by the Contractor at his own expense to the satisfaction of the Contract Administrator. The pipeline must be delivered free from dirt or other foreign matter.

b. **Laying of Pipe:** Pipe shall be laid true to the lines and grades shown on the plans and given in the field. Procedures for laying and joining the pipe will be in accordance with the manufactures recommendations. Each pipe shall be carefully laid to the line and grade given in the field with bells upstream, and the ends of adjoining pipes shall butt against each other in such manner that there will be no shoulder or unevenness of any kind. Special care shall be taken that the invert of the pipe shall be a smooth continuous surface. At each bell, a hole shall be excavated of a size to give ample working room for proper make-up of the joint. Unless expressly ordered by the Contract Administrator, each pipe shall be brought to the required grade as established from grade lines. The Contractor shall, at his own expense, furnish all tools, materials, and labor, and shall construct cross-frames or horses at such intervals as the Contract Administrator may order in the field. The Contractor shall furnish all other implements necessary to determine the proper setting of the pipes.

c. **Establishing Grade:** The grade line shown on the plans is the elevation of the invert or flow line of the pipeline. The grade line shall be established in the trench by one of the following methods:

- 1) Use of batter boards set at grade stakes not farther than fifty feet (50'). Not less than three (3) batter boards shall be maintained in correct position while pipe is being placed.
- 2) Use of level and philly rod with grade stakes not farther than 300 feet apart. When this method is used the invert elevation of each section shall be verified before the next section is placed.
- 3) Use of level and philly rod with grade stakes not farther than 300 feet apart to set a laser for establishing the grade line in the trench. When this method is used, the invert elevation of shall be verified once between each manhole at approximately the center point and when the laser is moved.

d. **Jointing the Pipe:** Pipe shall assemble with bell and spigot joints having rubber gaskets which compress to form a water tight seal. Joints shall be assembled by bar and block, coupling pulleys or by backhoe. If the backhoe bucket is used to assembly the joint, a block of wood shall be placed between the end of the pipe and the bucket and care shall be taken to prevent damage to the pipe.

e. **Service Lines:** House services and/or taps for house services, if required, shall be installed, in accordance with the appropriate sections of these specifications, before the pipeline is tested.

f. **Interferences:** All known underground lines are shown on the plans. This does not necessarily mean that all such lines that may be encountered are shown. Where existing utility lines or other subsurface obstructions are shown on the drawings, they have been located as accurately as practicable by the City. Such obstructions are shown for the purpose of

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advising the Contractor that they may interfere with the work to be done hereunder but not for the purpose of indicating that the work can be performed without such interference. Elevations of underground obstructions and lines are shown as accurately as known on the profile sheets.

g. **Backfilling:** Backfilling of the trench shall be accomplished in accordance with Section 312 and Standard Drawing SS01. Dig through locator tape as specified in section 657 shall be buried two(2) feet above the line.

h. **Flushing:** The flushing velocity shall be at least 2.5 feet per second for small mains. The table in Section 904 lists required hydrant openings to obtain required flushing velocities. The flushing velocity for larger lines shall be as specified by the design engineer. Flushing is not required on replacement lines constructed wet.

i. **Testing:** Testing shall be accomplished in accordance with Section 108. Testing shall be at the Contractor's expense, and if required by a testing laboratory approved by the City. Tests shall be as specified in Section 108 and as directed by the Utilities Inspector.

j. **Connection to the System:** When the line is tied into the existing sanitary sewer, the contractor shall take special care in breaking into the existing manhole to ensure the minimum size hole necessary to accomplish the connection is cut. If the connection is into an existing manhole, the connection shall utilize the connection detail as shown in Standard Drawing SS06. If the connection is made using a new manhole the contractor shall accomplish the connection in accordance with Section 512 Manholes. Special care shall be taken to cut the existing line and not break the line.

k. **Aerial Crossings and Crossings with less than four (4) feet of Cover:** These crossings shall consist of 3/16ths of an inch thick smooth wall steel casing, welded to form a one piece crossing, on concrete piers with bolted steel straps. The crossing shall be conducted in accordance with standard drawing SS14. The concrete shall be 3,500psi and sonitube forms may be used. The crossing will be included in the price per foot for pipe installation unless otherwise stated.

501.04 SPECIAL REQUIREMENTS:

a. **Inspection of Trench:** The Contractor shall notify the Utility Inspectors, Public Works Department, prior to excavating any trench. The trench shall be approved by the inspector prior to installation of any pipe.

b. **Bridging of Trench:** When ordered by the City, the Contractor shall, at his own expense, construct suitable platforms to bridge the trench at street intersections, at driveways to properties abutting the line of the work and at such points as may be required to permit vehicle and/or pedestrian travel.

c. **Shop Tests:** The Contractor shall be responsible for obtaining tests of all materials as required by these specifications. The contractor shall furnish to the City, in the required number of copies, a certificate of shop tests on all pipe. These tests shall be witnessed by a reputable and established testing laboratory or firm, previously approved by the City.

d. **Location of Taps:**

1. **New Installations:** The contractor shall locate the top of taps in new locations by measuring from the center of the cap to the center of the nearest manhole. This measurement Will be verified by the Utilities Inspector and entered, by the contractor, on the as-built drawings in the following manner "Tap for Lot 1, Block 1, 99.9 feet from Manhole #8".

2. **Replacement Sewer lines:** The contractor shall locate the taps in replacement lines by measuring from the center of the tap to the center of the nearest manhole. This measurement Will be verified by the Utilities Inspector and entered on the as-built drawings in the following manner "Tap for Lot 1, Block 1, 99.9 feet from Manhole #8".

501.05 METHOD OF MEASUREMENT: When this item is included as a pay item in the contract it will be measured by the linear foot, through all taps and fittings. This measurement will be made by the Utility Inspector and the contractor down the centerline of the pipeline.

501.06 BASIS OF PAYMENT: PVC pipe, measured as provided above, will be paid for by the linear foot and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. The price bid shall include all cost and expense of furnishing, hauling, laying and jointing the pipe, installing the protective materials, testing, flushing, and repairing of leaks. Excavation is paid under Section 311.

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Backfill and compaction are paid under either Section 312 or Section 313. Taps are paid under Section 514 or 515. This item will be paid as a separate bid item and payment will be made upon installation of the pipe. When this item is included in a contract it will be listed as follows:

BA 501 PVC PIPE INSTALLATION (SANITARY SEWER)

LINEAR FOOT

501.07 STANDARD DRAWINGS: SS01, SS06, SS12

502 PVC FORCE MAIN INSTALLATION (08/19/99):

502.01 DESCRIPTION: This work shall consist of furnishing, hauling, placing, jointing, and testing the pipe and connecting the new line to the existing system, if the connection is into an existing manhole, as shown on the plans or directed by the Contract Administrator.

502.02 MATERIALS:

a. **Pipe Materials:** Section 650 Sanitary Sewer - PVC Pipe, Fittings, and Joints

b. **Bedding and Backfill Material Requirements for PCV Pipe:** See Standard Drawing SS01 and Section 602.

502.03 CONSTRUCTION METHODS:

a. **Protection of Work:** During the progress of the work, the Contractor shall provide suitable barricades, fencing, signs, lighting, platforms, and/or scaffolding to protect the work during construction, to prevent damage to such work, and to protect the public from the work. At the close of each day's work, the open end of the pipelines shall be closed by suitable cover or plug, and shall not be reopened until the work recommences. Any obstructions which may occur in the line after being laid shall be removed by the Contractor at his own expense to the satisfaction of the Contract Administrator. The pipeline must be delivered free from dirt or other foreign matter.

b. **Laying of Pipe:** Pipe shall be laid true to the lines and grades shown on the plans and given in the field. Procedures for laying and joining the pipe will be in accordance with the manufactures recommendations. Each pipe shall be carefully laid to the line and grade given in the field with bells upstream, and the ends of adjoining pipes shall butt against each other in such manner that there will be no shoulder or unevenness of any kind. Special care shall be taken that the invert of the pipe shall be a smooth continuous surface. At each bell, a hole shall be excavated of a size to give ample working room for proper make-up of the joint. Unless expressly ordered by the Contract Administrator, each pipe shall be brought to the required grade as established from grade lines. The Contractor shall, at his own expense, furnish all tools, materials, and labor, and shall construct cross-frames or horses at such intervals as the Contract Administrator may order in the field. The Contractor shall furnish all other implements necessary to determine the proper setting of the pipes.

c. **Establishing Grade:** The grade line shown on the plans is the elevation of the invert or flow line of the pipeline. This section shall not apply when the plans only require a minimum of four (4) feet of cover and do not set an exact grade for the force main. The contractor shall verify the requirement for exact grade with the design engineer prior to starting construction. The grade line shall be established in the trench by one of the following methods:

1) Use of batter boards set at grade stakes not farther than fifty feet (50'). Not less than three (3) batter boards shall be maintained in correct position while pipe is being placed.

2) Use of level and philly rod with grade stakes not farther than 300 feet apart. When this method is used the invert elevation of each section shall be verified before the next section is placed.

3) Use of level and philly rod with grade stakes not farther than 300 feet apart to set a laser for establishing the grade line in the trench. When this method is used, the invert elevation of shall be verified once between each manhole at approximately the center point and when the laser is moved.

d. **Jointing the Pipe:** Pipe shall assemble with bell and spigot joints having rubber gaskets which compress to form a water tight seal. Joints shall be assembled by bar and block, coupling pulleys or by backhoe. If the backhoe bucket is used to assembly the joint, a block of wood shall be placed between the end of the pipe and the bucket and care shall be taken to prevent damage to the pipe.

e. **Interferences:** All known underground lines are shown on the plans. This does not necessarily mean that all such

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lines that may be encountered are shown. Where existing utility lines or other subsurface obstructions are shown on the drawings, they have been located as accurately as practicable by the City. Such obstructions are shown for the purpose of advising the Contractor that they may interfere with the work to be done hereunder but not for the purpose of indicating that the work can be performed without such interference. Elevations of underground obstructions and lines are shown as accurately as known on the profile sheets.

f. **Backfilling:** Backfilling of the trench shall be accomplished in accordance with Section 312 and Standard Drawing SS01. Dig through locator tape as specified in section 657 shall be buried two(2) feet above the line.

g. **Flushing:** The flushing velocity shall be at least 2.5 feet per second for small mains. The table in Section 904 lists required hydrant openings to obtain required flushing velocities. The flushing velocity for larger mains shall be as specified by the design engineer. Flushing is not required on replacement lines constructed wet.

h. **Testing:** Testing shall be accomplished in accordance with Section 108. Testing shall be at the Contractor's expense, and if required by a testing laboratory approved by the City. Tests shall be as specified in Section 108 and as directed by the Utilities Inspector.

j. **Connection to the System:** When the line is tied into the existing sanitary sewer, the contractor shall take special care in breaking into the existing manhole to ensure the minimum size hole necessary to accomplish the connection is cut. If the connection is into an existing manhole, the connection shall utilize the connection detail as shown in Standard Drawing SS06. If the connection is made using a new manhole the contractor shall accomplish the connection in accordance with Section 512 Manholes. Special care shall be taken to cut the existing line and not break the line.

k. **Aerial Crossings and Crossings with less than four (4) feet of Cover:** These crossings shall consist of 3/16ths of an inch thick smooth wall steel casing, welded to form a one piece crossing, on concrete piers with bolted steel straps. The crossing shall be conducted in accordance with standard drawing SS14. The concrete shall be 3,500psi and sonitube forms may be used. The crossing will be included in the price per foot for pipe installation unless otherwise stated.

502.04 SPECIAL REQUIREMENTS:

a. **Inspection of Trench:** The Contractor shall notify the Utility Inspectors, Public Works Department, prior to excavating any trench. The trench shall be approved by the inspector prior to installation of any pipe.

b. **Bridging of Trench:** When ordered by the City, the Contractor shall, at his own expense, construct suitable platforms to bridge the trench at street intersections, at driveways to properties abutting the line of the work and at such points as may be required to permit vehicle and/or pedestrian travel.

c. **Shop Tests:** The Contractor shall be responsible for obtaining tests of all materials as required by these specifications. The contractor shall furnish to the City, in the required number of copies, a certificate of shop tests on all pipe. These tests shall be witnessed by a reputable and established testing laboratory or firm, previously approved by the City.

d. **Locator Wire:** All force main sanitary sewer lines constructed of polyvinyl chloride pipe shall have a No. 8 bare copper conductor wire buried on the top surface of the pipe. This wire shall be connected at the lift station end to the header pipe and at the manhole end to the manhole ring by Cadweld braising just above the ground or attachment to an above ground bolt. This shall be done for the purpose of allowing construction workers to locate the polyvinyl chloride pipe after it has been buried.

502.05 METHOD OF MEASUREMENT: When this item is included as a pay item in the contract it will be measured by the linear foot, through all fittings. This measurement will be made by the Utility Inspector and the contractor down the centerline of the pipeline.

502.06 BASIS OF PAYMENT: PVC pipe, measured as provided above, will be paid for by the linear foot and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. The price bid shall include all cost and expense of furnishing, hauling, laying and jointing the pipe, installing the protective materials, testing, flushing, and repairing of leaks. Excavation is paid under Section 311.

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Backfill and compaction are paid under either Section 312 or Section 313. This item will be paid as a separate bid item and payment will be made upon installation of the pipe. When this item is included in a contract it will be listed as follows:

BA 502 PVC PIPE INSTALLATION (FORCE MAIN)

LINEAR FOOT

502.07 STANDARD DRAWINGS: SS01, SS06

503 DUCTILE IRON SEWER PIPE INSTALLATION (08/19/99):

503.01 DESCRIPTION: This work shall consist of furnishing, hauling, placing, jointing, and testing the pipe and connecting the new line to the existing system, if the connection is into an existing manhole, as shown on the plans or directed by the Contract Administrator.

503.02 MATERIALS:

a. **Pipe Materials:** Section 651 Sanitary Sewer - Ductile Iron Pipe, Fittings, and Joints and Section 605 Polyethylene Wrap.

b. **Bedding and Backfill Material Requirements for Ductile Iron Pipe:** See Standard Drawing SS01 and Section 602.

503.03 CONSTRUCTION METHODS:

a. **Protection of Work:** During the progress of the work, the Contractor shall provide suitable barricades, fencing, signs, lighting, platforms, and/or scaffolding to protect the work during construction, to prevent damage to such work, and to protect the public from the work. At the close of each day's work, the open end of the pipelines shall be closed by suitable cover or plug, and shall not be reopened until the work recommences. Any obstructions which may occur in the line after being laid shall be removed by the Contractor at his own expense to the satisfaction of the Contract Administrator. The pipeline must be delivered free from dirt or other foreign matter.

b. **Laying of Pipe:** Pipe shall be laid true to the lines and grades shown on the plans and given in the field. Procedures for laying and joining the pipe will be in accordance with the manufactures recommendations. Each pipe shall be carefully laid to the line and grade given in the field with bells upstream, and the ends of adjoining pipes shall butt against each other in such manner that there will be no shoulder or unevenness of any kind. Special care shall be taken that the invert of the pipe shall be a smooth continuous surface. At each bell, a hole shall be excavated of a size to give ample working room for proper make-up of the joint. Unless expressly ordered by the Contract Administrator, each pipe shall be brought to the required grade as established from grade lines. The Contractor shall, at his own expense, furnish all tools, materials, and labor, and shall construct cross-frames or horses at such intervals as the Contract Administrator may order in the field. The Contractor shall furnish all other implements necessary to determine the proper setting of the pipes. Ductile iron pipe that is buried shall be installed with polywrap. The polywrap shall be installed in accordance with the manufactures recommendations, with particular attention to joint overlap (minimum of one (1) foot), joint tape, and protection of polywrap to prevent tears or penetrations.

c. **Establishing Grade:** The grade line shown on the plans is the elevation of the invert or flow line of the pipeline. This section shall not apply to force mains when the plans only require a minimum of four (4) feet of cover and do not set an exact grade for the force main. The contractor shall verify the requirement for exact grade with the design engineer prior to starting construction. The grade line shall be established in the trench by one of the following methods:

1) Use of batter boards set at grade stakes not farther than fifty feet (50'). Not less than three (3) batter boards shall be maintained in correct position while pipe is being placed.

2) Use of level and philly rod with grade stakes not farther than 300 feet apart. When this method is used the invert elevation of each section shall be verified before the next section is placed.

3) Use of level and philly rod with grade stakes not farther than 300 feet apart to set a laser for establishing the grade line in the trench. When this method is used, the invert elevation of shall be verified once between each manhole at approximately the center point and when the laser is moved.

d. **Jointing the Pipe:** Pipe shall assemble with bell and spigot joints having rubber gaskets which compress to form a

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water tight seal. Joints shall be assembled by bar and block, coupling pulleys or by backhoe. If the backhoe bucket is used to assemble the joint, a block of wood shall be placed between the end of the pipe and the bucket and care shall be taken to prevent damage to the pipe.

e. **Interferences:** All known underground lines are shown on the plans. This does not necessarily mean that all such lines that may be encountered are shown. Where existing utility lines or other subsurface obstructions are shown on the drawings, they have been located as accurately as practicable by the City. Such obstructions are shown for the purpose of advising the Contractor that they may interfere with the work to be done hereunder but not for the purpose of indicating that the work can be performed without such interference. Elevations of underground obstructions and lines are shown as accurately as known on the profile sheets.

f. **Backfilling:** Backfilling of the trench shall be accomplished in accordance with Section 312 and Standard Drawing SS01. Dig through locator tape as specified in section 657 shall be buried two(2) feet above the line.

g. **Flushing:** The flushing velocity shall be at least 2.5 feet per second for small mains. The table in Section 904 lists required hydrant openings to obtain required flushing velocities. The flushing velocity for larger mains shall be as specified by the design engineer. Flushing is not required on replacement lines constructed wet.

h. **Testing:** Testing shall be accomplished in accordance with Section 108. Testing shall be at the Contractor's expense, and if required by a testing laboratory approved by the City. Tests shall be as specified in Section 108 and as directed by the Utilities Inspector.

j. **Connection to the System:** When the line is tied into the existing sanitary sewer, the contractor shall take special care in breaking into the existing manhole to ensure the minimum size hole necessary to accomplish the connection is cut. If the connection is into an existing manhole, the connection shall utilize the connection detail as shown in Standard Drawing SS06. If the connection is made using a new manhole the contractor shall accomplish the connection in accordance with Section 512 Manholes. Special care shall be taken to cut the existing line and not break the line.

k. **Aerial Crossings and Crossings with less than four (4) feet of Cover:** These crossings shall consist of 3/16ths of an inch thick smooth wall steel casing, welded to form a one piece crossing, on concrete piers with bolted steel straps. The crossing shall be conducted in accordance with standard drawing SS14. The concrete shall be 3,500psi and sonitube forms may be used. The crossing will be included in the price per foot for pipe installation unless otherwise stated.

503.04 SPECIAL REQUIREMENTS:

a. **Inspection of Trench:** The Contractor shall notify the Utility Inspectors, Public Works Department, prior to excavating any trench. The trench shall be approved by the inspector prior to installation of any pipe.

b. **Bridging of Trench:** When ordered by the City, the Contractor shall, at his own expense, construct suitable platforms to bridge the trench at street intersections, at driveways to properties abutting the line of the work and at such points as may be required to permit vehicle and/or pedestrian travel.

c. **Shop Tests:** The Contractor shall be responsible for obtaining tests of all materials as required by these specifications. The contractor shall furnish to the City, in the required number of copies, a certificate of shop tests on all pipe. These tests shall be witnessed by a reputable and established testing laboratory or firm, previously approved by the City.

503.05 METHOD OF MEASUREMENT: When this item is included as a pay item in the contract it will be measured by the linear foot, through all fittings. This measurement will be made by the Utility Inspector and the contractor down the centerline of the pipeline.

503.06 BASIS OF PAYMENT: Ductile Iron pipe, measured as provided above, will be paid for by the linear foot and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. The price bid shall include all cost and expense of furnishing, hauling, laying and jointing the pipe, installing the protective materials, testing, flushing, and repairing of leaks. Excavation is paid under Section 311. Backfill and compaction are paid under either Section 312 or Section 313. This item will be paid as a separate bid item and payment will be made upon installation of the pipe. When this item is included in a contract it will

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be listed as follows:

BA 503A DUCTILE IRON PIPE INSTALLATION (FORCE MAIN)

LINEAR FOOT

BA 503B DUCTILE IRON PIPE INSTALLATION (SANITARY SEWER)

LINEAR FOOT

503.07 STANDARD DRAWINGS: SS01, SS06

504 CONCRETE SEWER PIPE INSTALLATION (08/19/99):

504.01 DESCRIPTION: This work shall consist of furnishing, hauling, placing, jointing, and testing the pipe and connecting the new line to the existing system, if the connection is into an existing manhole, as shown on the plans or directed by the Contract Administrator.

504.02 MATERIALS:

a. **Pipe Materials:** Section 652 Sanitary Sewer - Reinforced Concrete Pipe, Fittings, and Joints

b. **Bedding and Backfill Material Requirements for Reinforced Concrete Pipe:** See Standard Drawing SS01 and Section 602.

504.03 CONSTRUCTION METHODS:

a. **Protection of Work:** During the progress of the work, the Contractor shall provide suitable barricades, fencing, signs, lighting, platforms, and/or scaffolding to protect the work during construction, to prevent damage to such work, and to protect the public from the work. At the close of each day's work, the open end of the pipelines shall be closed by suitable cover or plug, and shall not be reopened until the work recommences. Any obstructions which may occur in the line after being laid shall be removed by the Contractor at his own expense to the satisfaction of the Contract Administrator. The pipeline must be delivered free from dirt or other foreign matter.

b. **Laying of Pipe:** Pipe shall be laid true to the lines and grades shown on the plans and given in the field. Procedures for laying and joining the pipe will be in accordance with the manufactures recommendations. Each pipe shall be carefully laid to the line and grade given in the field with bells upstream, and the ends of adjoining pipes shall butt against each other in such manner that there will be no shoulder or unevenness of any kind. Special care shall be taken that the invert of the pipe shall be a smooth continuous surface. At each bell, a hole shall be excavated of a size to give ample working room for proper make-up of the joint. Unless expressly ordered by the Contract Administrator, each pipe shall be brought to the required grade as established from grade lines. The Contractor shall, at his own expense, furnish all tools, materials, and labor, and shall construct cross-frames or horses at such intervals as the Contract Administrator may order in the field. The Contractor shall furnish all other implements necessary to determine the proper setting of the pipes.

c. **Establishing Grade:** The grade line shown on the plans is the elevation of the invert or flow line of the pipeline. This section shall not apply to force mains when the plans only require a minimum of four (4) feet of cover and do not set an exact grade for the force main. The contractor shall verify the requirement for exact grade with the design engineer prior to starting construction. The grade line shall be established in the trench by one of the following methods:

1) Use of batter boards set at grade stakes not farther than fifty feet (50'). Not less than three (3) batter boards shall be maintained in correct position while pipe is being placed.

2) Use of level and philly rod with grade stakes not farther than 300 feet apart. When this method is used the invert elevation of each section shall be verified before the next section is placed.

3) Use of level and philly rod with grade stakes not farther than 300 feet apart to set a laser for establishing the grade line in the trench. When this method is used, the invert elevation of shall be verified once between each manhole at approximately the center point and when the laser is moved.

d. **Jointing the Pipe:** Pipe shall assemble with bell and spigot joints having rubber gaskets which compress to form a water tight seal. Joints shall be assembled by bar and block, coupling pulleys or by backhoe. If the backhoe bucket is used to assembly the joint, a block of wood shall be placed between the end of the pipe and the bucket and care shall be taken to prevent damage to the pipe.

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e. **Interferences:** All known underground lines are shown on the plans. This does not necessarily mean that all such lines that may be encountered are shown. Where existing utility lines or other subsurface obstructions are shown on the drawings, they have been located as accurately as practicable by the City. Such obstructions are shown for the purpose of advising the Contractor that they may interfere with the work to be done hereunder but not for the purpose of indicating that the work can be performed without such interference. Elevations of underground obstructions and lines are shown as accurately as known on the profile sheets.

f. **Backfilling:** Backfilling of the trench shall be accomplished in accordance with Section 312 and Standard Drawing SS01. Dig through locator tape as specified in section 657 shall be buried two(2) feet above the line.

g. **Flushing:** The flushing velocity shall be at least 2.5 feet per second for small mains. The table in Section 904 lists required hydrant openings to obtain required flushing velocities. The flushing velocity for larger mains shall be as specified by the design engineer. Flushing is not required on replacement lines constructed wet.

h. **Testing:** Testing shall be accomplished in accordance with Section 108. Testing shall be at the Contractor's expense, and if required by a testing laboratory approved by the City. Tests shall be as specified in Section 108 and as directed by the Utilities Inspector.

j. **Connection to the System:** When the line is tied into the existing sanitary sewer, the contractor shall take special care in breaking into the existing manhole to ensure the minimum size hole necessary to accomplish the connection is cut. If the connection is into an existing manhole, the connection shall utilize the connection detail as shown in Standard Drawing SS06. If the connection is made using a new manhole the contractor shall accomplish the connection in accordance with Section 512 Manholes. Special care shall be taken to cut the existing line and not break the line.

k. **Aerial Crossings and Crossings with less than four (4) feet of Cover:** These crossings shall consist of 3/16ths of an inch thick smooth wall steel casing, welded to form a one piece crossing, on concrete piers with bolted steel straps. The crossing shall be conducted in accordance with standard drawing SS14. The concrete shall be 3,500psi and sonitube forms may be used. The crossing will be included in the price per foot for pipe installation unless otherwise stated.

504.04 SPECIAL REQUIREMENTS:

a. **Inspection of Trench:** The Contractor shall notify the Utility Inspectors, Public Works Department, prior to excavating any trench. The trench shall be approved by the inspector prior to installation of any pipe.

b. **Bridging of Trench:** When ordered by the City, the Contractor shall, at his own expense, construct suitable platforms to bridge the trench at street intersections, at driveways to properties abutting the line of the work and at such points as may be required to permit vehicle and/or pedestrian travel.

c. **Shop Tests:** The Contractor shall be responsible for obtaining tests of all materials as required by these specifications. The contractor shall furnish to the City, in the required number of copies, a certificate of shop tests on all pipe. These tests shall be witnessed by a reputable and established testing laboratory or firm, previously approved by the City.

504.05 METHOD OF MEASUREMENT: When this item is included as a pay item in the contract it will be measured by the linear foot, through all fittings. This measurement will be made by the Utility Inspector and the contractor down the centerline of the pipeline.

504.06 BASIS OF PAYMENT: Reinforced Concrete pipe, measured as provided above, will be paid for by the linear foot and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. The price bid shall include all cost and expense of furnishing, hauling, laying and jointing the pipe, installing the protective materials, testing, flushing, and repairing of leaks. Excavation is paid under Section 311. Backfill and compaction are paid under either Section 312 or Section 313. This item will be paid as a separate bid item and payment will be made upon installation of the pipe. When this item is included in a contract it will be listed as follows:

BA 504A REINFORCED CONCRETE PIPE INSTALLATION (FORCE MAIN)	LINEAR FOOT
BA 504B REINFORCED CONCRETE PIPE INSTALLATION (SANITARY SEWER)	LINEAR FOOT

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504.07 STANDARD DRAWINGS: SS01, SS06

510 FITTINGS (05/16/94):

510.01 DESCRIPTION: The term fittings is understood to mean bends, tees, crosses, sleeves, plugs, restrained joints, and other specified fittings. This work shall consist of furnishing, hauling, placing, and joining the fittings as shown on the plans or directed by the Contract Administrator.

510.02 MATERIALS: Section 650 Sanitary Sewer - PVC Pipe, Fittings, and Joints; Section 651 Sanitary Sewer - Ductile Iron Pipe, Fittings, and Joints; Section 652 Sanitary Sewer - Reinforced Concrete Pipe, Fittings, and Joints; and Section 605 Polyethylene Wrap.

510.03 CONSTRUCTION METHODS: Fittings shall be installed in accordance with the manufactures recommended procedures. Construction methods for fittings shall be the same as for the type of pipe corresponding to the fittings.

510.04 SPECIAL REQUIREMENTS:

a. **Polywrapping of Fittings:** All cast or ductile iron fittings shall be polywrapped in accordance with Section 402.03b.

b. **Thrust Blocks For Force Main Installation:** All bends, tees, crosses, and plugs shall be blocked with concrete under Section 544, except when the fittings have flanged, welded, or restrained joints, the Contract Administrator may, under certain conditions, delete the blocking. Blocking shall be placed so that joints are accessible for repair.

510.05 METHOD OF MEASUREMENT: When this item is included as a pay item in the contract it will be measured by each type of fitting.

510.06 BASIS OF PAYMENT: Fittings, measured as provided above, will be paid for by the individual fitting and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. The price bid shall include all cost and expense of furnishing, hauling, laying, jointing, installing the protective materials, testing, flushing, sterilization and repairing of leaks. Excavation is paid under Section 311. Backfill and compaction are paid under either Section 312 or Section 313. This item will be paid as a separate bid item and payment will be made upon installation of the fitting. When this item is included in a contract it will be listed as follows:

BA 510A1* BEND (Enter bend deflection, pipe size, and type material)	EACH
*(Each different bend deflection, size, and type will have a separate listing. Numbers run from BA 510A1 to BA 510A99)	
BA 510B1* TEE (Enter pipe sizes, and type material)	EACH
*(Each tee size and type will have a separate listing. Numbers run from BA 510B1 to BA 510B99)	
BA 510C1* CROSS (Enter pipe size, and type material)	EACH
*(Each cross size and type will have a separate listing. Numbers run from BA 510C1 to BA 510C99)	
BA 510D1* SLEEVES (Enter pipe size, and type material)	EACH
*(Each sleeve size, and type will have a separate listing. Numbers run from BA 510D1 to BA 510D99)	
BA 510E1* PLUGS (Enter pipe size, and type material)	EACH
*(Each plug size, and type will have a separate listing. Numbers run from BA 510E1 to BA 510E99)	
BA 510F1* RESTRAINED JOINT (Enter pipe size, and type material)	EACH
*(Each restrained joint size and type will have a separate listing. Numbers run from BA 510F1 to BA 510F99)	
BA 510G1* SPECIAL FITTING (Enter description)	EACH
*(Each special fitting will have a separate listing. Numbers run from BA 510G1 to BA 510G99)	

510.07 STANDARD DRAWINGS: SS01

511 MANHOLE (08/19/99):

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511.01 DESCRIPTION: The term manhole is understood to mean both standard and drop inlet manholes. This work shall consist of furnishing, hauling, excavating, placing, constructing, finishing, joining the pipe to the manhole, and backfilling the manholes as shown on the plans or directed by the Contract Administrator.

511.02 MATERIALS: Section 601 - Concrete; Section 602 - Pipe Bedding; Section 603 - Select Backfill; and Section 655 - Sanitary Sewer - Manholes.

511.03 CONSTRUCTION METHODS:

a. **Excavation and Backfill:** Excavation for manholes shall be made with vertical sides and minimum dimensions permitting construction of the manhole in accordance with the plans and standard drawings. Backfill of completed manholes shall be accomplished in accordance with Sections 312 and 313.

b. **Elevation of Manhole Lid:** The top of the manhole ring and lid shall be constructed at the finished elevation shown on the plans. In the absence of a finished elevation the top of the lid shall be constructed no lower than the existing ground elevation. Adjustment of the manhole lid shall be accomplished by mortaring concentric rings into place. No more than 12 inches of concentric rings may be used. Each ring shall have a full mortar joint not exceeding three-eighths (3/8) inch thickness. Inside joints shall be rubbed full and struck.

c. **Construction over an Existing Line:** Manholes shall be constructed around existing lines without disturbing the line. Construction shall begin by placing a minimum of an 8 inch thick 3,000 psi concrete slab reinforced with 10 gage 6 X 6 mesh under the existing line. This slab shall be placed on 12 inches of compacted Type "A" base rock. This slab shall extend a minimum of 8 inches outside the outside edge of the manhole. If there is a pipe joint within 2 feet of the edge of the base slab, the slab will be extended to cover the joint. Prior to placing the bottom section a rubber manhole pipe connector, as shown in the standard drawings, will be placed around the existing pipe. Following placement of the base, the bottom section of the manhole will be constructed. The invert of the manhole shall then be constructed and the existing pipe removed from the invert. The contractor shall saw out the existing pipe taking care not to break the remaining pipe or drop pieces of pipe or mortar which could cause a blockage. The manhole shall then be completed and the ring and lid placed.

d. **Pipe Connection:** Pipe connection to the manhole shall be made using a rubber manhole pipe connector, as shown in the standard drawings. This connector shall have a tight friction fit to the pipe and shall be anchored to the manhole by concrete.

e. **Invert Construction:** Above the base, manhole inverts shall be carefully constructed of solid concrete to maintain proper velocities. Changes in pipe grade, alignment, or size shall be made by transition sections of the invert, determined by the lower half of the inlet and outlet pipes, but not greater than that of the outlet pipe. All inlets shall be plastered, troweled, and brushed to a smooth, clean surface. The bottom of the manhole shall be sloped to the pipe for drainage with a fall of not less than 1/2 inch per foot. Inlet and outlet pipes shall not project beyond the interior wall of the manhole and shall be free of sharp edges.

f. **Manhole Steps:** During the construction of each manhole, steps as specified shall be set in place on the inside of the manhole, beginning 18 inches below the manhole top. If cast in place manholes are used, steps shall be securely fastened in place before the concrete is placed. For precast manholes the steps shall be securely fastened in place before the concrete is placed at the fabrication site. The centerline, spacing, and configuration of the steps shall be as shown on the plans and standard drawings.

g. **Cast in Place Manholes:** Cast in place manholes shall rest on a pad of compacted Type "A" base rock 12 inches thick. Construction shall begin by placing a minimum of an 8 inch thick 3,000 psi concrete slab reinforced with 10 gage 6 X 6 mesh under the line. The manhole shall be constructed of 3,000 psi concrete 8 inches thick, meeting the requirements of Section 330. Concrete shall be fully placed and vibrated. Steps shall be held in place by formwork during the placement. After removal of forms, all blemishes shall be plastered with mortar to a smooth finish.

h. **Precast Manholes:** Precast manholes with cast in place bases will be permitted for all standard and drop manhole installations. Precast manholes with precast bases will be permitted for standard and drop manhole installations with depths of 12 feet or less. Precast manholes with precast floors shall be set on a pad of compacted Type "A" base rock 12 inches thick. Precast manhole joints shall be sealed with omni-flex gaskets. After installation, all lifting eye holes and

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blemishes shall be plastered with mortar to a smooth finish.

i. **Ring and Lid Installation:** Rings shall be set on a bed of mortar not more than three-eighths (3/8) inch thick and shall be level. The inside joint shall be rubbed full and struck. The exterior shall be mortared to provide a water tight seal and shall be troweled and brushed to a smooth, clean surface.

j. **Clean up:** The contractor shall remove all construction debris from the manhole and shall take special care not to drop pieces of pipe, mortar, or other objects into the line which could cause a blockage.

k. **Flushing:** The flushing velocity shall be at least 2.5 feet per second for small mains. The table in Section 904 lists required hydrant openings to obtain required flushing velocities. The flushing velocity for larger mains shall be as specified by the design engineer. Flushing is not required on replacement lines constructed wet.

l. **Testing:** Testing shall be accomplished in accordance with Section 108. Testing shall be at the Contractor's expense, and if required by a testing laboratory approved by the City. Tests shall be as specified in Section 108 and as directed by the Utilities Inspector.

511.04 SPECIAL REQUIREMENTS:

a. **Brick Manholes:** Brick manholes may be used for very special situations and must be approved by the City Engineer prior to submittal. The contractor shall provide shop drawings and specifications for any brick manholes.

b. **Construction Sequencing:** Manholes shall be constructed concurrent with the laying of the sewer pipe. The contractor shall not have more than two (2) manholes under construction at one time without the approval of the Contract Administrator.

c. **Lid Type:** Manhole rings and lids for manholes in streets, front yards, and flood plains shall be of the bolt down sealing type. Standard ring and lid sets may be used in other areas.

d. **Manhole Width:** Manholes 4' 6" or less in height shall have the full width, shown on the plans, from top to bottom. Manholes over 4' 6" may taper to the ring size unless prohibited by the plans.

e. **Inspection of Work:** The Contractor shall notify the Utility Inspectors, Public Works Department, prior to excavating. The excavation shall be approved by the inspector prior to installation of the manhole and the manhole installation shall be approved prior to backfilling.

511.05 METHOD OF MEASUREMENT: When this item is included as a pay item in the contract it will be measured by the manhole and by the vertical foot of extra depth. A manhole of the specified width, with the specified ring and lid, and six (6) feet deep or less, measured from the invert to the top of the concrete cover, shall be considered one manhole. If the measured depth exceeds six (6) feet, the extra depth shall be obtained by measuring from the invert to the top of the cover and subtracting six (6) feet. This extra depth shall be paid for by the linear foot. Any ring adjustments shall not be considered additional depth.

511.06 BASIS OF PAYMENT: Manholes, measured as provided above, will be paid for by the individual manhole and foot of extra depth and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. The price bid shall include all cost and expense of furnishing, hauling, laying, jointing, installing the protective materials, testing, flushing, and repairing of leaks. This item will be paid as a separate bid item and payment will be made upon installation of the manhole. When this item is included in a contract it will be listed as follows:

BA 511A 4 FOOT ID MANHOLE W/STANDARD LID	EACH
BA 511B 4 FOOT ID MANHOLE W/BOLT DOWN LID	EACH
BA 511C 4 FOOT ID MANHOLE EXTRA FOOT OF DEPTH	LF
BA 511D 5 FOOT ID MANHOLE W/STANDARD LID	EACH
BA 511E 5 FOOT ID MANHOLE W/BOLT DOWN LID	EACH
BA 511F 5 FOOT ID MANHOLE EXTRA FOOT OF DEPTH	LF
BA 511G * FOOT ID MANHOLE W/STANDARD LID	EACH

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BA 511H * FOOT ID MANHOLE W/BOLT DOWN LID
BA 511I * FOOT ID MANHOLE EXTRA FOOT OF DEPTH

EACH
LF

* Specify Diameter

511.07 STANDARD DRAWINGS: SS06, SS07, SS08, and SS11.

512 LAMPHOLE (05/16/94):

512.01 DESCRIPTION: This work shall consist of furnishing, hauling, excavating, placing, constructing, finishing, joining the pipe to the lamphole, and backfilling the lampholes as shown on the plans or directed by the Contract Administrator.

512.02 MATERIALS: Section 601 - Concrete; Section 602 - Pipe Bedding; Section 603 - Select Backfill; and Section 656 - Sanitary Sewer - Lampholes.

512.03 CONSTRUCTION METHODS:

a. **Excavation and Backfill:** Excavation for lampholes shall be made with vertical sides and minimum dimensions permitting construction of the lamphole in accordance with the plans and standard drawings. Backfill of completed lampholes shall be accomplished in accordance with Sections 312 and 313.

b. **Elevation of Lamphole Lid:** The top of the lamphole ring and lid shall be constructed at the finished elevation shown on the plans. In the absence of a finished elevation the top of the lid shall be constructed no lower than the existing ground elevation. Adjustment of the lamphole lid shall be accomplished by moving the ring up or down as required on the pipe and compacting the backfill around the ring.

c. **Concrete Encasement:** Concrete encasement of the lamphole and pipe shall be accomplished using 3,000 psi plain concrete and shall be placed in accordance with Section 330 and the standard drawing.

d. **Ring and Lid Installation:** Rings shall be set on compacted cohesive select fill and shall be level. The exterior shall be filled to ground level with cohesive select fill and compacted.

e. **Clean up:** The contractor shall remove all construction debris from the lamphole and shall take special care not to drop pieces of pipe, mortar, or other objects into the line which could cause a blockage.

f. **Flushing:** The flushing velocity shall be at least 2.5 feet per second for small mains. The table in Section 904 lists required hydrant openings to obtain required flushing velocities. The flushing velocity for larger mains shall be as specified by the design engineer. Flushing is not required on replacement lines constructed wet.

g. **Testing:** Testing shall be accomplished in accordance with Section 108. Testing shall be at the Contractor's expense, and if required by a testing laboratory approved by the City. Tests shall be as specified in Section 108 and as directed by the Utilities Inspector.

512.04 SPECIAL REQUIREMENTS:

a. **Construction Sequencing:** Lampholes shall be constructed concurrent with the laying of the sewer pipe. The contractor shall not have more than one (1) lampholes under construction at one time without the approval of the Contract Administrator.

b. **Inspection of Work:** The Contractor shall notify the Utility Inspectors, Public Works Department, prior to excavating. The excavation shall be approved by the inspector prior to installation of the lamphole and the lamphole installation shall be approved prior to backfilling.

512.05 METHOD OF MEASUREMENT: When this item is included as a pay item in the contract it will be measured by the lamphole.

512.06 BASIS OF PAYMENT: Lampholes, measured as provided above, will be paid for by the individual

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Lamphole and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. The price bid shall include all cost and expense of furnishing, hauling, laying, jointing, installing the protective materials, testing, flushing, and repairing of leaks. This item will be paid as a separate bid item and payment will be made upon installation of the lamphole. When this item is included in a contract it will be listed as follows:

BA 512 LAMPHOLE

EACH

512.07 STANDARD DRAWINGS: SS10.

513 FORCE MAIN AIR RELIEF VALVE ASSEMBLIES (05/16/94):

513.01 DESCRIPTION: It is understood that an air relief valve assembly shall consist of the vault with lid, tap or outlet assembly, piping and bends, gate valve, air relief valve, and all associated items required to complete the installation. This work shall consist of furnishing and installing air relief valve assemblies, as shown on Standard Drawing W02, and all other items necessary to complete the air relief valve assembly installation at the locations shown on the plans or as directed by the Contract Administrator.

513.02 MATERIALS: Section 601 - Concrete; Section 602 - Pipe Bedding; Section 603 - Select Backfill; Section 605 Polyethylene Wrap; Section 650 Sanitary Sewer - PVC Pipe, Fittings, and Joints; Section 651 Sanitary Sewer - Ductile Iron Pipe, Fittings, and Joints; Section 652 Sanitary Sewer - Reinforced Concrete Pipe, Fittings, and Joints; Section 623 Water Line - Copper Service Line and Fittings; Section 624 Water Line - Taps; and Section 654 - Sanitary Sewer - Valves.

513.03 CONSTRUCTION METHODS:

- a. **Excavation:** Shall be accomplished in accordance with Section 311 Excavation.
- b. **Backfill:** Shall be accomplished in accordance with Section 312 Common Backfill and Compaction and/or Section 313 Select Backfill and Compaction.
- c. **Concrete Work:** Shall be accomplished in accordance with Section 330 Concrete Placement.
- d. **Tap or Outlet:** Taps shall be accomplished in accordance with Section 413 Service Line Taps for eight (8) inch and smaller lines. For lines larger than eight (8) inches outlets shall be accomplished in accordance with Section 421 Outlet Assemblies.
- e. **Assembly:** Shall be accomplished in accordance with the section that applies to the pipe being used and according to the manufactures recommendations.
- f. **Vault Construction:** Shall be accomplished in accordance with Section 433 Meter or Valve Vaults.

513.04 SPECIAL REQUIREMENTS:

- a. **Vertical Position:** The top of the vault shall be placed at ground level.
- b. **Testing:** All air relief valves shall be in place prior to testing. Valve operation shall be checked during filling and draining of the line.

513.05 METHOD OF MEASUREMENT: When this item is included as a pay item in the contract it will be measured by each air relief valve assembly, by type.

513.06 BASIS OF PAYMENT: Air relief valve assemblies, measured as provided above, will be paid for by the individual assembly and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. The price bid shall include all cost and expense of furnishing, hauling, excavating, installing, installing the protective materials, backfilling, testing, flushing, sterilization and repairing of leaks. This item will be paid as a separate bid item and payment will be made upon installation of the air and/or

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vacuum valve assembly. When this item is included in a contract it will be listed as follows:

BA 513A1* AIR RELIEF VALVE ASSEMBLY (Enter description)

EACH

*(Each different air relief valve assembly will have a separate listing. Numbers run from BA 513A1 to BA 513A99)

513.07 STANDARD DRAWINGS: W02.

514 TAPS (NEW CONSTRUCTION) (05/16/94):

514.01 DESCRIPTION: This work shall consist of furnishing and installing sanitary sewer taps, as shown on Standard Drawings SS03 and SS03A, and all other items necessary to complete the tap installation at the locations shown on the plans or as directed by the Contract Administrator.

514.02 MATERIALS: Section 602 - Pipe Bedding; Section 603 - Select Backfill; Section 620 Water Line - PVC Pipe, Fittings, and Joints; and Section 650 Sanitary Sewer - PVC Pipe, Fittings, and Joints

514.03 CONSTRUCTION METHODS: Installation of the PVC tee, spacer, and schedule 40 PVC pipe shall be in accordance with Section 501. The follow items will receive special attention.

- a. **Jointing:** All joints will be properly glued to include the cap on the top of the schedule 40 pipe.
- b. **Backfill:** Special care will be taken to place sand around the tap where the schedule 40 pipe connects to the SDR 35 tee. The sand will be placed for a minimum of six (6) inches on the top and sides of the connection and fully supporting the connection. This sand will be in place and compacted prior to backfilling the trench around the tap.
- c. **Marking:** The metal coupon will be placed on top of the glued schedule 40 cap and backfilled to ensure it remains in place. The mylar marking tape will be tied to the schedule 40 pipe and pulled vertical while the backfill material is placed.

514.04 SPECIAL REQUIREMENTS: The contractor will measure the location of the tap from the nearest manhole and mark the distance on the as built drawings. The Utility Inspector will observe this process and the backfilling of the tap.

514.05 METHOD OF MEASUREMENT: When this item is included as a pay item in the contract it will be measured by each tap.

514.06 BASIS OF PAYMENT: Taps, measured as provided above, will be paid for by the individual tap and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. The price bid shall include all cost and expense of furnishing, hauling, excavating, installing, installing the protective materials, backfilling, testing, flushing, and repairing of leaks. This item will be paid as a separate bid item and payment will be made upon installation of the tap. When this item is included in a contract it will be listed as follows:

BA 514 SANITARY SEWER TAP (NEW CONSTRUCTION)

EACH

514.07 STANDARD DRAWINGS: SS03 and SS03A

515 TAPS (EXISTING LINES) (05/16/94):

515.01 DESCRIPTION: This work shall consist of furnishing and installing sanitary sewer taps, as shown on Standard Drawing SS02, and all other items necessary to complete the tap installation at the locations shown on the plans or as directed by the Contract Administrator.

515.02 MATERIALS: Section 602 - Pipe Bedding; Section 603 - Select Backfill; Section 620 Water Line - PVC Pipe, Fittings, and Joints; and Section 650 Sanitary Sewer - PVC Pipe, Fittings, and Joints

515.03 CONSTRUCTION METHODS: Installation of the tapping saddle and schedule 40 PVC pipe shall be in

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accordance with Section 501. The follow items will receive special attention.

a. **Jointing:** All joints will be properly glued or epoxyed to ensure a water tight fit.

b. **Cutting The Tap:** Each tap will be cut in with the proper cutting tools. The plumber making the tap must show the Building Inspector the coupon that was cut from the lateral line. Under no circumstances will a hammer, chisel, ax, or other inappropriate tool be used to cut a tap.

c. **Backfill:** Special care will be taken to place concrete around the tap where the schedule 40 pipe connects to the saddle. The concrete will be placed for a minimum of six (6) inches on the top and sides of the connection and fully supporting the connection. This concrete will be in place and set prior to backfilling the trench around the tap.

515.04 SPECIAL REQUIREMENTS: The contractor must comply with the BOCA code for installation of sanitary sewer service lines. Inspection of this type of tap will normally be by the City Building Inspectors.

515.05 METHOD OF MEASUREMENT: When this item is included as a pay item in the contract it will be measured by each tap.

515.06 BASIS OF PAYMENT: Taps, measured as provided above, will be paid for by the individual tap and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. The price bid shall include all cost and expense of furnishing, hauling, excavating, installing, installing the protective materials, backfilling, testing, flushing, and repairing of leaks. This item will be paid as a separate bid item and payment will be made upon installation of the tap. When this item is included in a contract it will be listed as follows:

BA 514 SANITARY SEWER TAP (EXISTING LINE)

EACH

515.07 STANDARD DRAWINGS: SS02

516 CONNECTIONS (08/19/99):

516.01 DESCRIPTION: This work shall consist of all excavation, furnishing all materials required, construction, finishing, and backfilling of connections to manholes, as shown on the plans or as directed by the Contract Administrator.

516.02 MATERIALS: Section 601 Concrete; Section, 602 Pipe Bedding; Section 603 Select Backfill; Section 655 Sanitary Sewer - Manholes; Section 650 Sanitary Sewer - PVC pipe, fittings, and Joints; Section 651 Ductile Iron Pipe, Fittings, and Joints.

516.03 CONSTRUCTION METHODS:

a. **Excavation and Backfill:** Excavation for connection shall be made with vertical sides and minimum dimensions permitting construction of the connection in accordance with the plans and standard drawings. Backfill of completed connections shall be accomplished in accordance with Section 312 Common Backfill and Compaction and Section 313 Select Backfill and Compaction.

b. **New Manhole Connection:** Pipe connection to the manhole shall be made using a rubber manhole pipe connector, as shown in the Standard Drawings SS06. The contractor shall accomplish the connection in accordance with Section 511 Manholes. Special care shall be taken to cut the existing line without breaking the existing line.

c. **Existing Manhole Connection:** The contractor shall take special care in breaking into the existing manhole to ensure that the minimum size hole necessary to insert the pipe is cut, to accomplish the connection. Pipe Connections to the manhole shall be made at the specified grade, using a rubber manhole pipe connector, as shown in the Standard Drawings SS06. The connection shall have a tight friction fit and shall be anchored to the manhole by concrete.

d. **New Manhole Invert Construction:** The invert construction shall be as shown in the Standard Drawings SS11. The contractor shall accomplish the invert construction in accordance with Section 511 Manholes.

e. **Existing Manhole Invert Construction:** The manhole base shall be cut and reconstructed in such a manner that a

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proper invert section is maintained, as shown in Standard Drawings SS06 and SS11. The contractor shall accomplish the invert reconstruction in accordance with Section 511 Manholes, inlet and outlet pipes at the invert shall not project more than two (2) inches beyond the interior walls of the manholes.

f. Step Relocation: The contractor shall remove and replace the existing manhole steps in the proper location. The location shall be as shown in the Standard Drawings SS11, if they are not properly located after the connection is made.

g. Wet Connection: Any and all diversion or pumping of sewage in a wet connection shall be included in this item.

h. Cleanup: The contractor shall remove all construction debris from the manhole and shall take special care not to drop pieces of pipe, mortar, or other objects in the line which could cause blockage.

516.04 BASIS OF PAYMENT: Connections, measured as provided above, will be paid for by each type of connection constructed and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals to complete the work as specified. The price bid shall include all cost and expense of furnishing, laying, jointing, installing the protective materials, testing flushing, and repairing of each. This item will be paid as a separate bid item and payment will be made upon installation of the connection. When this item is included in a contract, it will be listed as follows:

BA516A Standard Connection	Each
BA516B Drop Connection	Each

516-05 Standard Drawings: SS06, SS08, and SS11

540 CONCRETE ENCASEMENT (05/16/94):

540.01 DESCRIPTION: See Section 330.

540.02 MATERIALS: See Section 330.

540.03 CONSTRUCTION METHODS: See Section 330.

540.04 SPECIAL REQUIREMENTS: See Section 330.

540.05 METHOD OF MEASUREMENT: See Section 330.

540.06 BASIS OF PAYMENT: See Section 330.

BA 540 CONCRETE ENCASEMENT

540.07 STANDARD DRAWINGS: W07.

CY

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541 CONCRETE SLAB PROTECTION FOR PIPELINES (05/16/94):

- 541.01 DESCRIPTION: See Section 330.
- 541.02 MATERIALS: See Section 330.
- 541.03 CONSTRUCTION METHODS: See Section 330.
- 541.04 SPECIAL REQUIREMENTS: See Section 330.
- 541.05 METHOD OF MEASUREMENT: See Section 330.
- 541.06 BASIS OF PAYMENT: See Section 330.
- BA 541 CONCRETE SLAB PROTECTION FOR PIPELINES**
- 541.07 STANDARD DRAWINGS: N/A

CY

542 CONCRETE CRADLE (05/16/94):

- 542.01 DESCRIPTION: See Section 330.
- 542.02 MATERIALS: See Section 330.
- 542.03 CONSTRUCTION METHODS: See Section 330.
- 542.04 SPECIAL REQUIREMENTS: See Section 330.
- 542.05 METHOD OF MEASUREMENT: See Section 330.
- 542.06 BASIS OF PAYMENT: See Section 330.
- BA 542 CONCRETE CRADLE**
- 542.07 STANDARD DRAWINGS: W07

CY

543 CONCRETE THRUST BLOCKS (05/16/94):

- 543.01 DESCRIPTION: See Section 330.
- 543.02 MATERIALS: See Section 330.
- 543.03 CONSTRUCTION METHODS: See Section 330.
- 543.04 SPECIAL REQUIREMENTS: See Section 330.
- 543.05 METHOD OF MEASUREMENT: See Section 330.
- 543.06 BASIS OF PAYMENT: See Section 330.
- BA 543 CONCRETE THRUST BLOCKS**
- 543.07 STANDARD DRAWINGS: W06.

CY

544 REINFORCED CONCRETE PIERS (05/16/94):

- 544.01 DESCRIPTION: See Section 330.
- 544.02 MATERIALS: See Section 330.
- 544.03 CONSTRUCTION METHODS: See Section 330.
- 544.04 SPECIAL REQUIREMENTS: See Section 330.
- 544.05 METHOD OF MEASUREMENT: See Section 330.
- 544.06 BASIS OF PAYMENT: See Section 330.
- BA 544 REINFORCED CONCRETE PIERS**
- 544.07 STANDARD DRAWINGS: N/A

CY

SECTION 600 - MATERIALS

600 MATERIALS:

600.01 GENERAL (05/16/94): The criteria established in the following specifications sets the minimum standards for materials used in construction of utilities in the City of Broken Arrow. Contractors are urged to provide materials that exceed these minimum standards and if necessary submit alternative materials for approval.

600.02: APPROVAL OF MATERIALS (05/16/94): The contractor installing the materials must submit certifications, testing reports, and requests for approval of materials in accordance with the City of Broken Arrow's current utility construction inspection procedure.

601 CONCRETE (05/16/94):

601.01 DESCRIPTION: This specification covers concrete for use in construction of utilities, structures, streets, sidewalks, and drainage structures.

601.02 CRITERIA:

a. **Specifications:** All concrete used in the City of Broken Arrow will meet the requirements of these specifications. Contractors shall submit a mix design at the start of each project and shall not deviate from that mix design without written approval. **Fly Ash shall not be substituted for cement in concrete used for street construction.**

b. Classes of Concrete and Their Uses:

1. Class BA1 (3,500 PSI, Minimum 540 pounds of Portland Cement per cubic yard): Street paving, curb and gutter, structural applications (ie. Bridge Decks, Box culvert decks, concrete piles, building foundations, etc.) and other applications as designated by the design engineer.

2. Class BA2 (3,000 PSI, Minimum 500 pounds of Portland Cement per cubic yard): Abutments, retaining walls, culverts, manhole bases, reinforced concrete not requiring class AA concrete, and other applications as designated by the design engineer.

3. Class BA3 (2,500 PSI, Minimum 470 pounds of Portland Cement per cubic yard): Thrust Blocks, encasement, pipe cradle, and other applications as designated by the design engineer.

4. Class BA4 (2,400 PSI, Minimum 395 pounds of Portland Cement per cubic yard): Soil erosion control structures and other applications as designated by the design engineer.

5. Class BA SPECIAL: Applications and strength as designated by the design engineer.

602 PIPE BEDDING (08/19/99):

602.01 DESCRIPTION: This specification covers pipe bedding which is the material placed under a pipeline as required by the applicable standard detail.

602.02 CRITERIA:

a. **Sand Bedding:** Sand bedding shall all pass a one inch (25mm) sieve and shall contain 5% to 35% of material passing the No. 200 sieve (0.075mm). The final material shall have a liquid limit of 35 or less and a plasticity index not to exceed eight.

b. **Crushed Stone Bedding:** Crushed and washed limestone chips with a nominal size of 3/8".

c. **Select Material Bedding:** Select material from trench excavation if it is satisfactory to the Engineer for such use. Bedding material be friable soil containing no rocks. Clay soil or any soil containing hard lumps shall not be used in the cushion.

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603 SELECT BACKFILL (08/19/99):

603.01 DESCRIPTION: This specification covers select backfill which is material placed over a pipeline as required by the applicable standard detail.

603.02 CRITERIA:

a. **Sand:** Sand backfill may be Arkansas River sand, free from objectionable material and containing not more than ten percent (10%) clay and loam by weight, one hundred percent (100%) shall pass a 3/4" sieve and ninety-five percent (95%) shall pass number four sieve.

b. **Select Material:** Pipe may be initially backfilled with select material from trench excavation if it is satisfactory to the Engineer for such use. Backfill to six inches (6") over the pipe shall be friable soil containing no rock in excess of one inch (1") in maximum dimension. Clay soil or any soil containing hard lumps shall not be used in the initial backfill.

c. **Washed 3/4 Inch Rock:** Limestone rock free of fines with a nominal size of 3/4 inch.

d. **Crushed Rock:** Shall be ODOT Type A Aggregate Base as specified in Section 703.01 Aggregate for Aggregate Base in the ODOT Standard Specifications.

e. **Flowable Fill:** Flowable shall be a sand-cement slurry consisting of 2,970 pounds of sand, 100 pounds of cement, and approximately 458 pounds of water per cubic yard. The slurry will be mixed to a pourable soupy mix in a ready mix truck. When the flowable fill is to be a Quick-Set flowable fill, the cement shall be replaced with a rapid set cement and the slurry shall have a strength of 65 to 75 psf in 1 to 1.5 hours.

604 CONDUIT (08/19/99):

604.01 DESCRIPTION: This specification covers all conduit used in pipelines in the City.

604.02 CRITERIA: Conduit (also known as tunnel liner or pipe sleeve) shall conform to, and be tested in accordance with one of the following:

a. **Concrete Conduit:** Reinforced Concrete Culvert, Storm Drain and Sewer Pipe, A.S.T.M. Designation C 76, Class IV.

b. **Galvanized Metal Conduit:** Corrugated galvanized metal pipe meeting AASHO Designation M36, 12-gauge for railroad crossings, and 14-gauge for street crossing.

c. **Steel Conduit:** 12-gauge steel pipe meeting AWWA Standard for Electrically Welded Steel Water Pipe, AWWA Designation C 201 or Mill-Type Steel Water Pipe, AWWA Designation C 202, either to have 3/16 inch wall thickness with the interior.

605 POLYETHYLENE WRAP (05/16/94):

605.01 DESCRIPTION: This specification covers polyethylene wrap for ductile iron pipe and ductile or cast iron fittings and valves.

605.02 CRITERIA: When a polyethylene tube is specified or required, it shall be made from virgin polyethylene resin in accordance with ASTM Specifications D-1248. Thickness shall not be less than eight mils (.008 inch). The material shall be chemically inert and moisture resistant to form an effective seal against penetration by water or vapor. Tensile strength shall be 1800 psi with elongation of 500 percent. The material shall be Polyetube, or approved equal, as manufactured by Polyetube Corporation, Birmingham, Alabama. Tape for polyethylene tube shall be plastic backed adhesive tape, Polykan #900, Scotchrap #50 or approved equal, two inches (2") in width. The tube shall be of such length that a one foot (1') overlap is provided at each joint in pipe. Minimum flattened polyethylene tube widths for use with specific pipe sizes and joint types:

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NOMINAL PIPE SIZE	PUSH-ON JOINT FLAT TUBE WIDTH	MECHANICAL JOINT FLAT TUBE WIDTH
4"	14"	16"
6"	17"	20"
8"	21"	24"
10"	25"	27"
12"	29"	30"
14"	33"	34"
16"	37"	37"
18"	41"	41"
20"	45"	45"
24"	53"	53"

606 WATER LINE - VALVE BOXES, VAULTS, PITS, AND MANHOLES (08/19/99):

606.01 DESCRIPTION: This specification covers all valve enclosures used in the water distribution and sanitary sewer systems.

606.02 CRITERIA:

a. Castings:

1. General: Castings for valve boxes, valve vaults, manholes, and other appurtenances shall conform to and be tested in accordance with the specifications for Gray Cast Iron ASTM, Designation A 48, Class 30. Castings shall conform to dimensions shown on the Standard Drawing, shall be bodily filleted at angles and the arises shall be sharp and perfect, true to form and thickness. Frames or covers that are to be located in traveled ways or in any location subject to vehicular traffic shall have all bearing surface machined so that fitting parts will not rattle or rock under traffic and the covers shall fit frames without wedging. All castings shall be thoroughly cleaned and given two coats of bituminous paint. Covers shall carry the legend "Broken Arrow Water" in one inch (1") letters.

2. Water Valve Manhole Frame and Lid: Shall be as shown on Standard Drawing W03 and shall be used on all water valve manholes and valve vaults unless the valve vault frame and lid shown in Standard Drawing W05 is specified.

3. Valve Vault Frame and Lid: Special requirement frame and lid shall be as shown on Standard Drawing W05.

4. Valve Boxes: Casting for valve boxes shall conform to and be tested in accordance with specifications for Gray Cast Iron, ASTM Designation A 48, Class 30. All castings shall be subject to a hammer test before installation. Valve boxes shall be screw adjustable with drop covers as shown on Standard Drawing W04.

b. **Concrete Masonry Units:** Concrete masonry units shall conform to and be tested in accordance with the specifications for Concrete Masonry, Hollow Load Bearing Concrete Masonry Units, ASTM Designation C 90 or Concrete Building Brick C 55, Grade A. Manhole units shall conform to and be tested in accordance with one of the following: Sewer Brick (made from clay or shale), ASTM Designation C 32, Grade MA; Concrete Building Brick ASTM Designation C 55, Grade A; or Concrete Masonry Units for Construction of Catch Basins and Manholes, ASTM, Designation C 139.

c. **Precast Manholes:** Precast manholes shall conform to and be tested in accordance with the specifications for Precast Reinforced Concrete Manhole Risers and Tops, ASTM Designation C 478, flat slab top type.

620 WATER LINE - PVC PIPE, FITTINGS, AND JOINTS (08/19/99):

620.01 DESCRIPTION: This specification covers polyvinyl chloride (PVC) pipe, fittings, and joints used in the water distribution system as main lines or return lines for looping.

620.02 CRITERIA:

a. **Main Line Pipe:** Polyvinyl chloride (PVC) pipe shall conform to the provisions of AWWA C900 AWWA Standard for PVC Pressure pipe 4" through 12" for water and shall conform to requirements set forth herein. The size, OD base, pressure class, and type of joint shall be as shown on the plans. Where not shown otherwise, the pipe shall

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have cast iron pipe equivalent OD, elastomeric gasket bell joints, and dimension ratio (DR) of 14. Polyvinyl chloride (PVC) pipe shall conform to the provisions of AWWA C905 AWWA Standard for PVC Pressure pipe over 12" in diameter for water and shall conform to requirements set forth herein. The size, OD base, pressure class, and type of joint shall be as shown on the plans. Where not shown otherwise, the pipe shall have cast iron pipe equivalent OD, elastomeric gasket bell joints, and dimension ratio (DR) of 18. PVC pipe shall be marked to show that it has been approved by Underwriters Lab., Inc. The contractor shall furnish an affidavit from the pipe manufacturer that all delivered materials comply with Standard for PVC Pressure Pipe 4" through 12" for Water and shall conform to requirements set forth herein. Set screw retainer glands manufactured for PVC pipe, may be used to restrain pipe sections.

b. **Main Line Fittings:** All fittings used for connections shall have mechanical joints, except when specifically designated on the plans, flanged joints shall be used. Fittings shall conform to the "American National Standard for Gray Iron and Ductile Iron Fittings, 4 inch through 48 inch, for Water and Other Liquids", No. A21.10 (AWWA C153) as latest revised, for 250-psi pressure ratings for gray iron, except that fittings fourteen inches (14") and larger in size shall be ductile iron only. When Ductile Iron fittings are used they shall be class 350. All fittings shall have cement-mortar lining with a bituminous seal coat in accordance with the "American National Standard for Cement-Mortar Lining for Cast Iron and Ductile Iron Pipe and Fittings for Water", No. A21.4 (AWWA C104). The outside of pipe and fittings shall be coated with a standard bituminous coal tar or asphalt base coating. Set screw retainer glands manufactured for PVC pipe, may be used to restrain fittings. All glands used for fittings shall be approved for that fitting and shall be of similar manufacture. Solid sleeves for pipe 12 inches or smaller shall be a minimum of 12 inches long. Solid sleeves for pipe larger than 12 inches shall be a minimum of 15 inches long.

c. **Main Line Joints:** The size, joint type, and pressure rating shall be as shown on the plans. Where not otherwise shown, push-on joints shall be used. Pressure ratings shall be 250 psi or more.

d. **Prohibited Fittings and Glands:** From time to time certain fittings and glands are prohibited from use in the City of Broken Arrow. A current list of prohibited items may be obtained from the Operations Division, Public Works Department.

621 WATER LINE - DUCTILE IRON PIPE, FITTINGS, AND JOINTS (08/19/99):

621.01 DESCRIPTION: This specification covers ductile iron pipe, fittings, and joints pipe used in the water distribution system as main or distribution lines.

621.02 CRITERIA:

a. **Pipe:** Ductile iron shall conform to ASTM specifications A 536 with physical properties of Grade 60-42-10. The minimum standard thickness of each size pipe shall be in accordance with the manufacturers published recommendations based on trench conditions, backfill, loading and depth bury. These thicknesses are the minimum required. Greater thicknesses shall be furnished for special requirements as set out in the Construction Specifications or shown on the plans. Ductile iron pipe shall conform to "American National Standard for Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds for Water and Other Liquids", No. A 21.51 (AWWA C 151). Pipe shall be furnished in 18-foot or 20-foot lengths, except that shorter lengths may be used as necessary at fittings and connections. Minimum pipe class for four (4) inch pipe shall be class 51. For pipe larger than four (4) inch through 12 inch pipe the minimum class shall be shall 50. All pipe over 12 inch shall be class 51. Set screw retainer glands manufactured for ductile iron pipe, may be used to restrain pipe sections.

b. **Fittings:** All fittings used for connections shall have mechanical joints, except when specifically designated on the plan, flanged joints shall be used. Fittings shall conform to the "American National Standard for Ductile-Iron Fittings, 2" through 48", for Water and Other Liquids;, No. A 21.10 (AWWA C 153) and fittings fourteen inches (14") and larger in size shall be case from ductile iron only. When Ductile Iron fittings are used they shall be class 350. Set screw retainer glands manufactured for ductile iron pipe, may be used to restrain fittings. All glands used for fittings shall be approved for that fitting and shall be of similar manufacture. Solid sleeves for pipe 12 inches or smaller shall be a minimum of 12 inches long. Solid sleeves for pipe larger than 12 inches shall be a minimum of 15 inches long.

c. **Coatings and Linings:** All pipe and fitting shall have cement-mortar lining with a bituminous seal coat in

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accordance with the "American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water", No. A 21.4 (AWWA C104). The outside of pipe and fittings shall be coated with a standard bituminous coal-tar or asphalt base coating.

d. **Prohibited Fittings and Glands:** From time to time certain fittings and glands are prohibited from use in the City of Broken Arrow. A current list of prohibited items may be obtained from the Operations Division, Public Works Department.

622 WATER LINE - PRESTRESSED CONCRETE PIPE, FITTINGS, AND JOINTS (05/16/94):

622.01 DESCRIPTION: This specification covers prestressed concrete pipe, fittings, and joints used in the water distribution system as distribution lines.

622.02 CRITERIA:

a. **Pipe:** Prestressed concrete pipe and fittings shall conform to and be tested in accordance with the AWWA Standard for Reinforced Concrete Water Pipe Steel Cylinder Type, Prestressed, AWWA Designation C 301. All pipe shall be manufactured by an established manufacturer who has had at least three years experience in successfully building this type of pipe. Each length of straight pipe shall be plainly marked to indicate where the head for each pipe is designed and to indicate where the pipe will be used by reference to the layout drawings.

b. **Fittings:** All specials and fittings shall be either of Type A or Type B and must be built to the details furnished by the manufacturer and approved by the Engineer. Each special shall be plainly marked to indicate where the head for each special is designed and to indicate where the pipe will be used by reference to the layout drawings.

c. **Joints:** Reinforced concrete pipe and fittings for water lines shall be jointed according to AWWA Standard for Reinforced Concrete Water Pipe Steel Cylinder Type, Prestressed, AWWA Designation C 301.

623 WATER LINE - COPPER SERVICE LINE AND FITTINGS (05/16/94):

623.01 DESCRIPTION: This specification covers copper lines and fittings that are used from the tap to the water meter.

623.02 CRITERIA:

a. **Pipe:** Copper service pipe shall be a seamless copper tubing cold drawn to size. It shall be Type K soft annealed and shall meet the requirements of ASTM B 88.

b. **Fittings:** All fittings shall be of cast brass or bronze and shall be finished in a thoroughly workmanlike manner. They shall be sound, clean, free from blow holes, porous places, cracks, or any other defects affecting their strength or appearance, which would indicate inferior quality of metal. All moving parts shall be accurately fitted up so as to work smooth and freely, without binding. They shall be of standard type commonly used and shall be the product of a recognized manufacturer of such fittings. Each casting shall bear the name or trademark of the manufacturer, permanently cast in the metal. Connectors shall be flare or compression type.

624 WATER LINE TAPS (08/19/99):

624.01 DESCRIPTION: This specification covers taps on all main and distribution water lines.

624.02 CRITERIA:

a. **Service Line Taps (PVC and Ductile Iron Lines):** Service line taps shall have a solid brass body, brass straps, brass bolts, and brass nuts. The gaskets shall be tight sealing and resistant acids, alkalis, and water. Saddles shall be of the two (2) strap design and shall have a pressure rating equal to or greater than the pressure rating of the pipe. The saddles shall be Ford 202b brass service saddles or equal.

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b. **Main Line Taps (PVC and Ductile Iron Lines):** Tapping sleeves shall have a stainless steel body and stainless steel bolts and nuts. Tapping sleeves shall be full circle gasketed through 12 inch diameter, with flanged joint at the valve connection. Tapping sleeves shall conform to and be tested in accordance with the American Standard for Cast Iron Fittings, 2 inch through 48 inch for Water and Other Liquids, AWWA Designation C 100. Pressure rating shall be 250 PSI. Sleeves shall be Ford FAST style or equal. Tapping valves shall be of the same construction as specified for gate valves with seat opening larger than nominal size to permit full diameter cuts. Inlet ends are to be flanged to attach to the tapping sleeves. Outlet ends are to be mechanical joint. Tapping valves shall be Mueller or equal. Direct taps shall not be used.

c. **Prestressed Concrete Pipe Taps:** The tap used shall conform to the pipe manufactures recommendations. Tapping sleeves shall have a flanged joint at the valve connection. Tapping sleeves shall conform to and be tested in accordance with the American Standard for Cast Iron Fittings, 2 inch through 48 inch for Water and Other Liquids, AWWA Designation C 100. Pressure rating shall be 250 PSI. Tapping valves shall be of the same construction as specified for gate valves with seat opening larger than nominal size to permit full diameter cuts. Inlet ends are to be flanged to attach to the tapping sleeves. Outlet ends are to be mechanical joint. Tapping valves shall be Mueller or equal. Direct taps shall not be used.

625 WATER LINE - VALVES (05/16/94):

625.01 DESCRIPTION: This specification covers all valves used in the water distribution system.

625.02 CRITERIA:

a. **Gate Valves:** Gate valves shall conform to and be tested in accordance with, the AWWA Standard for Gate Valves for Ordinary Water Works Service; AWWA Designation C 500. Valves shall have double disc parallel seats, non-rising stem, vertical mounting "O" ring stem seal, counter clockwise opening and ends to fit the pipe or fitting to which attached. This type of valve shall be used only on lines larger than 12 inches in diameter. Only the following makes or approved equal will be permitted: Crane, Darling, Ludlow, Rensselaer, M & H, Mueller, A.P. Smith, or Kennedy.

b. **Resilient Seated Gate Valve:** Valves shall conform to AWWA C509, Standard for Resilient Seated Gate Valve. Wedge shall be constructed of ductile iron, fully encapsulated in synthetic rubber except for guide and wedge nut areas. Wedge rubber shall be molded in place and bonded to the ductile iron portion, and shall not be mechanically attached with screws, rivets or similar fasteners. Wedge shall seat against surfaces arranged symmetrically about the centerline of the operating stem, so that seating is equally effective regardless of direction of pressure unbalance across the wedge. All seating surfaces in body shall be inclined to the vertical at a minimum angle of 32 degrees (when stem is in a vertical position) to eliminate abrasive wear of rubber sealing surfaces. Stem shall be sealed by at least two "O" rings; all stem seals shall be replaceable with valve wide while open and subjected to full rate pressure. Waterway shall be smooth and have no depressions or cavities in seat area where foreign material can lodge and present closure or sealing. Valve body and bonnet shall be epoxy coated, inside and out.

c. **Butterfly Valves:** Butterfly valves shall be of the tight closing, rubber-seat type, with rubber seats which are securely fastened to the valve body. No metal-to-metal seating surfaces will be permitted. Valves shall be bubble-tight at rated pressures, and shall be satisfactory for applications involving valve operation after long periods of inactivity. Valve discs shall rotate 90 degrees from full open position to the tight-shut position. Valves 24 inch and larger shall be capable of providing bubble-tight shutoff with disc up to + one-quarter inch off dead center position. Valves shall meet the full requirements of AWWA Standard C-504-74, Class 150B. The valve bodies shall be mechanical joint end or flanged valves as shown on the plans. Valve bodies shall be constructed of cast iron, ASTM A-126, Class B. Flange drilling shall be in accordance with ANSI B16.1 Standard for cast iron flanges. Two trunnions for shaft bearings shall be integral with each valve body. Body thickness shall be strictly in accordance with AWWA Standard C 504-74. Valve discs shall be constructed of cast iron or ductile iron with stainless steel seating edge. Discs shall be secured to shafts by stainless steel pins sized to transmit torques required and withstand stresses imposed under specified operating conditions. Shafts of all valves shall be turned, ground and polished. Valve shafts shall be constructed of 18-8 type 304 Stainless steel. Shaft diameters must meet minimum requirements established by AWWA Standard C 504-74, Class 150B. Valve seats shall be of a synthetic rubber compound. Valve seats shall be field adjustable and replaceable without dismantling operator, disc, or shaft, and without removing the valve from the line. Seats shall be retained in the valve body by mechanical means without retaining rings, segments, screws or hardware of any kind in the flow stream. Seats shall be

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continuous throughout 360 degrees and shall have a plurality of grooves mating with a spherically shaped stainless steel disc edge seating surface. Seats attached to the valve disc are not acceptable. Valve bearings shall be fitted with sleeve type bearings. Bearings shall be corrosion resistant and self-lubricating. Bearing load shall not exceed one-fifth of the compressive strength of the bearing or shaft material. Placing shall be self adjusting chevron type. Valve operators shall conform to the operating requirements of AWWA Standard C504-74 and shall be designed to hold the valve in any intermediate position between full open fully closed without creeping or fluttering. The buried nut manual operator shall be of the traveling nut, self-locking type and shall be equipped with mechanical stop limiting devices to prevent over-travel of the disc in the closed or open positions. Operator components shall withstand an input torque of 450 ft/lbs at extreme operator positions without damage. The manufacturer shall have manufactured tight-closing, rubber seat butterfly valves for a period of at least five years. All valves shall be manufactured by the Henry Pratt Company or approved equal.

d. **Air Relief Valves:** Air relief valves shall be heavy-duty combination air release and vacuum type for 300 psi water working pressure, testing to 300 psi, two inch in size. Body, cover, and baffle shall be cast iron. All internal parts to be either highest quality stainless steel or bronze, the inside of the valve coated with rust inhibitor. Only the following makes or approved equal will be permitted: Apco No. 245C, Crispin, Val-Matic.

e. **Check Valves:** Check valves shall conform to, and be tested in accordance with the AWWA Standard for Swing-Check Valves for Ordinary Water Works Service, AWWA Designation C 508. They shall be horizontally mounted, single disc, swing type with a full diameter passage providing minimum pressure loss. Valves shall be of the non-slamming type designed for the future installation of outside lever and weight. Disc faces and seat rings shall be bronze. Ends shall fit the pipe or fitting to which attached (push-on, mechanical, or flanged). Only the following makes or approved equal will be permitted: Crane, Darling, Ludlow-Rensselaer, M & H Mueller, AP Smith.

f. **Ball Valves:** Ball valves shall be: double-seated with natural or synthetic rubber, bronze or monel metal seats; designed for 150 psi working pressure; flanged end; "O" ring rotor bearing seals; constructed of high tensile strength cast iron; equipped with totally enclosed manual operators, with open-closed indicator and hand wheel with standard size square wrench nut for one man operation and 150 psi unbalance across the valve. Valves shall be tested by and shall withstand without leak, a hydrostatic pressure of; (1) 250 psi on the valve body with the rotor in the open position; and (2) 150 psi on each side of the valve with the opposite side upon to atmosphere. Four copies of the test results and manufacturer's drawings shall be submitted for approval prior to delivery of the valve. Only the following makes or approved equal will be permitted: Allis-Chambers, Henry Pratt or Williamette Iron and Steel.

g. **Valve Operators:** Valves, operator housing, supports and connections shall have provisions for four-bolt mounting. Operators shall be equipped with a two inch (2") square operating nut and shall be fully grease packed and gasketed for buried service. Operators shall have a link-lever arrangement providing for characterized closure of the valve. Valves shall close with a clockwise rotation of the nut. Operators shall be of the Pratt MDT type or approved equal.

h. **Valve Painting:** All surfaces of the valve shall be clean, dry and free from grease before painting. The valve interior and exterior surfaces except for seating shall be evenly coated with asphalt varnish or epoxy paint in accordance with Federal Specifications TT-V-51 and AWWA Standard C 504-74. Hydrostatic and leakage tests shall be conducted in strict accordance with AWWA Standard C 504-74, Section 12.

626 FIRE HYDRANTS AND EXTENSIONS (08/19/99):

626.01 DESCRIPTION: This specification covers all fire hydrants and extensions used in the water distribution system.

626.02 CRITERIA:

a. **Characteristics:** Fire hydrants shall be dry-top traffic model designs conforming to AWWA C-502 - Standard for Dry Barrel Fire Hydrants with the following selective and design specifications:

Working Pressure	Minimum 150 psi
Size of valve opening	Minimum 4"
Direction to turn to open	Left(Counterclockwise)

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Size and shape of operating nuts	1 1/2" Pentagon
Size and shape of nozzle cap nuts	1" Pentagon
Pumper nozzle threading	National Standard
Hose nozzle threading	National Standard
Number & size of hose connections	2-2"; 1-4"
Nozzle attachment to barrel	Threaded or lug locked
Operating nut material	All bronze
Upper valve plat material	Bronze
Seat ring material	Bronze
Seat ring thread	Bronze to Bronze
Bonnet lubrication point	Externally accessible
Bonnet weather cap	Required
Color above ground	Red enamel
Minimum Bury Depth	3'
Size & Type of inlet connection	6" mechanical joint
Lubrication Type	Oil Bath or Lithium Grease

All hydrants shall be dry top design in which the operating stem threads and the bearing systems are sealed from the waterway and from external elements by "O" rings. Lubrication shall occur each time the hydrants are operated. Only the following hydrants will be permitted: Mueller Centurian or an approved equal.

b. **Painting:** Hydrants shall be provided with red machinery enamel as manufactured by Glidden, DuPont or equal.
627 DIG THROUGH LOCATOR TAPE: Shall be a foil tape colored blue with "Water Line Buried" printed on the tape. It shall be Terra Tape Sentry Line 620 or approved equal.

650 SANITARY SEWER - PVC PIPE, FITTINGS, AND JOINTS (08/19/99):

650.01 DESCRIPTION: This specification covers all PVC pipe used in the sanitary sewer collection system as both gravity sewers and force mains.

650.02 CRITERIA:

a. Gravity Sewers:

1. Pipe: Polyvinyl Chloride Pipe (PVC) shall conform to ASTM Specifications D-3034-73, SDR 35. The material used in the pipe shall be virgin PVC material, except that scrap material from the manufacturing process may be reused. The wall thickness of the pipe shall be a side-to-diameter ratio of not more than 35. All pipe shall be suitable for use as a gravity sewer. Provisions must be made for contraction and expansion of each joint with a rubber ring. The bell shall consist of an integral wall section with a solid cross-section rubber ring, factory assembled, securely locked into place to prevent displacement and shall conform to ASTM Specifications D-1869. The standard length of PVC pipe shall be twenty (20) feet. Joint length may be reduced to 13 feet when construction conditions require the use of a trench box. The pipe stiffness shall be determined in accordance with the ASTM Designation D-2412 and the minimum pipe stiffness at five percent (5%) deflection shall be 46 for all sizes when tested in accordance with ASTM Designation. The contractor shall furnish an affidavit from the pipe manufacturer that all delivered materials comply with the requirements of the specifications.

2. Fittings: All fittings shall meet applicable pipe specifications and shall have bell and/or spigot configuration identical to that of the pipe.

3. Joints: All pipe shall have integral bell with a rubber gasket to form a water-tight joint.

4. Joint Length: Unless authorized in writing, by the City, full joints shall be 20 feet in length. Joint length may be reduced to 13 feet when construction conditions require the use of a trench box.

b. Force Mains:

1. Pipe: Polyvinyl chloride (PVC) pipe shall conform to the provisions of AWWA C900 AWWA Standard for PVC Pressure pipe 4" through 12" for water and shall conform to requirements set forth herein.

The size, OD base, pressure class, and type of joint shall be as shown on the plans. Where not shown otherwise, the pipe shall have ductile iron pipe equivalent OD, elastomeric gasket bell joints, and dimension ratio (DR) of 18. PVC pipe shall be marked to show that it has been approved by Underwriters Lab., Inc. The contractor shall furnish an affidavit

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from the pipe manufacturer that all delivered materials comply with the requirements of the specifications.

2. **Fittings:** All fittings used for connections shall have mechanical joints, except when specifically designated on the plans, flanged joints shall be used. Fittings shall conform to the "American National Standard for Gray Iron and Ductile Iron Fittings, 4 inch through 48 inch, for Water and Other Liquids", No. A21.10 (AWWA C153) as latest revised, for 250-psi pressure ratings for gray iron, except that fittings fourteen inches (14") and larger in size shall be ductile iron only. When Ductile Iron fittings are used they shall be class 350. All fittings shall have cement-mortar lining with a bituminous seal coat in accordance with the "American National Standard for Cement-Mortar Lining for Cast Iron and Ductile Iron Pipe and Fittings for Water", No. A21.4 (AWWA C104). The outside of pipe and fittings shall be coated with a standard bituminous coal tar or asphalt base coating.

3. **Joints:** The size, joint type, and pressure rating and type of iron shall be as shown on the plans. Where not otherwise shown, push-on joints shall be used. Pressure ratings shall be 250 psi or more, and the iron may be either gray iron or ductile iron.

4. **Joint Length:** Unless authorized in writing, by the City, full joints shall be 20 feet in length. Joint length may be reduced to 13 feet when construction conditions require the use of a trench box.

651 SANITARY SEWER - DUCTILE IRON PIPE, FITTINGS, AND JOINTS (08/19/99):

651.01 DESCRIPTION: This specification covers all ductile iron pipe used in the sanitary sewer collection system as aerial crossings or force main crossings. This material may be used for very limited applications and requires written approval of the Public Works Director.

651.02 CRITERIA:

a. **Pipe:** Ductile iron shall conform to ASTM specifications A 536 with physical properties of Grade 60-42-10. The minimum standard thickness of each size pipe shall be in accordance with the manufacturers published recommendations based on trench conditions, backfill, loading and depth bury. These thicknesses are the minimum required. Greater thicknesses shall be furnished for special requirements as set out in the Construction Specifications or shown on the plans. Ductile iron pipe shall conform to "American National Standard for Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds for Water and Other Liquids", No. A 21.51 (AWWA C 151). Pipe shall be furnished in 18-foot or 20-foot lengths, except that shorter lengths may be used as necessary at fittings and connections.

b. **Fittings:** All fittings used for connections shall have either mechanical joints or bell and spigot joints, except, when specifically designated on the plan, flanged joints shall be used. Fittings shall conform to the "American National Standard for Ductile-Iron Fittings, 2" through 48", for Water and Other Liquids, No. A 21.10 (AWWA C 110) and fittings fourteen inches (14") and larger in size shall be case from ductile iron only. When Ductile Iron fittings are used they shall be class 350.

c. **Joints:** All pipe shall be furnished with a mechanical joint conforming to the "American Pressure Pipe and Fitting", No. A21.11 (AWWA C111).

d. **Coatings and Linings:** All pipe and fittings shall have calcium aluminate mortar lining with a bituminous seal coat in accordance with the "American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water", No. A 21.4 (AWWA C104). The outside of pipe and fittings shall be coated with a standard bituminous coal-tar or asphalt base coating.

652 SANITARY SEWER - REINFORCED CONCRETE PIPE, FITTINGS, AND JOINTS (08/19/99):

652.01 DESCRIPTION: This specification covers all reinforced concrete pipe used in the sanitary sewer collection system.

652.02 CRITERIA:

a. **Pipe and Fittings:** Reinforced concrete sewer pipe shall conform to and be tested in accordance with the specifications of the American Society for Testing Materials, Designation C 76, for "Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe", of the class as shown on the drawings. No lengths of pipe shall be less than eight feet (8'). All concrete pipe shall be coated inside with two (2) coats (minimum of 30 mils total) of a coal tar epoxy, Koppers Bitumastic 300M, High Build or Tnemec Hi-Build Tneme-Tar, or equal, in accordance with manufacture's recommended

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application methods.

b. **Joints:** Joints shall be Bureau of Reclamation R4 bell and spigot. Gaskets shall be neoprene or polysprene seal type as specified by the design engineer.

653 SANITARY SEWER - TAPS (08/19/99):

653.01 DESCRIPTION: This specification covers all taps on pipes used in the sanitary sewer collection system.

653.02 CRITERIA:

All service connections to PVC sewers shall be with PVC saddles placed in accordance with manufacturer's recommendations. Connections shall be epoxyed and bound in place with suitable straps. The pipe material and fittings shall be similar and equal to John-Mansville PVC Gravity Sewer Pipe and Fittings, TRX-11. The alternative tapping system shall be inserta tees or approved equal. Inserta tees shall be for the type of pipe being tapped and installed in accordance with the manufacture's recommendations.

654 SANITARY SEWER - VALVES (05/16/94):

654.01 DESCRIPTION: This specification covers all valves used in the sanitary sewer collection system.

654.02 CRITERIA: All valves must be suitable for use in a sanitary sewer environment and must meet the following requirements:

a. **Resilient Seated Gate Valve:** Valves shall conform to AWWA C509, Standard for Resilient Seated Gate Valve. Wedge shall be constructed of ductile iron, fully encapsulated in synthetic rubber except for guide and wedge nut areas. Wedge rubber shall be molded in place and bonded to the ductile iron portion, and shall not be mechanically attached with screws, rivets or similar fasteners. Wedge shall seat against surfaces arranged symmetrically about the centerline of the operating stem, so that seating is equally effective regardless of direction of pressure unbalance across the wedge. All seating surfaces in body shall be inclined to the vertical at a minimum angle of 32 degrees (when stem is in a vertical position) to eliminate abrasive wear of rubber sealing surfaces. Stem shall be sealed by at least two "O" rings; all stem seals shall be replaceable with valve wide while open and subjected to full rate pressure. Waterway shall be smooth and have no depressions or cavities in seat area where foreign material can lodge and present closure or sealing. Valve body and bonnet shall be epoxy coated, inside and out.

b. **Butterfly Valves:** Butterfly valves shall be of the tight closing, rubber-seat type, with rubber seats which are securely fastened to the valve body. No metal-to-metal seating surfaces will be permitted. Valves shall be bubble-tight at rated pressures, and shall be satisfactory for applications involving valve operation after long periods of inactivity. Valve discs shall rotate 90 degrees from full open position to the tight-shut position. Valves 24 inch and larger shall be capable of providing bubble-tight shutoff with disc up to + one-quarter inch off dead center position. Valves shall meet the full requirements of AWWA Standard C-504-74, Class 150B. The valve bodies shall be mechanical joint end or flanged valves as shown on the plans. Valve bodies shall be constructed of cast iron, ASTM A-126, Class B. Flange drilling shall be in accordance with ANSI B16.1 Standard for cast iron flanges. Two trunnions for shaft bearings shall be integral with each valve body. Body thickness shall be strictly in accordance with AWWA Standard C 504-74. Valve discs shall be constructed of cast iron or ductile iron with stainless steel seating edge. Discs shall be secured to shafts by stainless steel pins sized to transmit torques required and withstand stresses imposed under specified operating conditions. Shafts of all valves shall be turned, ground and polished. Valve shafts shall be constructed of 18-8 type 304 Stainless steel. Shaft diameters must meet minimum requirements established by AWWA Standard C 504-74, Class 150B. Valve seats shall be of a synthetic rubber compound. Valve seats shall be field adjustable and replaceable without dismantling operator, disc, or shaft, and without removing the valve from the line. Seats shall be retained in the valve body by mechanical means without retaining rings, segments, screws or hardware of any kind in the flow stream. Seats shall be continuous throughout 360 degrees and shall have a plurality of grooves mating with a spherically shaped stainless steel disc edge seating surface. Seats attached to the valve disc are not acceptable. Valve bearings shall be fitted with sleeve type bearings. Bearings shall be corrosion resistant and self-lubricating. Bearing load shall not exceed one-fifth of the compressive strength of the bearing or shaft material. Placing shall be self adjusting chevron type. Valve operators shall conform to the operating requirements of AWWA Standard C504-74 and shall be designed to hold the valve in any intermediate position between full open fully closed without creeping or fluttering. The buried nut manual operator shall

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be of the traveling nut, self-locking type and shall be equipped with mechanical stop limiting devices to prevent over-travel of the disc in the closed or open positions. Operator components shall withstand an input torque of 450 ft/lbs at extreme operator positions without damage. The manufacturer shall have manufactured tight-closing, rubber seat butterfly valves for a period of at least five years. All valves shall be manufactured by the Henry Pratt Company or approved equal.

c. **Air Relief Valves:** Air relief valves shall be heavy-duty combination air release and vacuum type for 300 psi water working pressure, testing to 300 psi, two inch in size. Body, cover, and baffle shall be cast iron. All internal parts to be either highest quality stainless steel or bronze, the inside of the valve coated with rust inhibitor. Only the following makes or approved equal will be permitted: Apco No. 245C, Crispin, Val-Matic.

d. **Check Valves:** Check valves shall conform to, and be tested in accordance with the AWWA Standard for Swing-Check Valves for Ordinary Water Works Service, AWWA Designation C 508. They shall be horizontally mounted, single disc, swing type with a full diameter passage providing minimum pressure loss. Valves shall be of the non-slamming type designed for the future installation of outside lever and weight. Disc faces and seat rings shall be bronze. Ends shall fit the pipe or fitting to which attached (push-on, mechanical, or flanged). Only the following makes or approved equal will be permitted: Crane, Darling, Ludlow-Rensselaer, M & H Mueller, AP Smith.

e. **Ball Valves:** Ball valves shall be: double-seated with natural or synthetic rubber, bronze or monel metal seats; designed for 150 psi working pressure; flanged end; "O" ring rotor bearing seals; constructed of high tensile strength cast iron; equipped with totally enclosed manual operators, with open-closed indicator and hand wheel with standard size square wrench nut for one man operation and 150 psi unbalance across the valve. Valves shall be tested by and shall withstand without leak, a hydrostatic pressure of; (1) 250 psi on the valve body with the rotor in the open position; and (2) 150 psi on each side of the valve with the opposite side upon to atmosphere. Four copies of the test results and manufacturer's drawings shall be submitted for approval prior to delivery of the valve. Only the following makes or approved equal will be permitted: Allis-Chambers, Henry Pratt or Williamette Iron and Steel.

f. **Valve Operators:** Valves, operator housing, supports and connections shall have provisions for four-bolt mounting. Operators shall be equipped with a two inch (2") square operating nut and shall be fully grease packed and gasketed for buried service. Operators shall have a link-lever arrangement providing for characterized closure of the valve. Valves shall close with a clockwise rotation of the nut. Operators shall be of the Pratt MDT type or approved equal.

g. **Valve Painting:** All surfaces of the valve shall be clean, dry and free from grease before painting. The valve interior and exterior surfaces except for seating shall be evenly coated with asphalt varnish or epoxy paint in accordance with Federal Specifications TT-V-51 and AWWA Standard C 504-74. Hydrostatic and leakage tests shall be conducted in strict accordance with AWWA Standard C 504-74, Section 12.

655 SANITARY SEWER - MANHOLES (08/19/99):

655.01 DESCRIPTION: This specification covers all manholes used in the sanitary sewer collection system, except for manholes used for valves.

655.02 CRITERIA:

a. **Castings:** Castings for manholes shall conform to and be tested in accordance with the specifications for Gray Cast Iron ASTM, Designation A 48, Class 30. Castings shall conform to dimensions shown on the Standard Drawing, shall be bodily filleted at angles and the arises shall be sharp and perfect, true to form and thickness. Frames or covers that are to be located in traveled ways or in any location subject to vehicular traffic shall have all bearing surface machined so that fitting parts will not rattle or rock under traffic and the covers shall fit frames without wedging. All castings shall be thoroughly cleaned and given two coats of bituminous paint. Covers shall carry the legend "Broken Arrow Sewer" in one inch (1") letters. All castings shall be subject to a hammer test before installation. Manhole frame and cover shall be as shown on Standard Drawing SS09. The ring and lid shall be connected to the manhole with a non-shrink grout and asphaltic mastic shall be placed on the interior joint.

b. **Precast Sections:** Precast manhole sections to include bases shall conform to and be tested in accordance with the specifications for Precast Reinforced Concrete Manhole Risers and Tops, ASTM Designation C 478. The sides shall have a minimum thickness of 5" and a maximum thickness of 8". The minimum interior diameter shall be 4'. The precast

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manholes shall be as shown in Standard Drawing SS08. Cast Iron steps shall be placed in the manhole beginning 15" above the invert and 15" on center to within 18" of the top of the manhole. Steps shall be as shown on Standard Drawing SS11. The joints and lifting holes shall be grouted inside and outside with a non-shrink grout. The exterior of all joints and lifting holes shall be covered with asphaltic mastic, as specified in section 658, for a distance of four (4) inches past the grouted area in all directions.

c. **Elevation Adjustment Rings:** Shall be fabricated of 3,000 PSI concrete in thicknesses of two (2) to four (4) inches. They shall be fabricated and installed as shown on Standard Drawings SS07 and SS08.

d. **Brick Manholes:** Brick manholes may be used for sanitary sewer with the written approval of the Public Works Director. When used these manholes will be coated on the exterior with an approved asphaltic coating as specified in section 658. All other requirements for precast manholes will be met.

e. **Cast in Place Manholes:** Shall conform to the requirements in standard drawing SS07.

656 SANITARY SEWER - LAMPHOLE CASTINGS (05/16/94):

656.01 DESCRIPTION: This specification covers all lamphole castings used in the sanitary sewer collection system.

656.02 CRITERIA: Castings for lampholes shall conform to and be tested in accordance with the specifications for Gray Cast Iron ASTM, Designation A 48, Class 30. Castings shall conform to dimensions shown on the Standard Drawing, shall be bodily filleted at angles and the arises shall be sharp and perfect, true to form and thickness. Frames or covers that are to be located in traveled ways or in any location subject to vehicular traffic shall have all bearing surface machined so that fitting parts will not rattle or rock under traffic and the covers shall fit frames without wedging. All castings shall be thoroughly cleaned and given two coats of bituminous paint. All castings shall be subject to a hammer test before installation. Minimum lid weight 12 pounds. Minimum Frame weight 110 pounds.

657 DIG THROUGH LOCATOR TAPE: Shall be a foil tape colored green with "Sewer Line Buried" printed on the tape. It shall be Terra Tape Sentry Line 620 or approved equal.

658 ASPHALTIC MASTIC: Shall be an asphaltic mastic coating compound such as BIDCO Sealants BIDCO - 56 or approved equal.

SECTION 700 - PLAN NOTES AND STANDARD DETAILS

WATER NOTES

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1. All water distribution systems shall be designed in accordance with the current City of Broken Arrow Land Subdivision Code and constructed in accordance with the current City of Broken Arrow Standard Construction Specifications.
2. Prior to starting construction the Contractor shall participate in a Pre-Construction Conference with the Public Works Department. At this conference the contractor shall furnish certification from the manufacturer/supplier that all materials meet applicable specifications. Certifications shall be supplied in five (5) copies with three (3) copies stamped and approved, by the City, returned to the contractor. Materials shall not be installed until they have been approved by the City.
3. All water distribution system construction shall be inspected by the Public Works Department Utility Inspectors, in accordance with City of Broken Arrow Administrative Regulation 11-15.
4. Dig through locator tape will be buried 2 feet above the line.
5. When C-900 PVC is used, a No. 8 bare copper wire shall be taped to the top surface of the pipe and connected to each fire hydrant by attaching to a bolt, just above ground level.
6. All iron pipe and fittings shall be polywrapped.
7. Street crossings for main lines twelve (12) inches and larger, shall be placed in conduit.
8. Street crossings across existing arterials shall be bored. Conduit shall be installed, in the boring, for all main lines four (4) inches and larger. Arterials will be open cut only with the prior written approval of the Public Works Director.
9. All distribution lines in conduit and at drainage feature crossings shall be constructed with restrained joints.
10. All main lines shall have a minimum of three (3) feet and a maximum of eight (8) feet of cover.
11. Bedding, backfill, and compaction over water lines shall be in accordance with Standard Drawing W01. Backfill and compaction requirement for streets shall extend two (2) feet back of curb.
12. All water distribution system lines, except dead end for fire hydrants only, shall be looped to provide circulation.
13. Distribution lines smaller than four (4) inches shall not be installed.
14. Service lines shall be tapped to main lines using solid brass saddles.
15. Service lines shall be seamless copper water tube meeting the requirements of ASTM-B88.
16. All service line fittings shall be brass with flared, compression, soldered, or threaded connections.
17. When conduit is provided for service lines it shall be schedule 40 PVC or stronger.
18. Fire Hydrants:
 - a. Fire hydrants shall be Mueller Centurian or an approved equal.
 - b. Each hydrant shall be set with the streamer nozzle facing the street and with a minimum clearance of eighteen (18) inches above the finished grade.
 - c. All exposed portions of fire hydrants shall be painted with a bright red enamel as manufactured by Glidden or Dupont.
19. When working in or adjacent to existing subdivisions only one (1) days worth of trench may be open at a given time. This requirement may be modified, in writing by the Public Works Director, for a specific project.
20. Road closures must be coordinated a minimum of twenty four (24) hours in advance. Roads will not be closed for over eight (8) hours without written permission from the Public Works Director.

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SEWER NOTES

August 19, 1999

1. All sanitary sewer collection systems shall be designed in accordance with the current City of Broken Arrow Land Subdivision Code and constructed in accordance with the current City of Broken Arrow Standard Construction Specifications.
2. Prior to starting construction the Contractor shall participate in a Pre-Construction Conference with the Public Works Department. At this conference the contractor shall furnish certification from the manufacturer/supplier that all materials meet applicable specifications. Certifications shall be supplied in five (5) copies with three (3) copies stamped and approved, by the City, returned to the contractor. Materials shall not be installed until they have been approved by the City.
3. All sanitary sewer collection system construction shall be inspected by the Public Works Department Utility Inspectors, in accordance with City of Broken Arrow Administrative Regulation 11-15.
4. C900 PVC pipe shall be used at any point where concrete encasement is specified, or where a water main is within two (2) feet of the sewer.
5. Concrete encasement will be required at any point where centerline cut to original ground is 30 inches or less.
6. All taps shall be installed during lateral construction.
7. Special risers shall be installed for each lot where the main sewer depth will be fifteen (15) feet or greater below finished grade.
8. Bedding, backfill, and compaction shall be in accordance with Standard Drawing SS01. Street backfill and compaction requirements shall extend two (2) feet back of curb. When replacing a sewer in service 3/8 inch chips shall be used for bedding and initial backfill.
9. Taps on existing lines, that did not have taps installed during construction, shall be installed in accordance with Standard Drawing SS02.
10. All force mains constructed of non-metallic pipe shall have a No. 8 bare copper conductor wire taped to the top surface of the pipe and bolted to lift station and manhole ring.
11. When working in or adjacent to existing subdivisions only one (1) days worth of trench may be open at a given time. This requirement may be modified, in writing by the Public Works Director, for a specific project.
12. Road closures must be coordinated a minimum of twenty four (24) hours in advance. Roads will not be closed for over eight (8) hours without written permission from the Public Works Director.
13. Dig through locator tape will be buried 2 feet above the sewer line.
14. Service lines running across roadways shall be schedule 40 PVC, flowfilled in place.

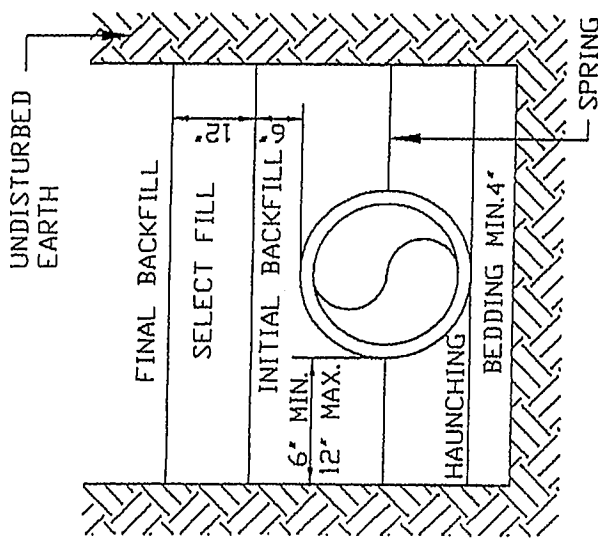
PAVING, DRAINAGE AND EROSION CONTROL NOTES

August 19,1999

1. All paving, drainage and erosion control shall be designed in accordance with the current City of Broken Arrow Land Subdivision Code and constructed in accordance with the current City of Broken Arrow Standard Construction Specifications.
2. Prior to starting construction the contractor shall participate in a Pre-Construction Conference with the Public Works Department. At this conference the contractor shall furnish certification from the manufacturer/supplier that all materials meet applicable specification. This information shall include moisture density curves for material to be used for embankment or subgrade construction, aggregate gradation tests, and mix designs for Portland cement concrete and/or asphaltic concrete. Certifications shall be supplied in five (5) copies with three (3) copies stamped and approved, by the City, returned to the contractor. Materials shall not be installed until they have been approved by the City.
3. All paving, drainage and erosion control construction shall be inspected by the Public Works Department Utility Inspectors, in accordance with City of Broken Arrow Administrative Regulation 11-15.
4. All utility construction (water, sewer, and storm water) shall be completed prior to subgrade preparation.
5. Subgrade shall be free of all organic matter, treated, and compacted according to the plans and specifications.
6. Sequence of construction for lime treated subgrades shall be blue top and fine grade, lime treated and stabilized, and then final fine grading.
7. Compaction tests shall be taken a minimum of once every 4,500 square feet for each eight (8) inch lift of material.
8. Subgrades shall be proof rolled if the stability of the material is questioned.
9. Paving shall be a minimum of 26' face to face of curb and centered in the right of way.
10. The Contractor shall furnish the following testing services by a reputable independent testing laboratory approved by the City:
 - a. Field density tests of embankment, subgrade, or base, at locations specified by the Inspector.
 - b. Stability, density, bitumen content and gradation tests of asphaltic concrete every 200 tons or daily which ever is less.
 - c. Compression test of concrete cylinders at seven (7) and twenty-eight (28) days with one (1) of each tests conducted for every 100 cubic yards placed.
 - d. One core sample, at a location specified by the inspector for every 8,000 square feet of pavement.
11. The paving contractor shall adjust all valve boxes to grade after paving of streets has been completed.
12. The paving contractor shall place a concrete collar two (2) feet square and equivalent in thickness to the street being constructed, around each valve box not located in a paved area. The valve box shall be adjusted to grade prior to placing of the concrete collar.
13. The paving contractor shall mark all water line crossings by cutting a "W" 1/4 inch deep in the face of the curb, over the crossing, and painting the "W" blue. The paving contractor shall mark all water valve locations by cutting a "V" 1/4 inch deep in the face of the curb, over the valve, and painting the "V" blue.
14. Storm sewer bedding, backfill, and compaction shall be in accordance with Standard Drawing ST01.
15. When storm sewers are constructed of material that does not have a locking band at the joints, each joint will be wrapped as shown in Standard Drawing ST02.
16. All drop inlets shall have cast iron hoods.
17. All culverts shall be furnished with headwalls on both ends, and an apron on the downstream side.
18. Erosion control shall start with initial construction and be practiced throughout the project.
19. Hay bale dikes or silt fences shall be constructed adjacent to all drainage ways.
20. Upon completion of the storm sewer, hay bale dikes or silt fences shall be constructed in all areas that will erode into the storm sewer system.
21. Vegetative cover shall be established on all disturbed areas as soon as the work is completed.
22. Road closures must be coordinated a minimum of twenty four (24) hours in advance. Roads will not be closed for over eight (8) hours without written permission from the Public Works Director.

NON-PAVED AREAS		PAVED AREAS	
HDPE	STEEL	STEEL	CONCRETE
EXCAVATED MATERIAL	EXCAVATED MATERIAL	FLOWABLE FILL OR TYPE A ROCK	FLOWABLE FILL OR TYPE A ROCK
SELECT FILL	SELECT FILL	FLOWABLE FILL OR TYPE A ROCK	FLOWABLE FILL OR TYPE A ROCK
SAND	SAND	FLOWABLE FILL OR TYPE A ROCK	FLOWABLE FILL OR TYPE A ROCK
3/4" WASHED ROCK	3/4" WASHED ROCK	3/4" WASHED ROCK	3/4" WASHED ROCK
3/8" CHIPS OR 3/4" WASHED ROCK	3/8" CHIPS OR 3/4" WASHED ROCK	3/8" CHIPS	3/8" CHIPS

NON-PAVED AREAS		PAVED AREAS	
HDPE	STEEL	STEEL	CONCRETE
EXCAVATED MATERIAL	EXCAVATED MATERIAL	FLOWABLE FILL OR TYPE A ROCK	FLOWABLE FILL OR TYPE A ROCK
SELECT FILL	SELECT FILL	FLOWABLE FILL OR TYPE A ROCK	FLOWABLE FILL OR TYPE A ROCK
SAND	SAND	FLOWABLE FILL OR TYPE A ROCK	FLOWABLE FILL OR TYPE A ROCK
3/4" WASHED ROCK	3/4" WASHED ROCK	3/4" WASHED ROCK	3/4" WASHED ROCK
3/8" CHIPS OR 3/4" WASHED ROCK	3/8" CHIPS OR 3/4" WASHED ROCK	3/8" CHIPS	3/8" CHIPS



- NOTES:
1. SELECT FILL CONSISTS OF EXCAVATED MATERIALS CONTAINING NO ROCKS LARGER THAN 2 INCHES.
 2. BEDDING REQUIRED FOR ALL STORM SEWER REPLACEMENT PROJECTS, IN ROCK EXCAVATION, AND FOR LEVELING TRENCH IN NEW INSTALLATION.
 3. COMPACTION REQUIREMENTS:
 - a. NON-PAVED AREAS: 90% MAXIMUM STANDARD PROCTOR DENSITY FOR COHESIONLESS SOILS AND 85% FOR COHESIVE SOILS.
 - b. PAVED AREAS: 95% MAXIMUM STANDARD PROCTOR DENSITY FOR COHESIONLESS SOILS.
 4. FLOWABLE FILL MAY BE SUBSTITUTED FOR ALL MATERIALS IN ROAD CROSSING.

STORM SEWER PIPE BEDDING DETAIL

CITY OF BROKEN ARROW

STANDARD DRAWING: STD ST 01

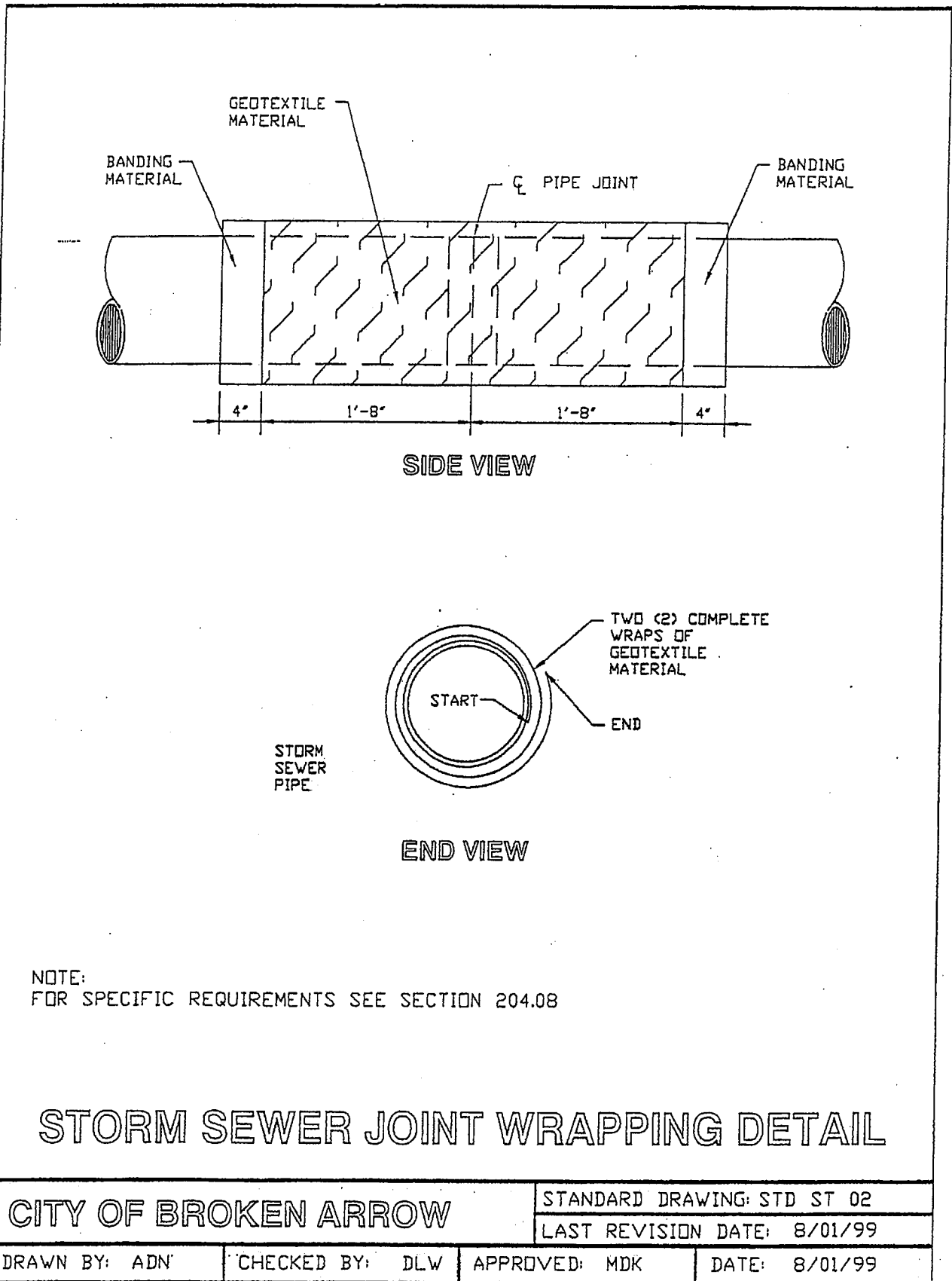
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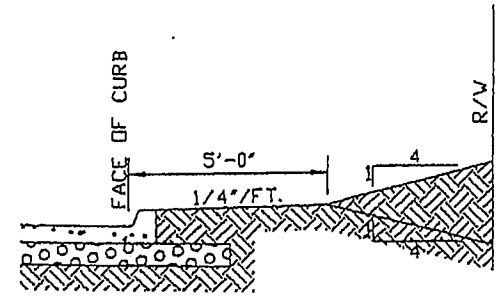
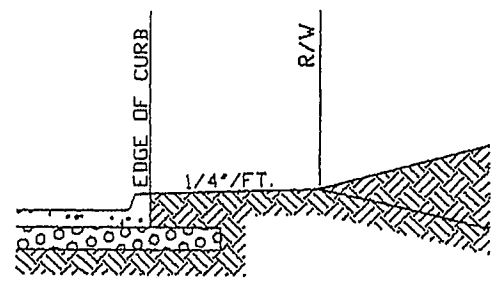
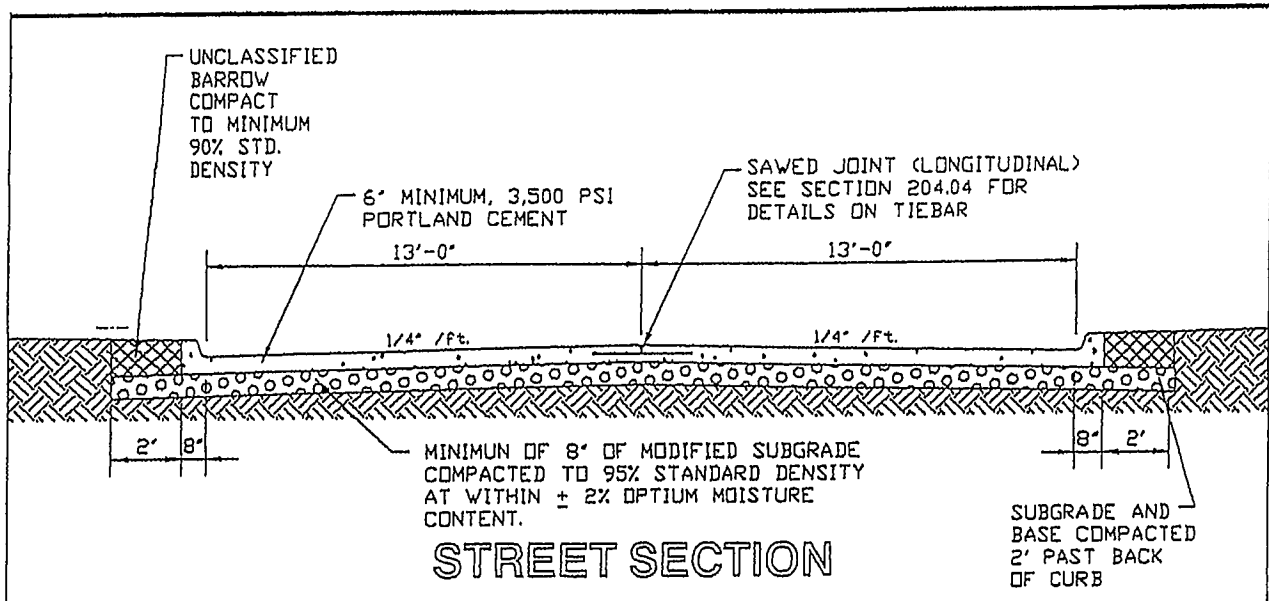
DRAWN BY: ADN

CHECKED BY: DLW

APPROVED: MDK

DATE: 8/01/99

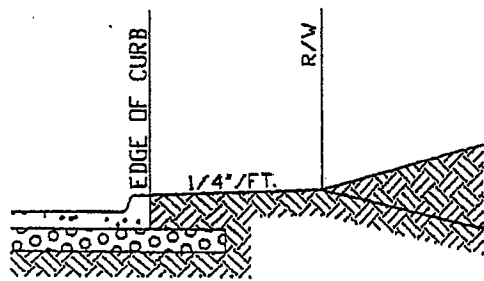
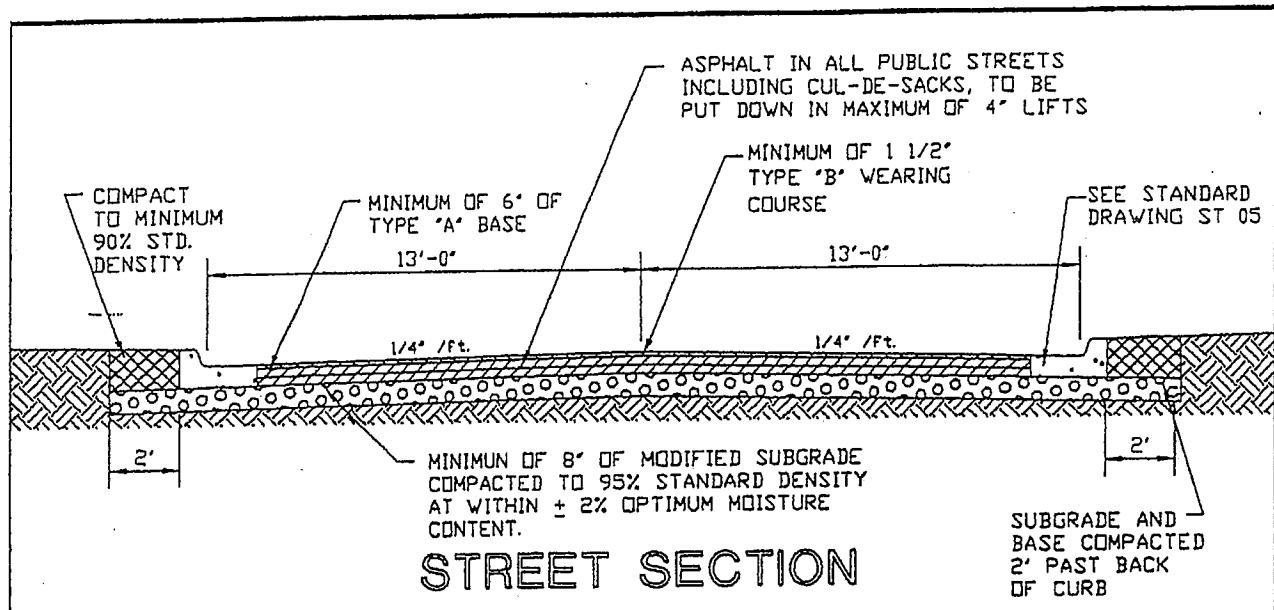




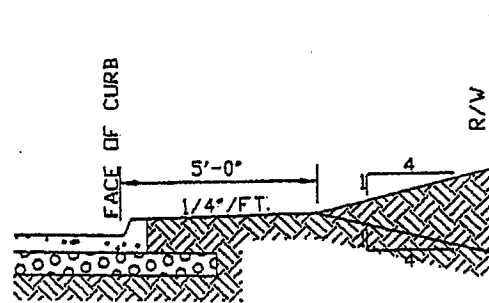
RIGHT OF WAY GRADING

**CONCRETE STREET SECTION
W/ CURB AND GUTTER**

CITY OF BROKEN ARROW		STANDARD DRAWING: STD ST 03	
		LAST REVISION DATE: 8/01/99	
DRAWN BY: ADN	CHECKED BY: DLW	APPROVED: MDK	DATE: 8/01/99



NORMAL CONDITIONS

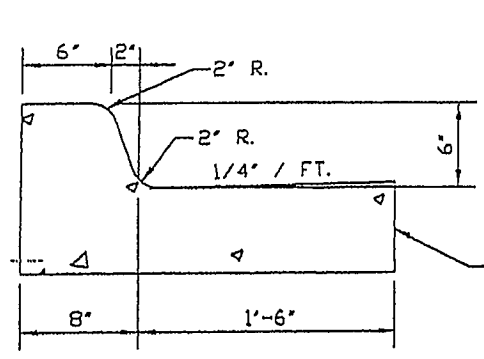


HILLY CONDITIONS

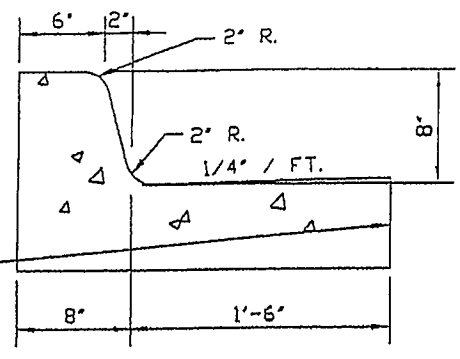
RIGHT OF WAY GRADING

**ASPHALT STREET SECTION
W/ CURB AND GUTTER**

CITY OF BROKEN ARROW		STANDARD DRAWING: STD ST 04	
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DRAWN BY: ADN	CHECKED BY: DLW	APPROVED: MDK	DATE: 8/01/99

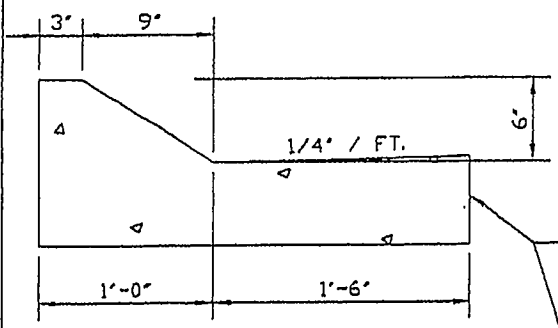


6" BARRIER CURB & GUTTER

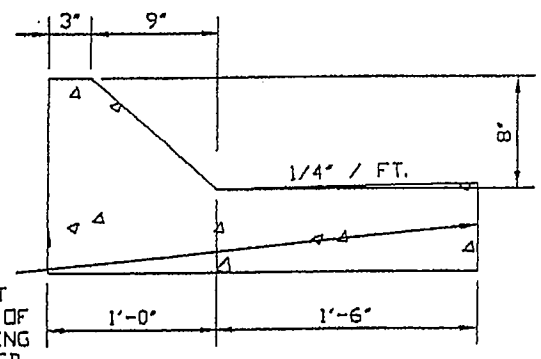


8" BARRIER CURB & GUTTER

6" MINIMUM EQUIVALENT THICKNESS OF STREET BEING CONSTRUCTED

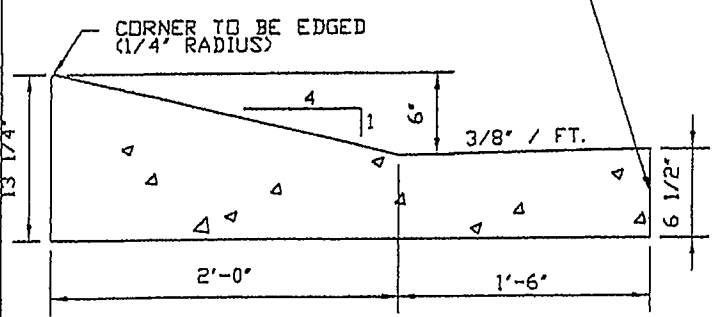


6" MOUNTABLE CURB & GUTTER

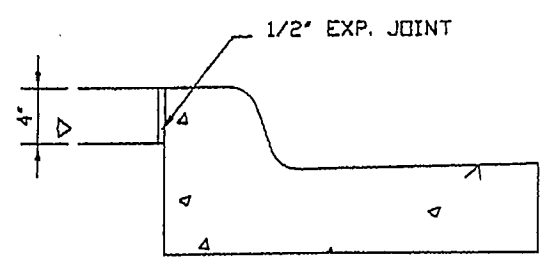


8" MOUNTABLE CURB & GUTTER

6" MINIMUM EQUIVALENT THICKNESS OF STREET BEING CONSTRUCTED



RESIDENTIAL MOUNTABLE CURB

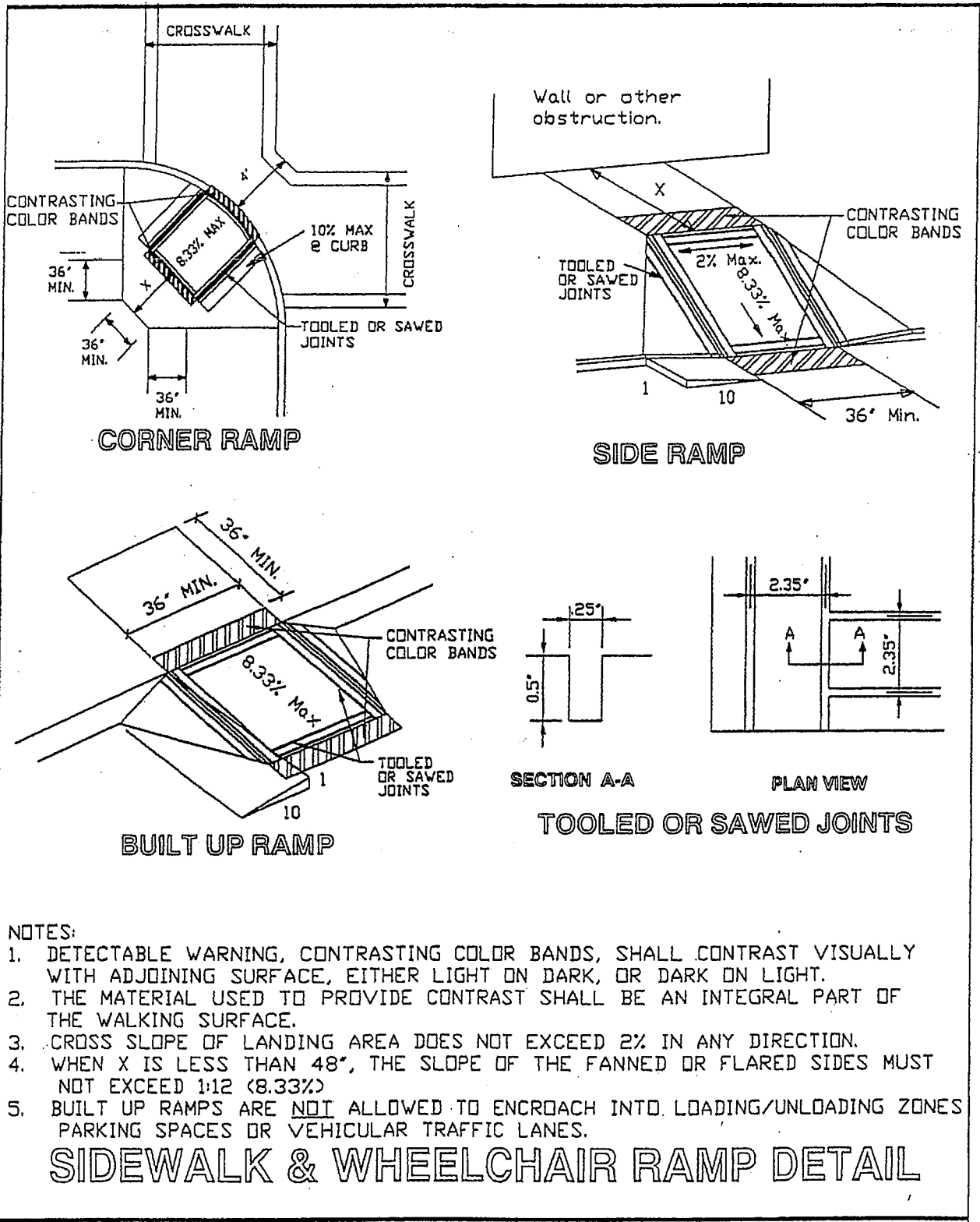


SIDEWALK ADJACENT TO CURB

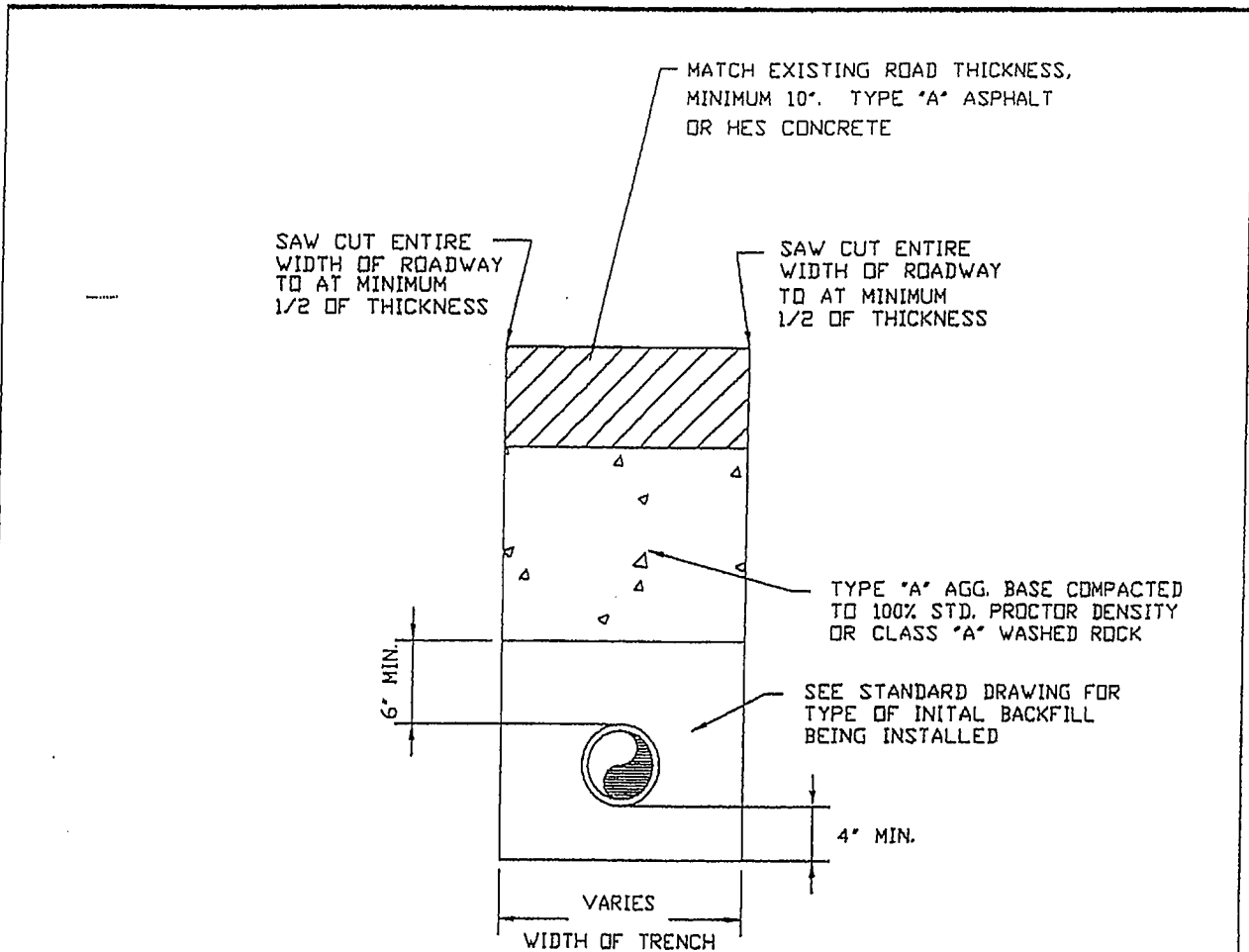
NOTE:
SEE SECTION 204.05 FOR DETAIL ON JOINTS AND TIEBARS

CURB AND GUTTER DETAIL

CITY OF BROKEN ARROW		STANDARD DRAWING: STD ST 05	
		LAST REVISION DATE: 8/01/99	
DRAWN BY: ADN	CHECKED BY: DLW	APPROVED: MDK	DATE: 8/01/99



CITY OF BROKEN ARROW			STANDARD DRAWING: STD ST 06	
			LAST REVISION DATE: 8/01/99	
DRAWN BY: ADN	CHECKED BY: DLW	APPROVED: MDK	DATE: 8/01/99	



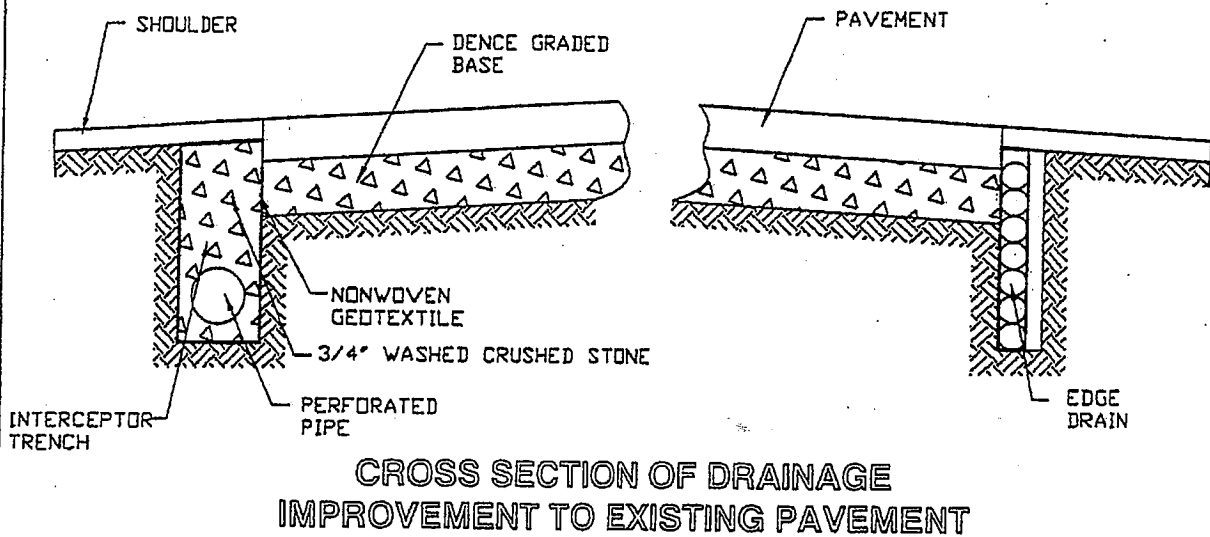
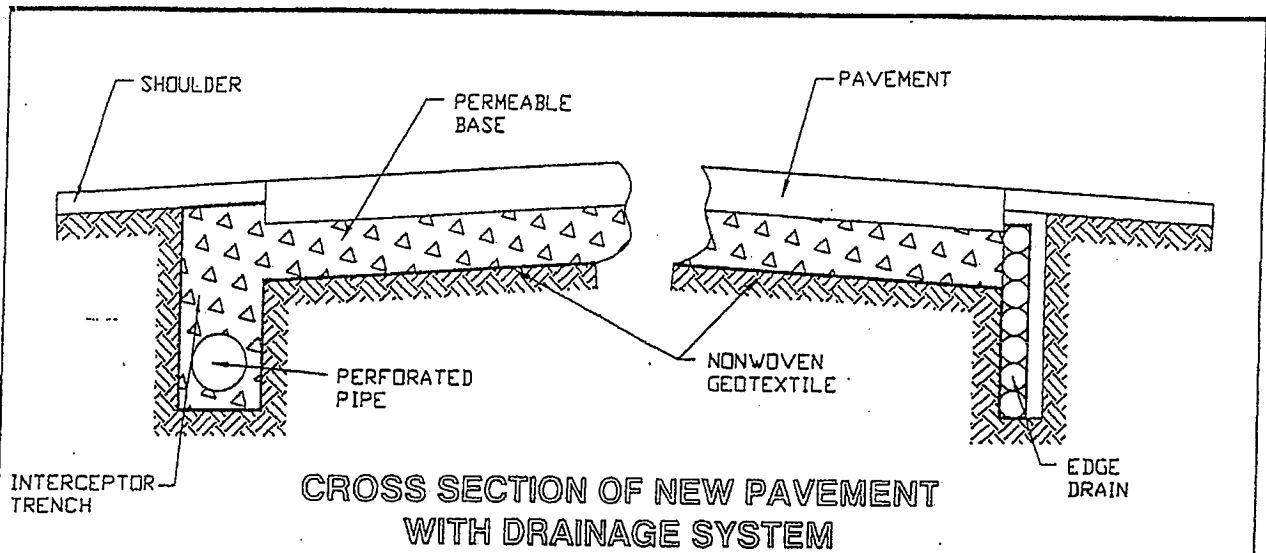
USE THIS DETAIL WHERE IT IS NECESSARY TO CUT THE PRESENT SURFACE FOR REMOVAL OR CONSTRUCTION OF AN UNDERGROUND FACILITY

NOTES:

1. NEW SURFACE TO TRANSITION SMOOTHLY TO EXISTING PAVEMENT.
2. STRENGTH OF PATCH MUST EQUAL OR EXCEED EXISTING STREET STRENGTH.

STREET PATCH DETAIL

CITY OF BROKEN ARROW			STANDARD DRAWING: STD ST 07	
			LAST REVISION DATE: 8/01/99	
DRAWN BY: ADN	CHECKED BY: DLW	APPROVED: MDK	DATE: 8/01/99	

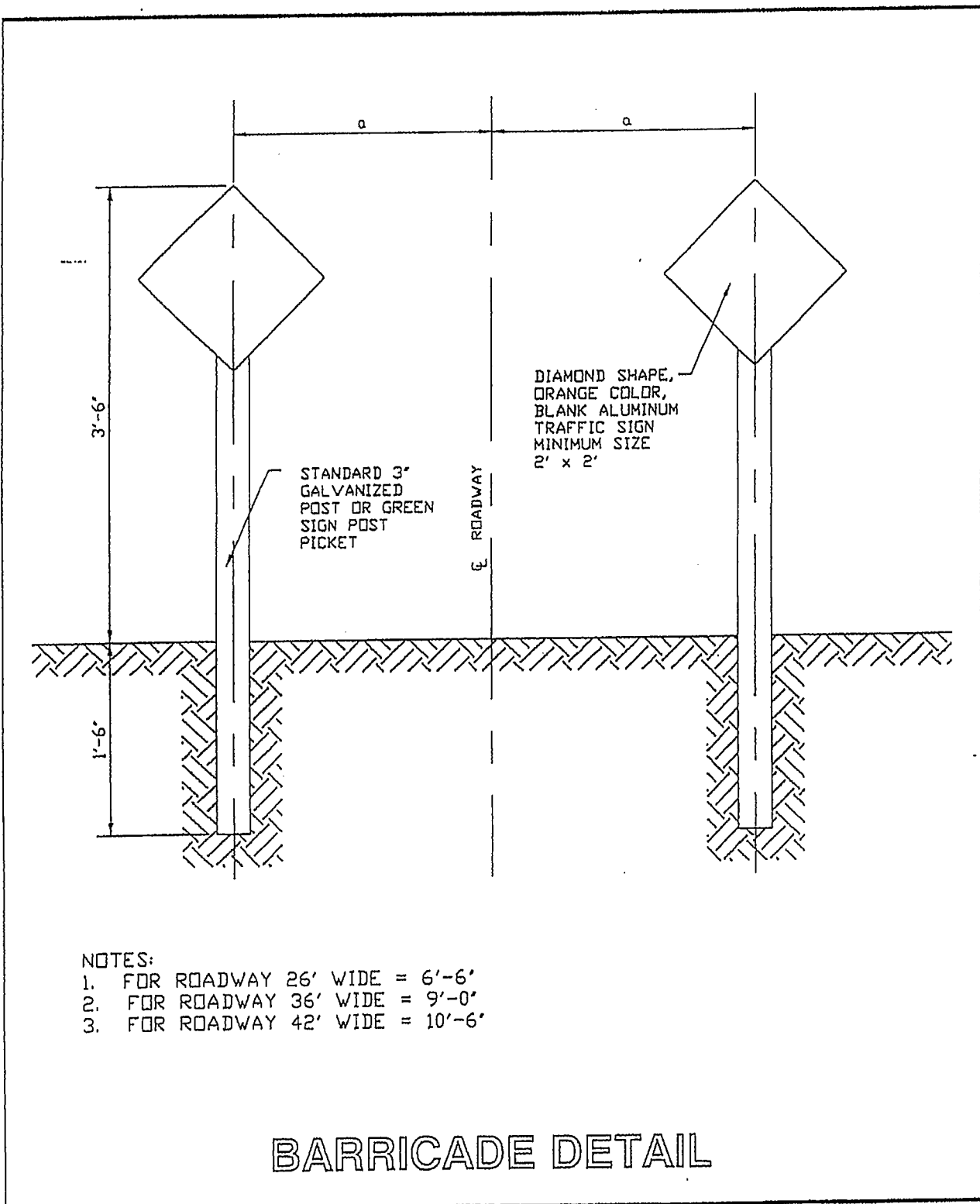


NOTES:

1. MINIMUM PERFORATED PIPE SIZE IS 4" DIAMETER.
2. PERFORATED PIPES SHALL BE TIED TO THE STORM SEWER SYSTEM.
3. ON STREETS WITH CURB AND GUTTER, THE DRAIN SHALL BE OUTSIDE BUT ADJACENT TO THE CURB.

BASE DRAINAGE

CITY OF BROKEN ARROW		STANDARD DRAWING: STD ST 08	
		LAST REVISION DATE: 8/01/99	
DRAWN BY: ADN	CHECKED BY: DLW	APPROVED: MDK	DATE: 8/01/99

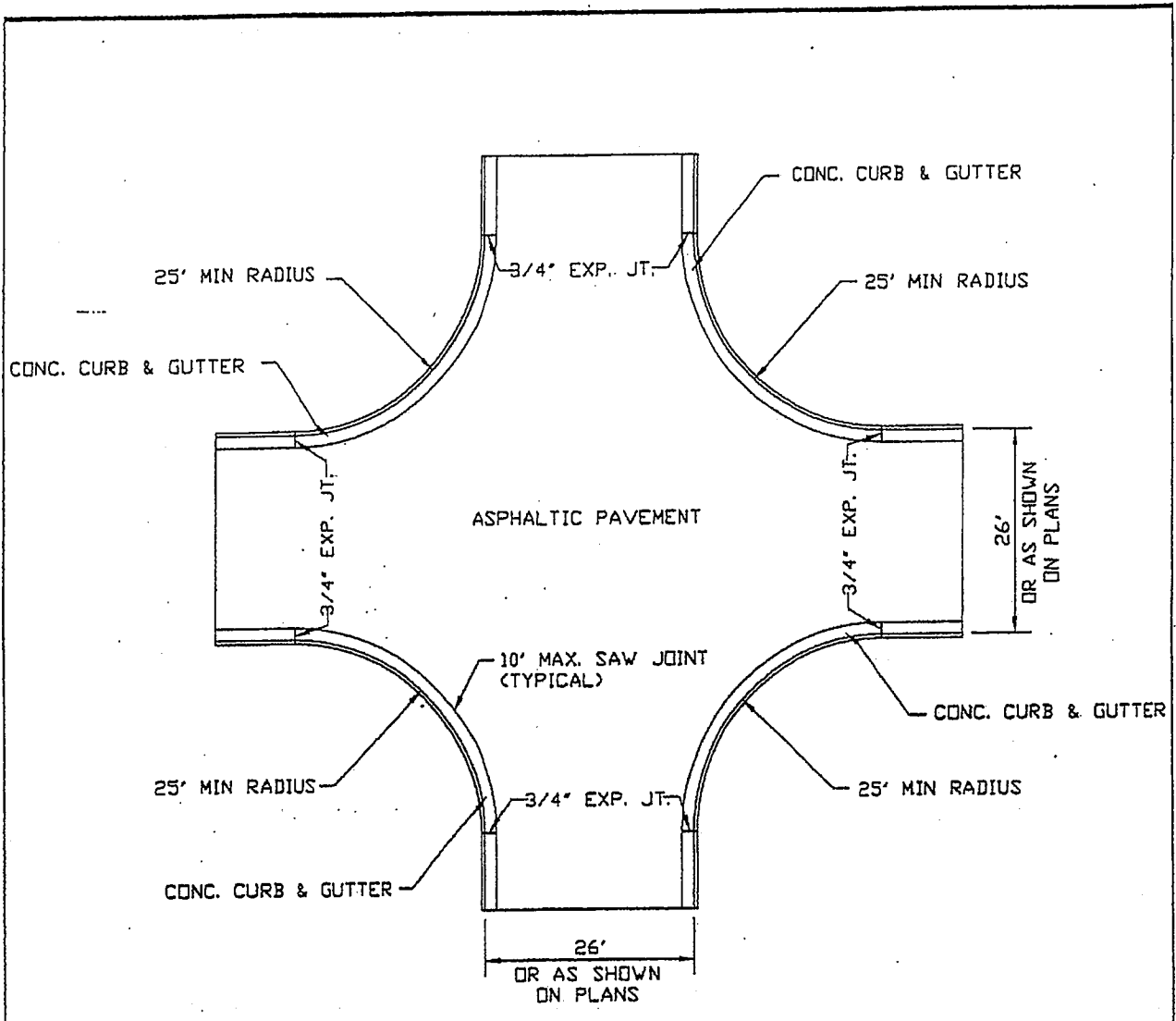


NOTES:

1. FOR ROADWAY 26' WIDE = 6'-6"
2. FOR ROADWAY 36' WIDE = 9'-0"
3. FOR ROADWAY 42' WIDE = 10'-6"

BARRICADE DETAIL

CITY OF BROKEN ARROW		STANDARD DRAWING: STD ST 09	
		LAST REVISION DATE: 8/01/99	
DRAWN BY: ADN	CHECKED BY: DLW	APPROVED: MDK	DATE: 8/01/99

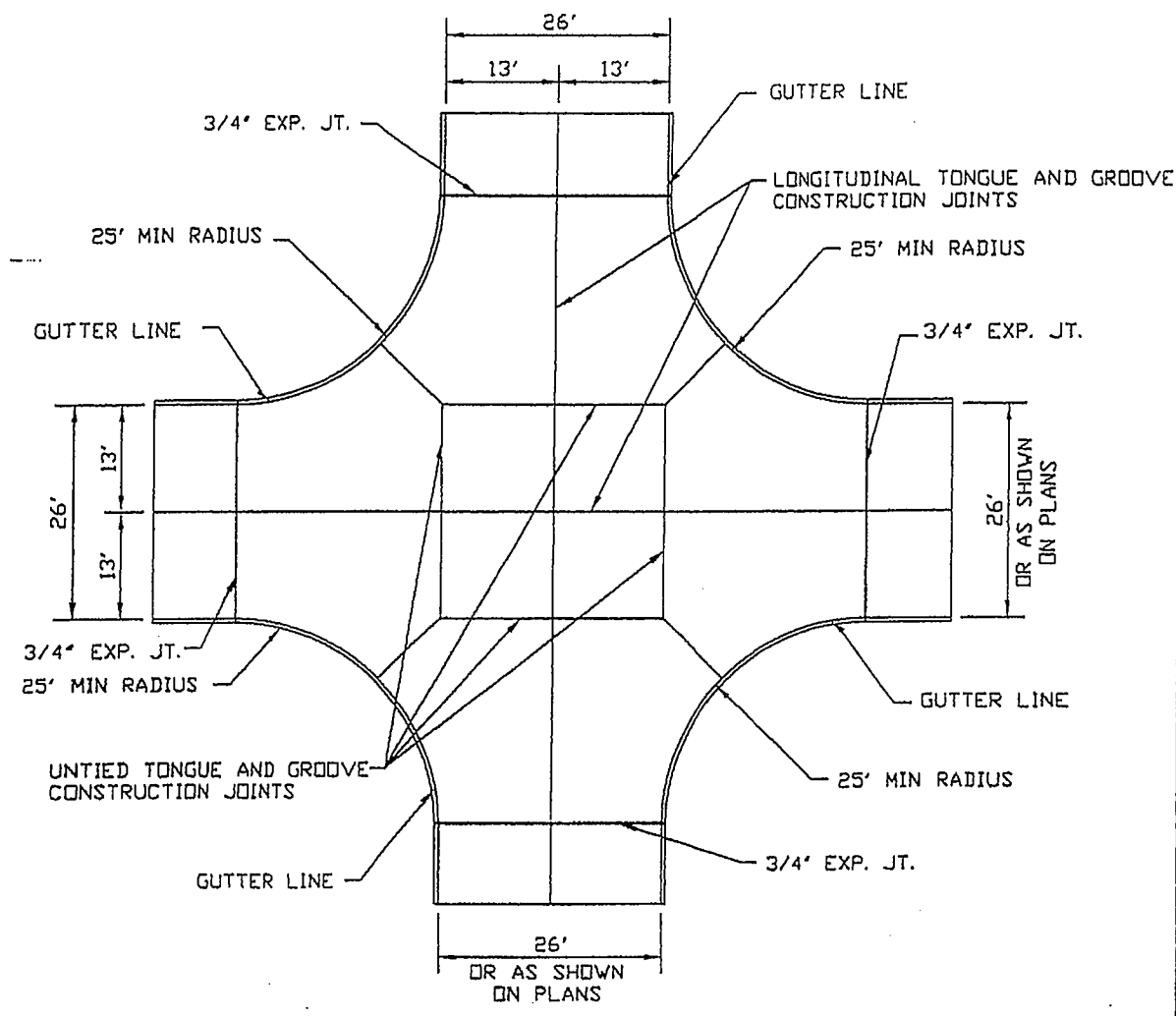


NOTES:

1. SIDEWALKS TO BE LOCATED PER THE LAND SUBDIVISION CODE
2. WHEELCHAIR RAMPS PER STANDARD ST 06

ASPHALTIC CONCRETE INTERSECTION LAYOUT

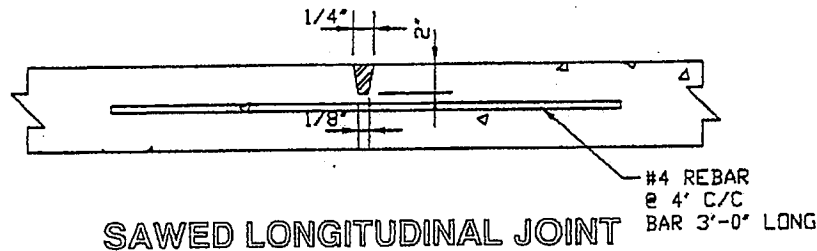
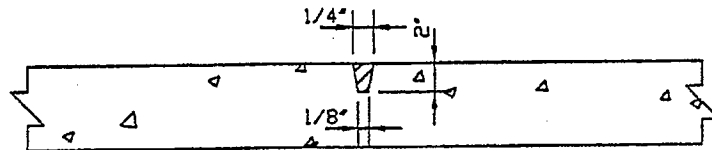
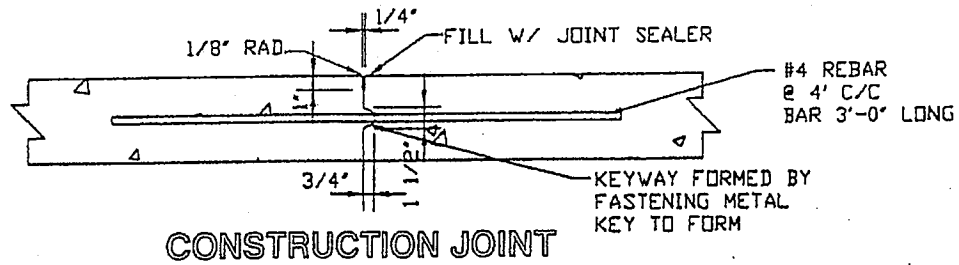
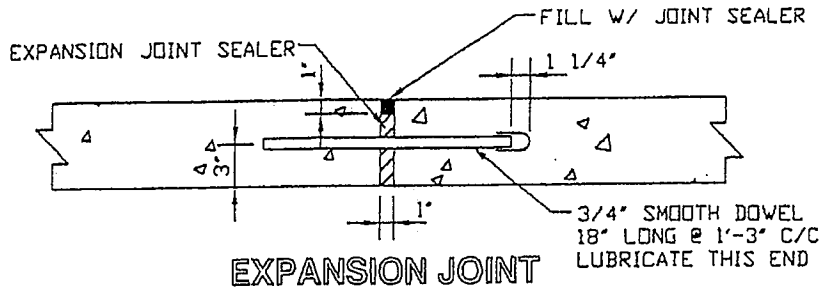
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DRAWN BY: ADN	CHECKED BY: DLW	APPROVED: MDK	DATE: 8/01/99



- NOTES:
1. SEE SECTION 204.04 FOR SPECIFIC REQUIREMENTS FOR CONCRETE STREET JOINTS AND TIEBARS.
 2. SEE SECTION 204.05 FOR SPECIFIC REQUIREMENTS FOR CURB AND GUTTER JOINTS AND TIEBARS.

CONCRETE STREET INTERSECTION LAYOUT

CITY OF BROKEN ARROW		STANDARD DRAWING: STD ST 11	
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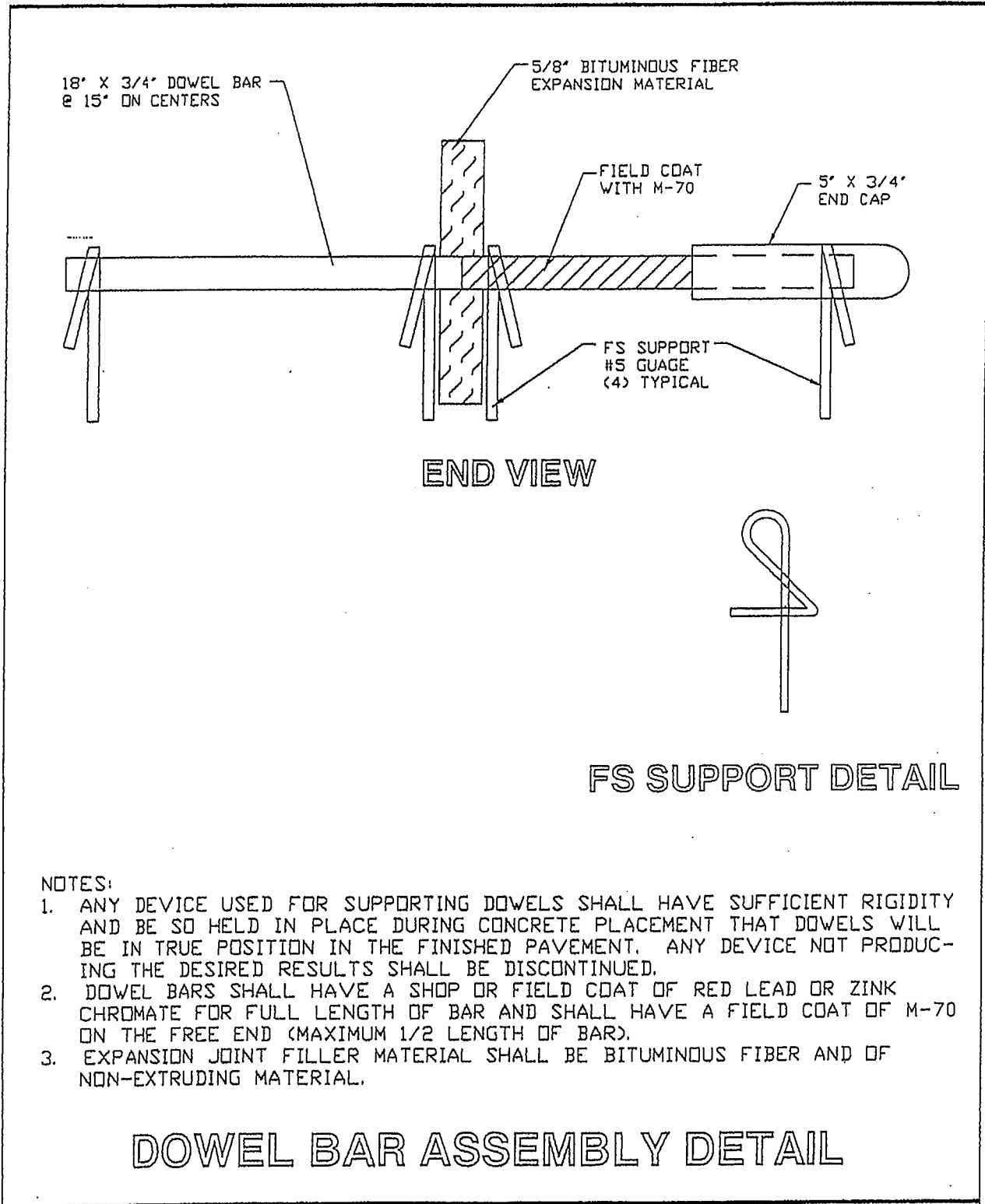


NOTES:

1. SEE SECTION 204.04 FOR JOINT SPACING AND TIEBAR REQUIREMENTS.
2. SAWED JOINTS SHALL BE SEALED AS REQUIRED IN SECTION 200.

STANDARD CONCRETE PAVEMENT JOINTS

CITY OF BROKEN ARROW		STANDARD DRAWING: STD ST 12	
		LAST REVISION DATE: 8/01/99	
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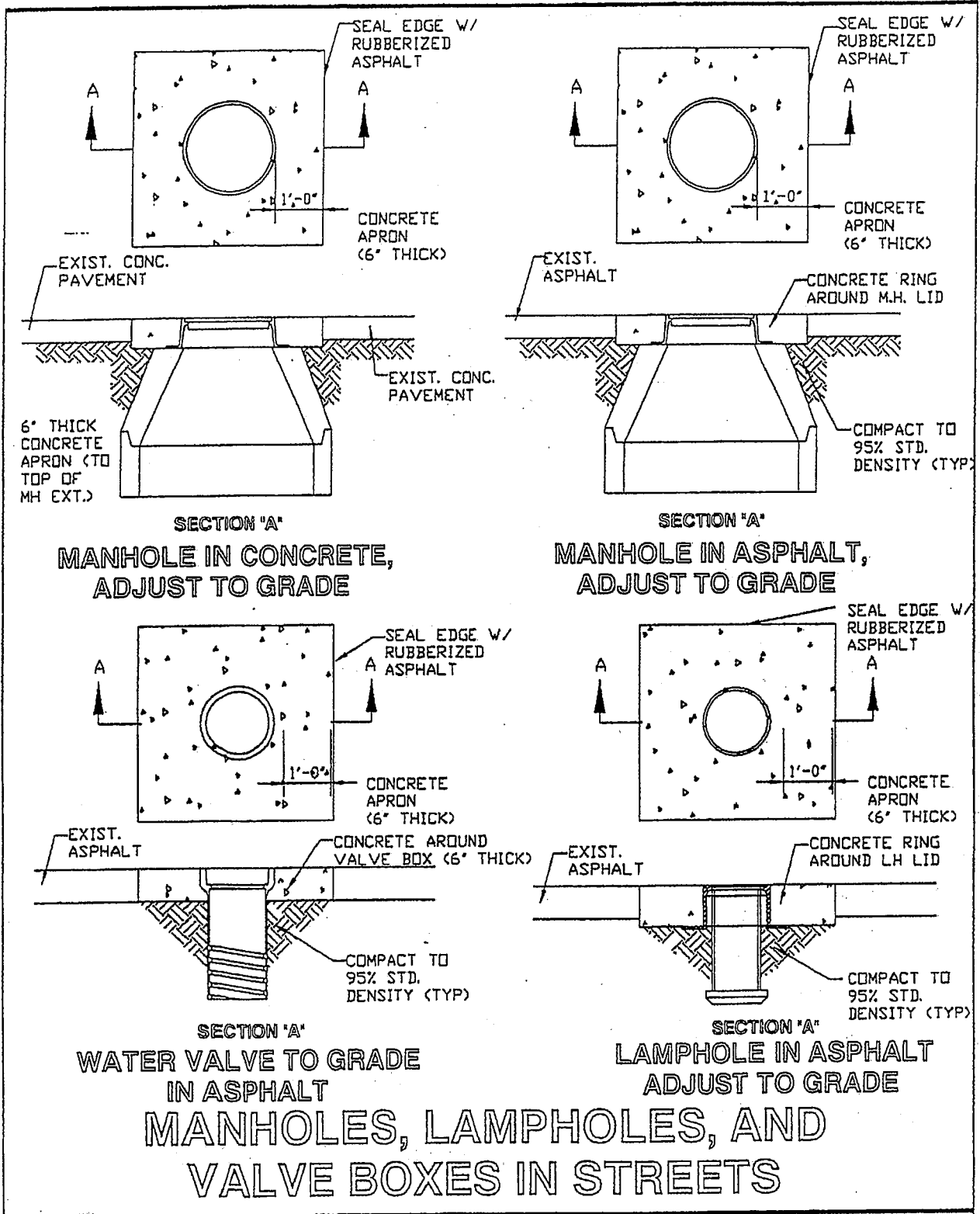


NOTES:

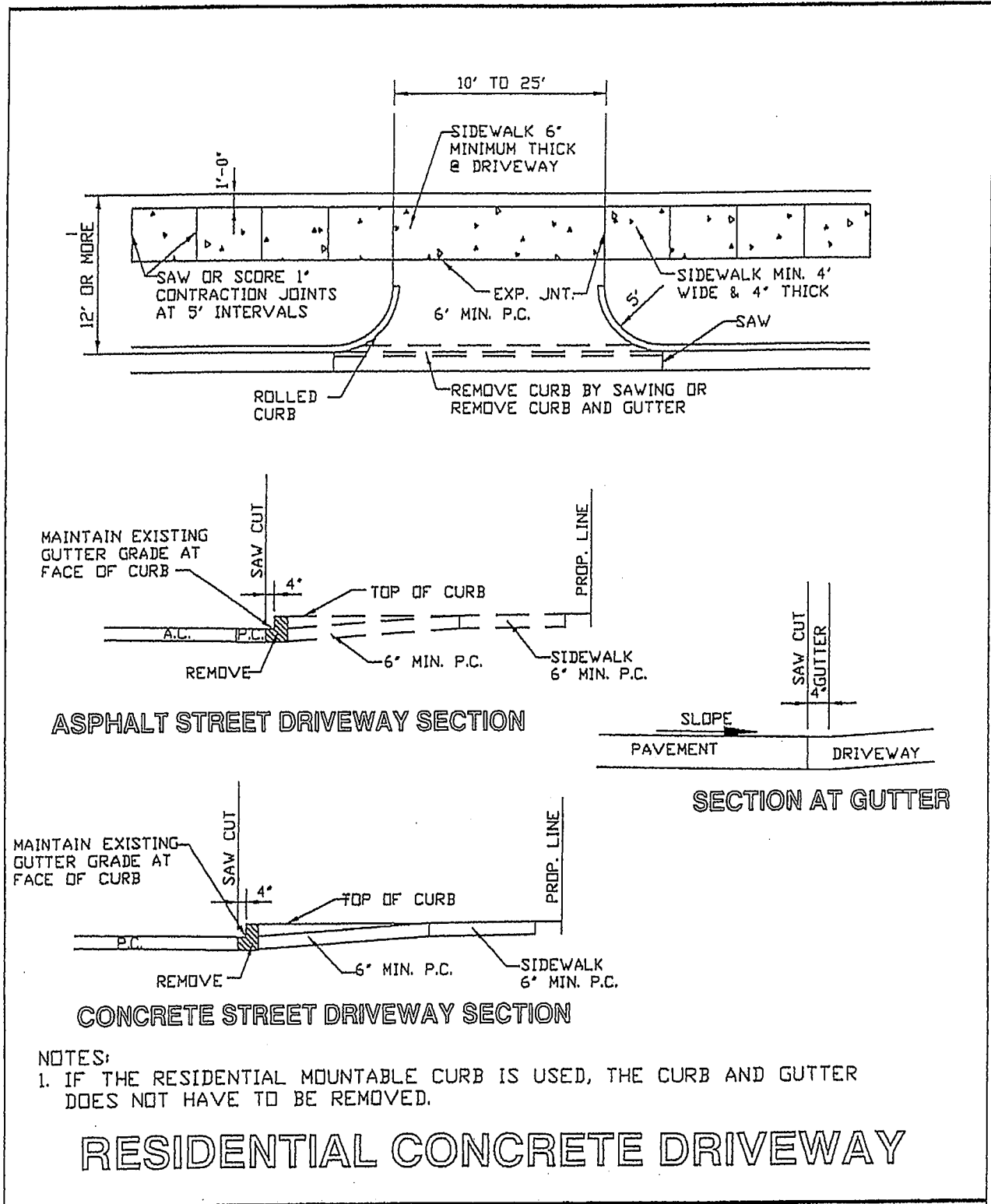
1. ANY DEVICE USED FOR SUPPORTING DOWELS SHALL HAVE SUFFICIENT RIGIDITY AND BE SO HELD IN PLACE DURING CONCRETE PLACEMENT THAT DOWELS WILL BE IN TRUE POSITION IN THE FINISHED PAVEMENT. ANY DEVICE NOT PRODUCING THE DESIRED RESULTS SHALL BE DISCONTINUED.
2. DOWEL BARS SHALL HAVE A SHOP OR FIELD COAT OF RED LEAD OR ZINK CHROMATE FOR FULL LENGTH OF BAR AND SHALL HAVE A FIELD COAT OF M-70 ON THE FREE END (MAXIMUM 1/2 LENGTH OF BAR).
3. EXPANSION JOINT FILLER MATERIAL SHALL BE BITUMINOUS FIBER AND OF NON-EXTRUDING MATERIAL.

DOWEL BAR ASSEMBLY DETAIL

CITY OF BROKEN ARROW		STANDARD DRAWING: STD ST 13	
		LAST REVISION DATE: 8/01/99	
DRAWN BY: ADN	CHECKED BY: DLW	APPROVED: MDK	DATE: 8/01/99



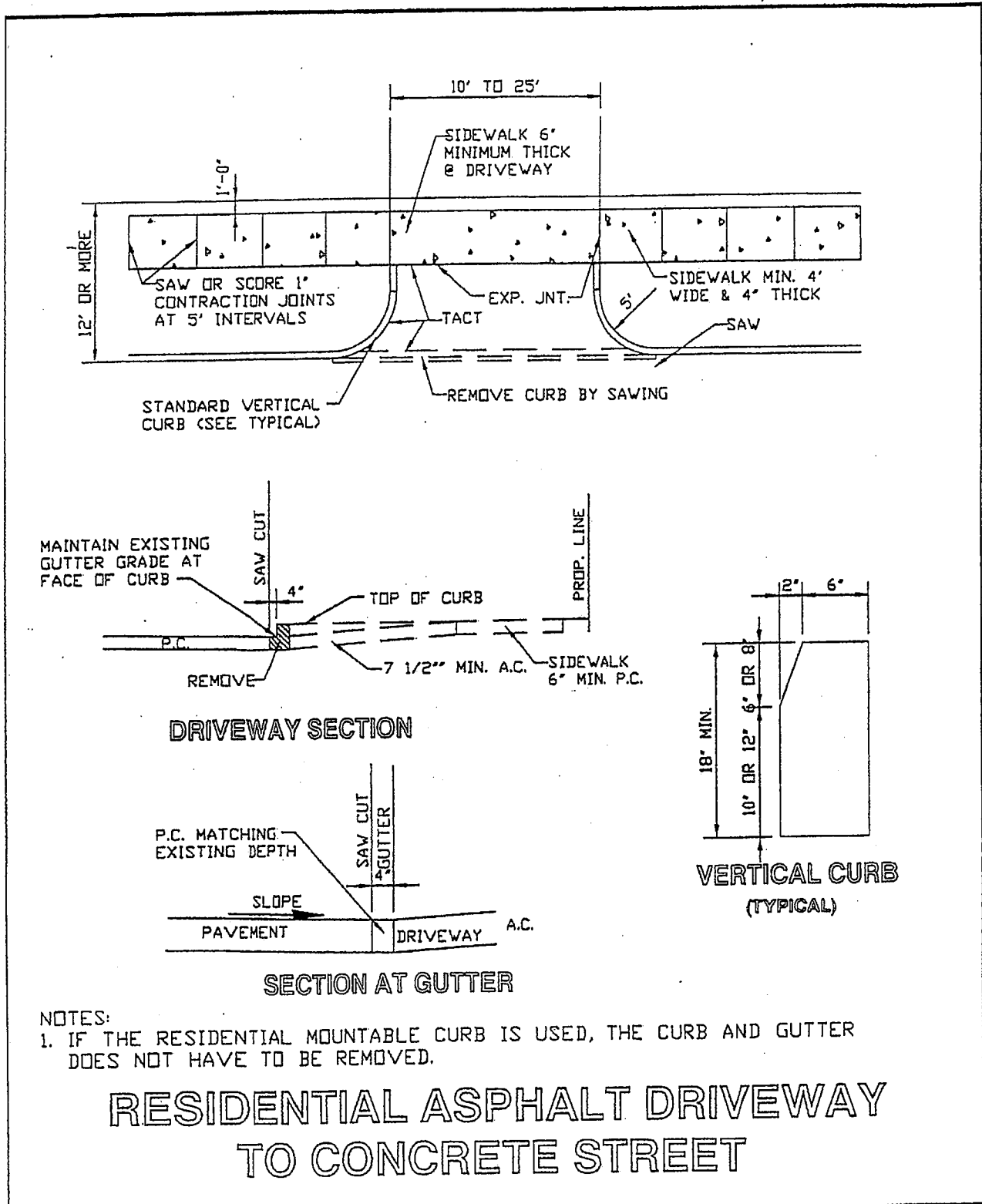
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		LAST REVISION DATE: 8/01/99	
DRAWN BY: ADN	CHECKED BY: DLW	APPROVED: MDK	DATE: 8/01/99



- NOTES:
 1. IF THE RESIDENTIAL MOUNTABLE CURB IS USED, THE CURB AND GUTTER DOES NOT HAVE TO BE REMOVED.

RESIDENTIAL CONCRETE DRIVEWAY

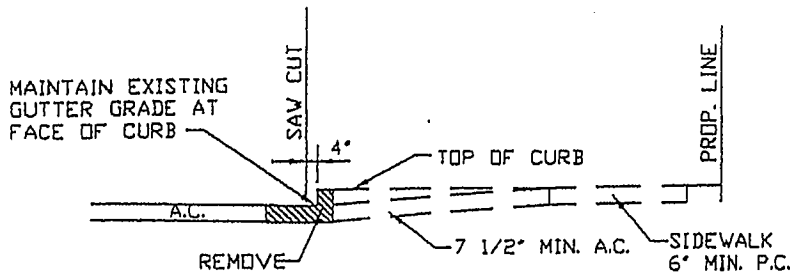
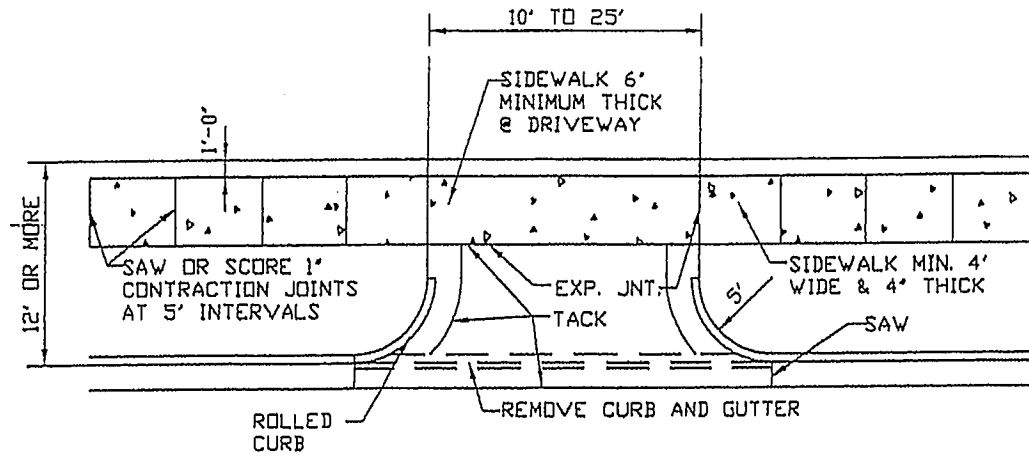
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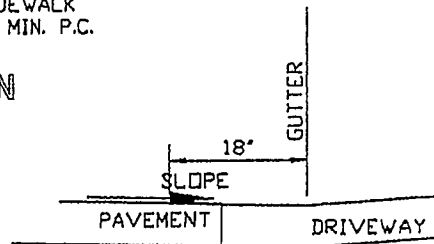
NOTES:
 1. IF THE RESIDENTIAL MOUNTABLE CURB IS USED, THE CURB AND GUTTER DOES NOT HAVE TO BE REMOVED.

RESIDENTIAL ASPHALT DRIVEWAY TO CONCRETE STREET

CITY OF BROKEN ARROW		STANDARD DRAWING: STD ST 16	
		LAST REVISION DATE: 8/01/99	
DRAWN BY: ADN	CHECKED BY: DLW	APPROVED: MDK	DATE: 8/01/99



ASPHALT STREET DRIVEWAY SECTION



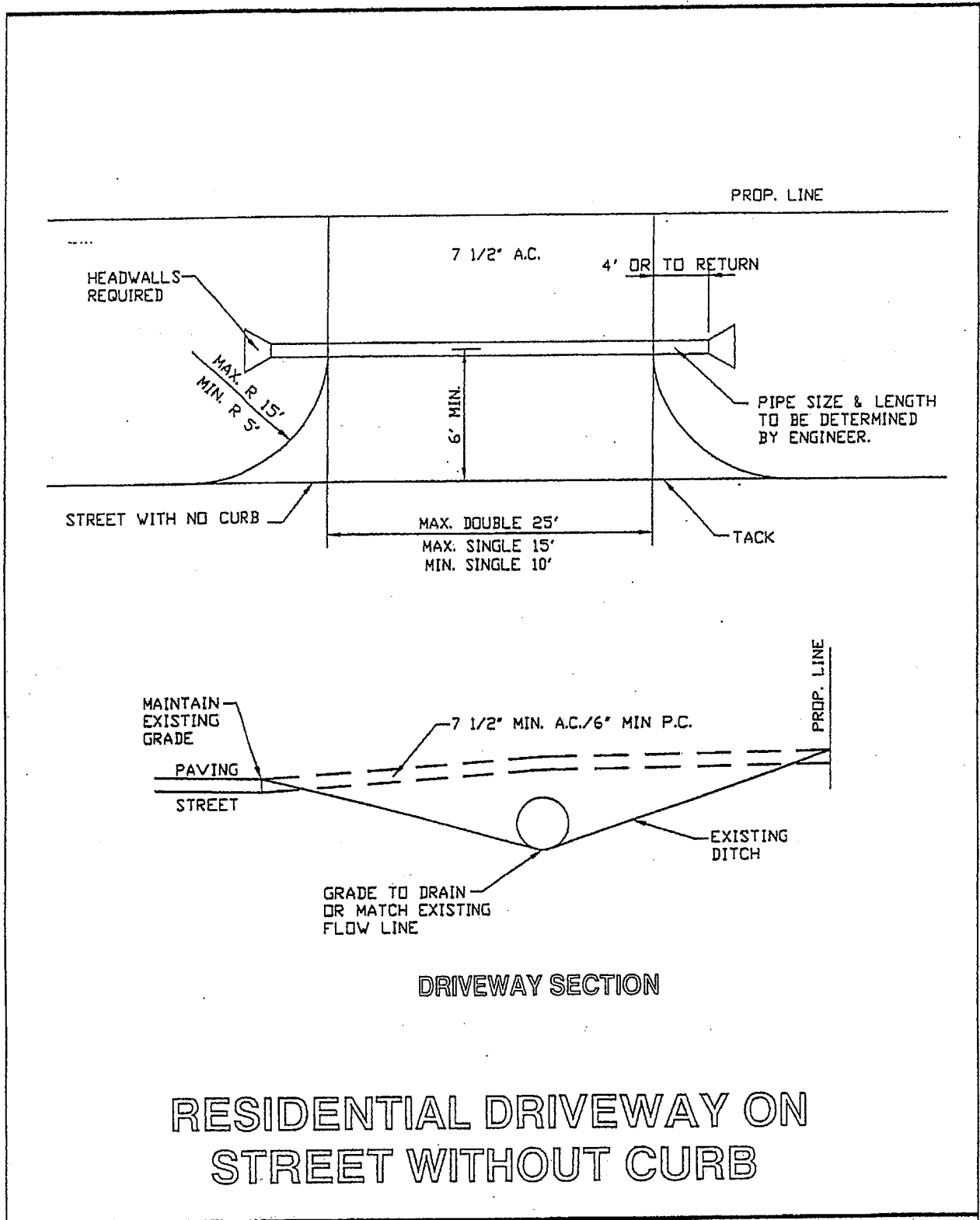
SECTION AT GUTTER

NOTES:

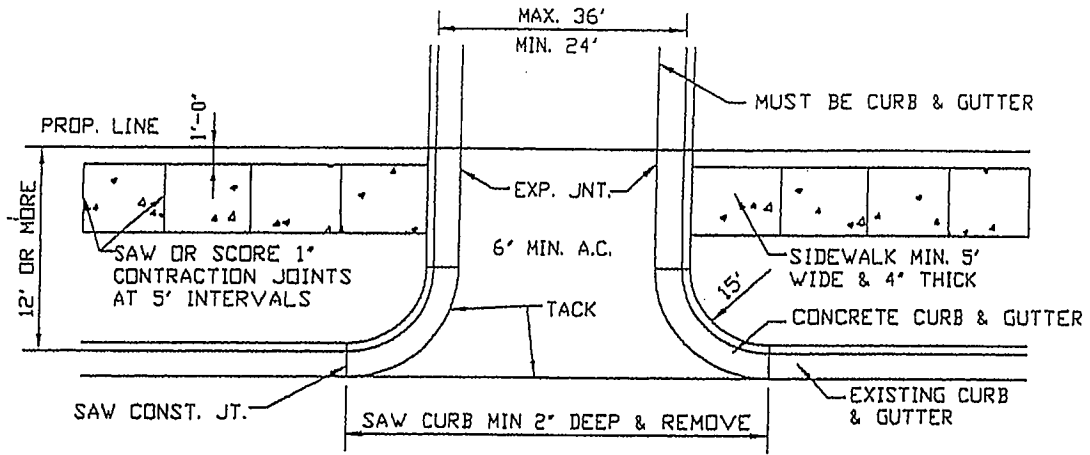
1. IF THE RESIDENTIAL MOUNTABLE CURB IS USED, THE CURB AND GUTTER DOES NOT HAVE TO BE REMOVED.

RESIDENTIAL ASPHALT DRIVEWAY TO ASPHALT STREET

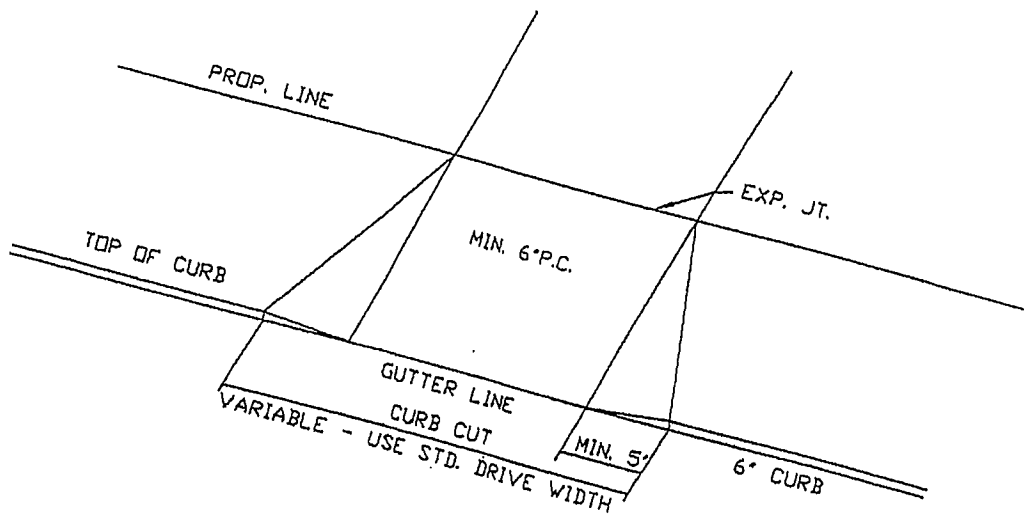
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		LAST REVISION DATE: 8/01/99	
DRAWN BY: ADN	CHECKED BY: DLW	APPROVED: MDK	DATE: 8/01/99



CITY OF BROKEN ARROW		STANDARD DRAWING: STD ST 18	
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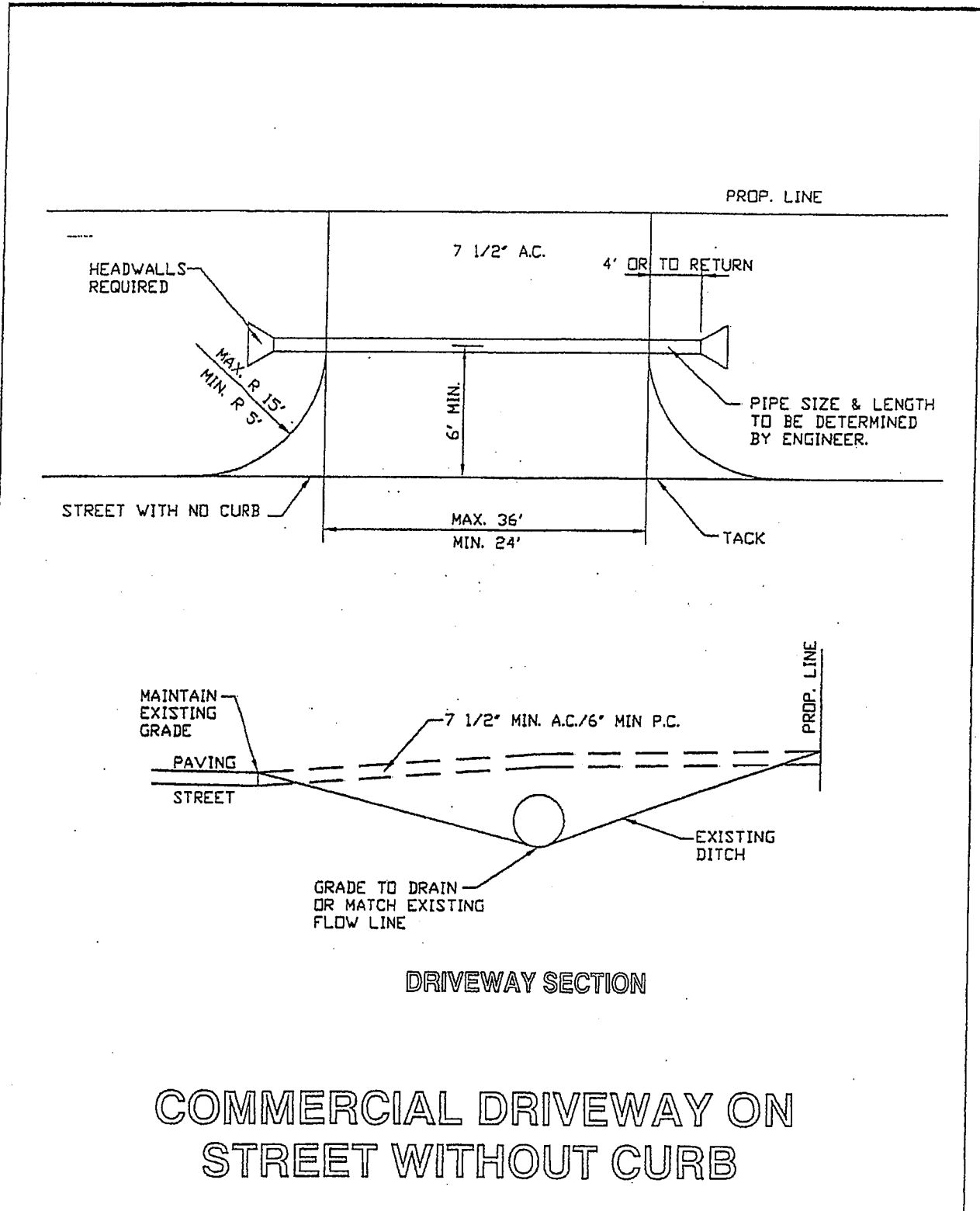
REGULAR DRIVE



RAMP TYPE DRIVE

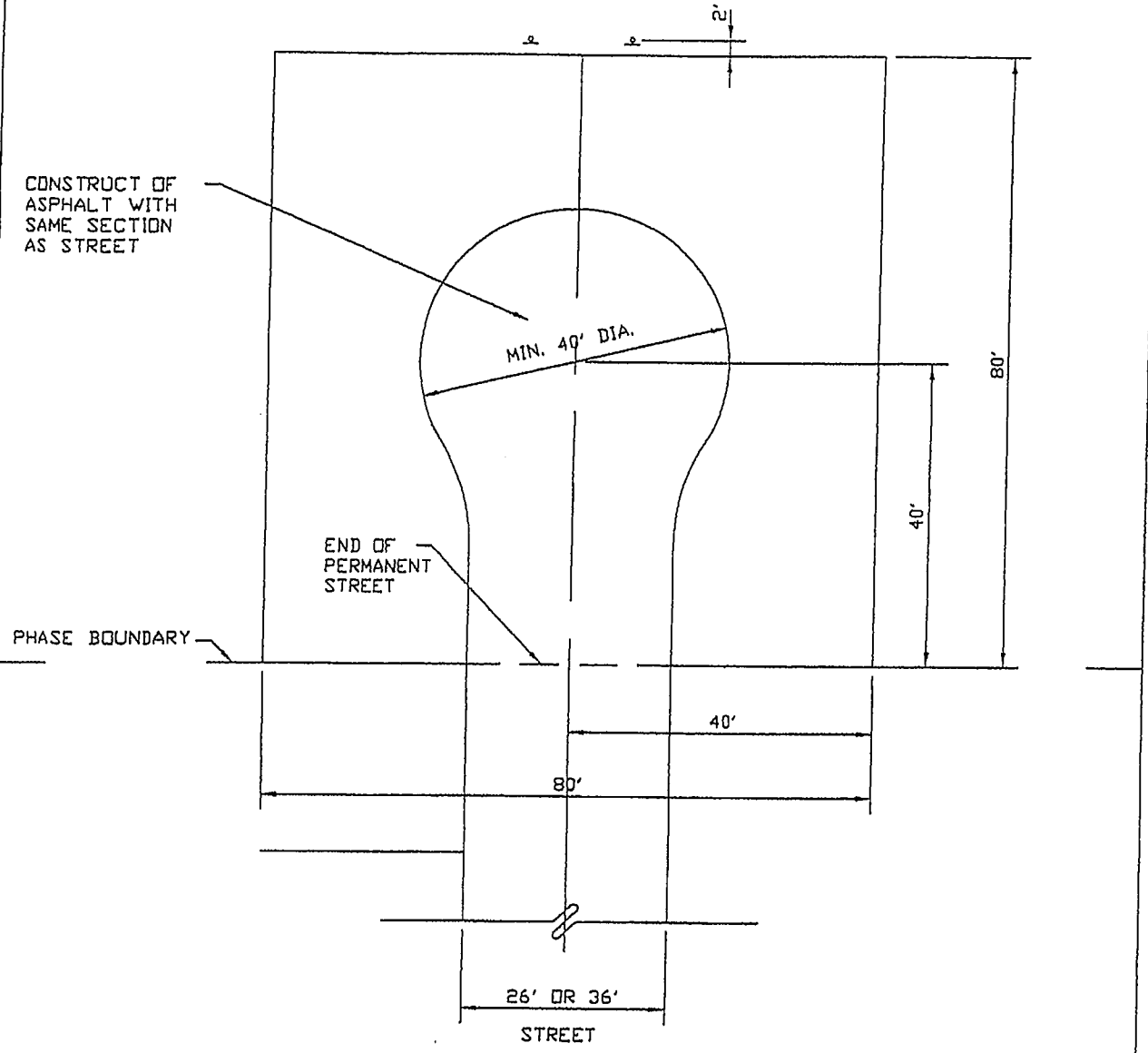
COMMERCIAL DRIVEWAY

CITY OF BROKEN ARROW		STANDARD DRAWING: STD ST 19	
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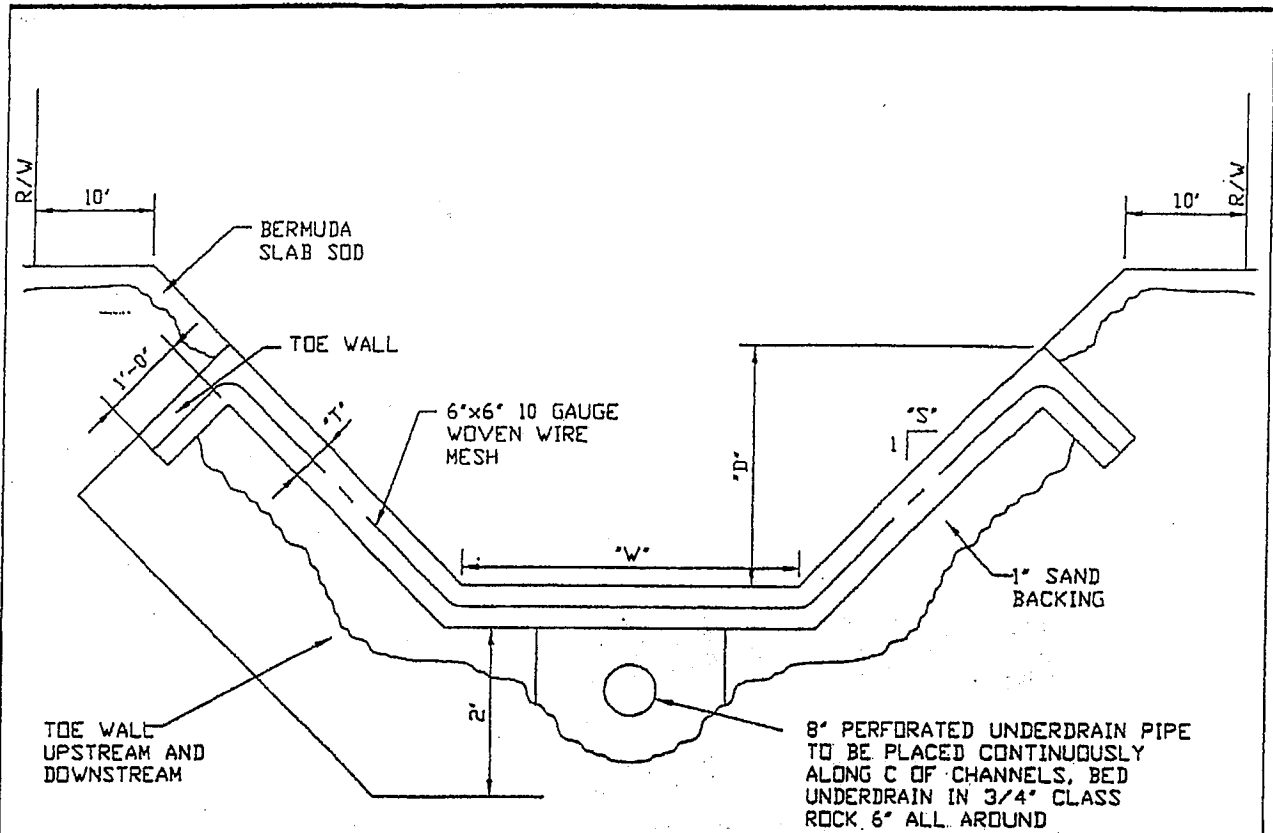
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		LAST REVISION DATE: 8/01/99	
DRAWN BY: ADN	CHECKED BY: DLW	APPROVED: MDK	DATE: 8/01/99

SEE STANDARD DRAWING STD ST 09
FOR BARRICADE DETAIL



TEMPORARY TURN-AROUND

CITY OF BROKEN ARROW		STANDARD DRAWING: STD ST 21	
		LAST REVISION DATE: 8/01/99	
DRAWN BY: ADN	CHECKED BY: DLW	APPROVED: MDK	DATE: 8/01/99



NOTES:

1. 3500 P.S.I. CONCRETE WITH NOT OVER 3" SLUMP.
2. 'W', 'D', 'T', AND 'S' TO BE SHOWN ON THE PLAN.
3. SEALED SAW CUT JOINTS @ 15' C/C.
4. SEALED 3/4" EXPANSION JOINTS @ 90' C/C.
5. TWO FEET (2') DEEP TOE WALL TO BE CONSTRUCTED AT EACH END.
6. EXTEND REINFORCING STEEL INTO TOP WALL AND TOE WALL.
7. WHERE REQUIRED ENERGY DISSIPATORS WILL BE CONSTRUCTED AS PART OF THE CHANNEL.

CONCRETE LINED CHANNEL

CITY OF BROKEN ARROW

STANDARD DRAWING: STD ST 22

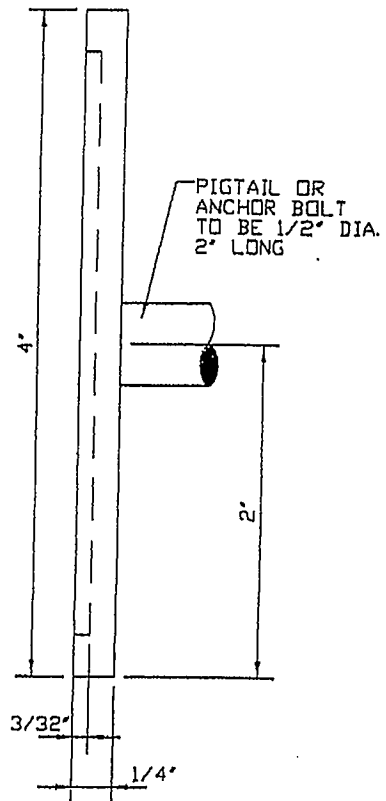
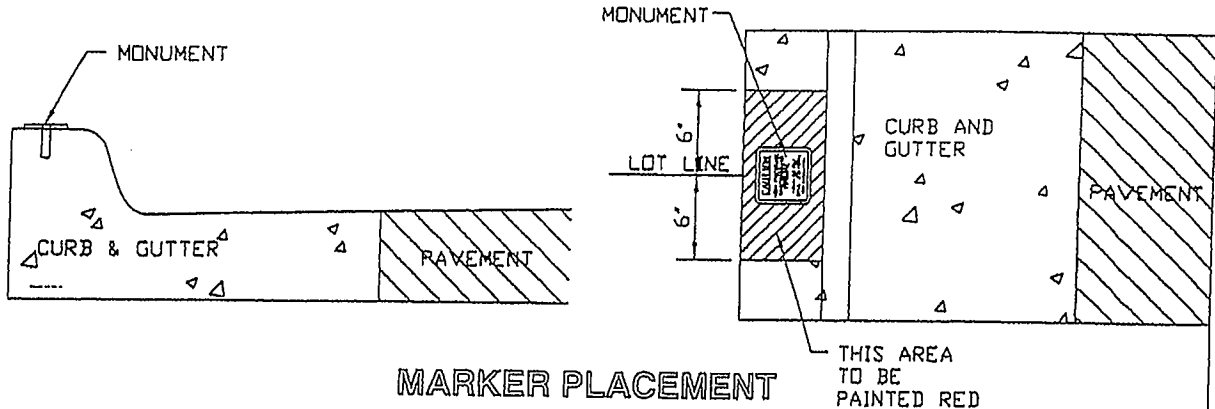
LAST REVISION DATE: 8/01/99

DRAWN BY: ADN

CHECKED BY: DLW

APPROVED: MDK

DATE: 8/01/99

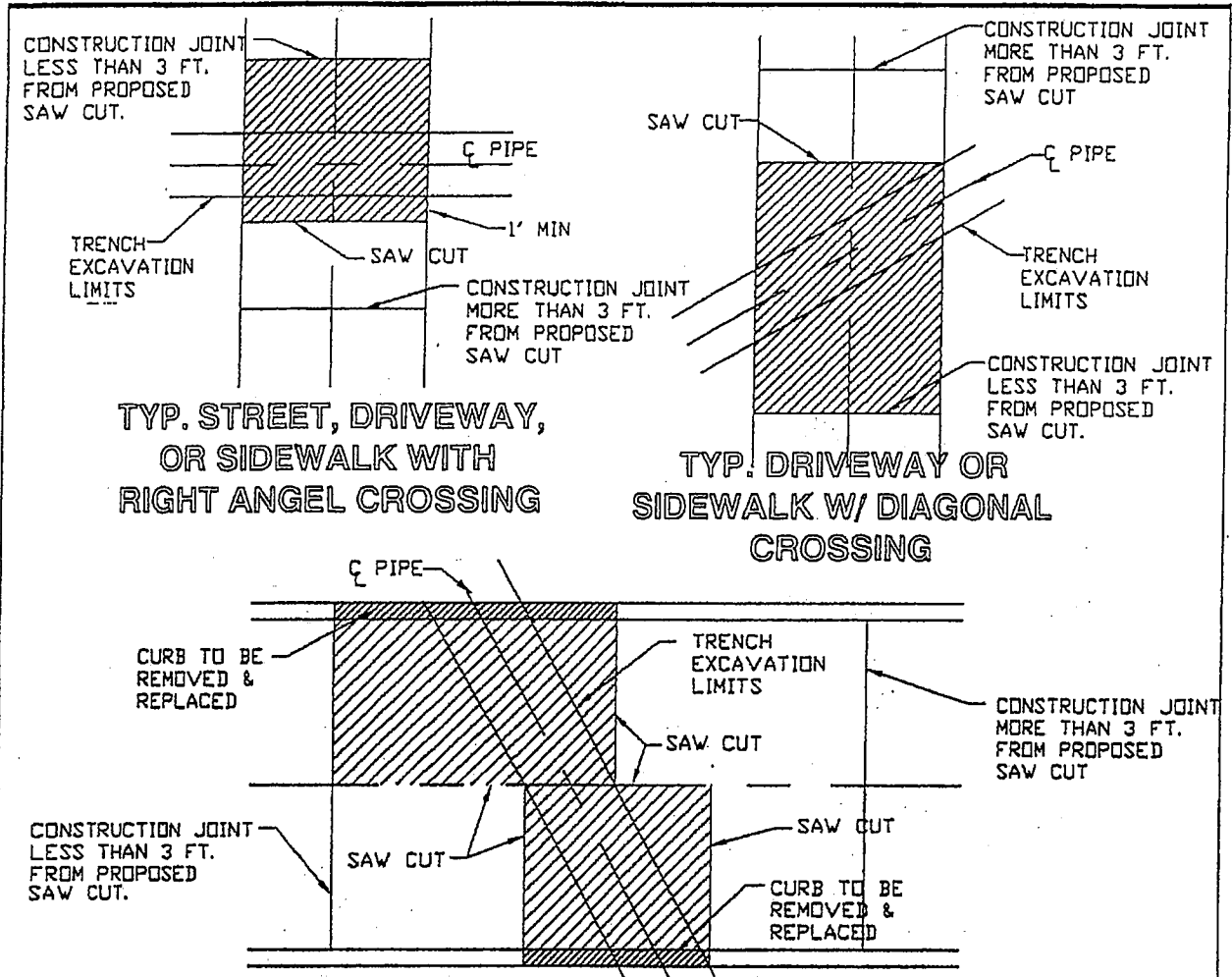


NOTES:

1. MONUMENT TO BE CAST FROM YELLOW BRASS. LETTERS TO BE FLUSH WITH BORDER.
2. MONUMENT TO BE PLACED ON THE CURB AT THE LOT LINE.

HIGH PRESSURE PIPELINE MARKER

CITY OF BROKEN ARROW		STANDARD DRAWING: STD ST 23	
		LAST REVISION DATE: 8/01/99	
DRAWN BY: ADN	CHECKED BY: DLW	APPROVED: MDK	DATE: 8/01/99

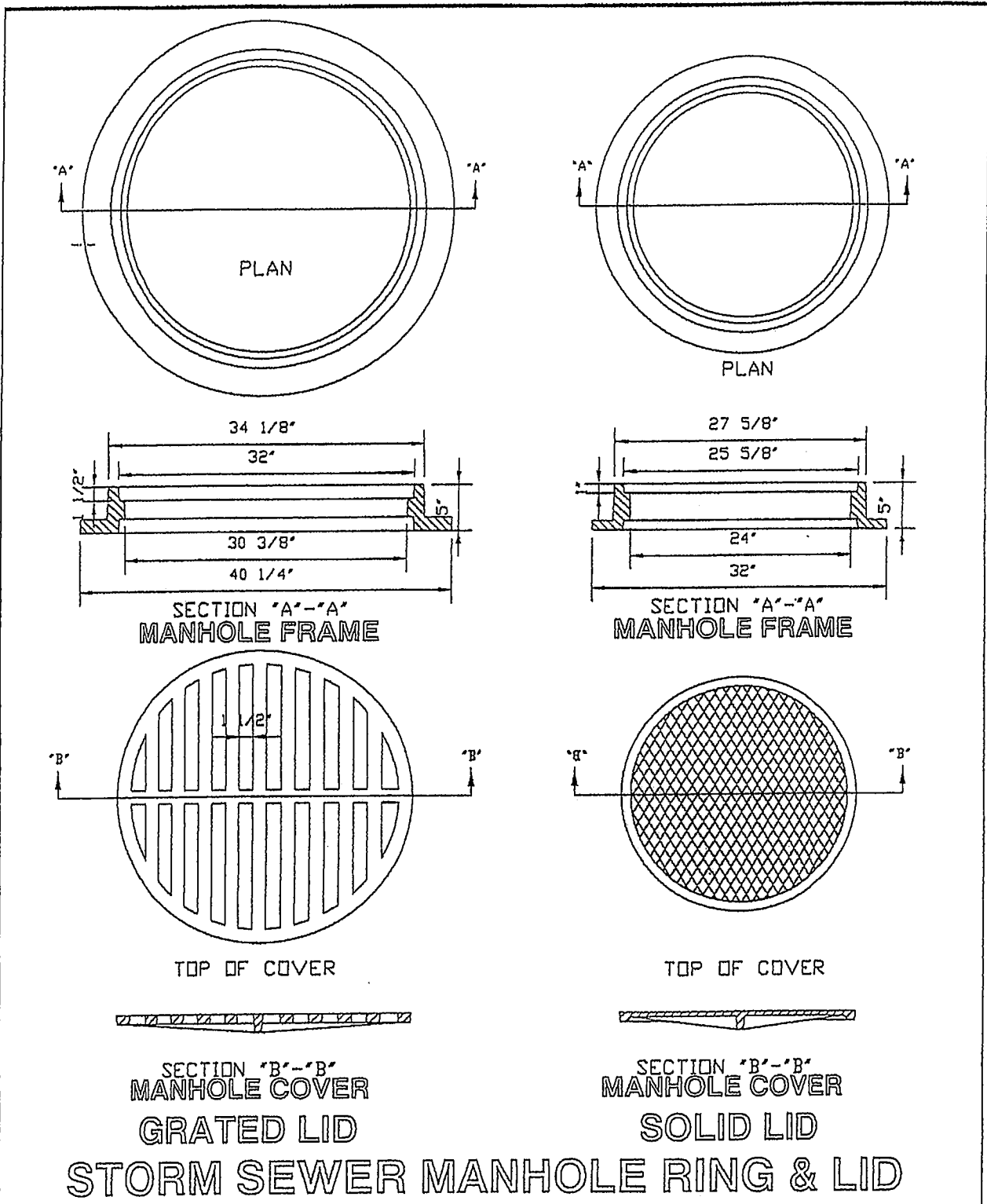


NOTES:

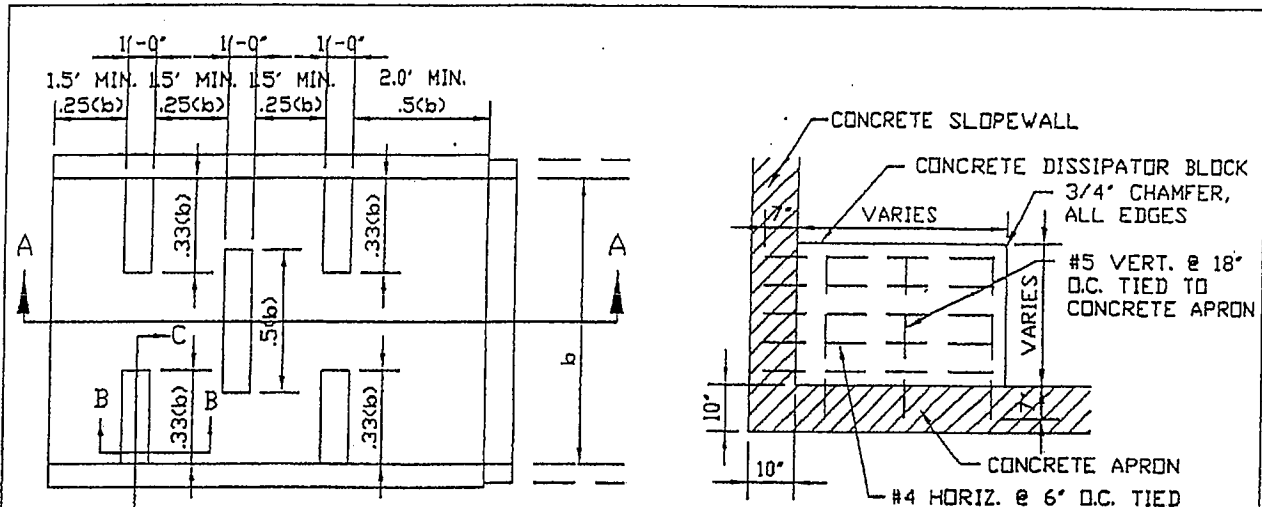
1. REMOVE AND REPLACE PAVEMENT WITHIN SHADED AREAS BOUNDED BY SAW CUTS AND/OR CONSTRUCTION JOINTS.
2. FOR DIAGONAL CROSSING, REPLACE PAVEMENT USING SQUARED CUTS, AS SHOWN. PAY QUANTITY WILL INCLUDED SQUARED AREA.
3. REMOVE AND REPLACE PAVEMENT TO CONSTRUCTION JOINT IF LESS THAN 3 FT. FROM PROPOSED SAW CUT. EXTRA AREA WILL BE INCLUDED IN PAY QUANTITY.
4. FOR LONGITUDINAL INSTALLATIONS: REMOVE AND REPLACE PAVEMENT AND CURB TO EDGE OF STREET, IF THE SAW CUT IS LESS THAN 3 FT. FROM THE OUTSIDE EDGE OF THE PAVEMENT OR CURB. AVOID SAW CUTS IN THE EXISTING WHEEL LINE. TRENCHES EXCEEDING 300 L.F. SHALL BE BACKFILLED AND MADE DRIVEABLE.
5. ALL CONSTRUCTION JOINTS SHALL BE REESTABLISHED IN ACCORDANCED WITH THE CITY OF BROKEN ARROW STANDARDS FOR PORTLAND CEMENT CONCRETE PAVEMENT. WHEN A PAVEMENT SECTION IS REMOVED ALONG AN EXISTING LONGITUDINAL CONSTRUCTION JOINT, THE NEW PAVEMENT SHALL BE DOWELLED TO THE PAVEMENT ADJACENT TO THE JOINT.

STANDARD DETAIL FOR PAVEMENT CUTS

CITY OF BROKEN ARROW		STANDARD DRAWING: STD ST 24	
		LAST REVISION DATE: 8/01/99	
DRAWN BY: ADN	CHECKED BY: DLW	APPROVED: MDK	DATE: 8/01/99

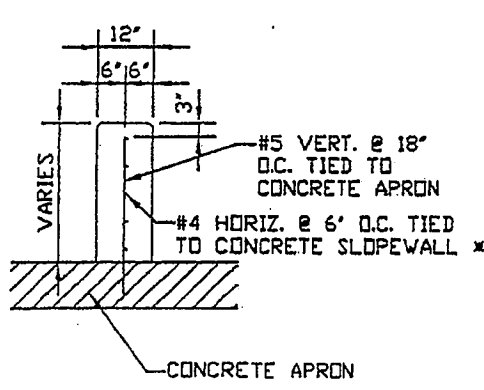


CITY OF BROKEN ARROW		STANDARD DRAWING: STD ST25	
		LAST REVISION DATE: 8/01/99	
DRAWN BY: ADN	CHECKED BY: DLW	APPROVED: MDK	DATE: 8/01/99

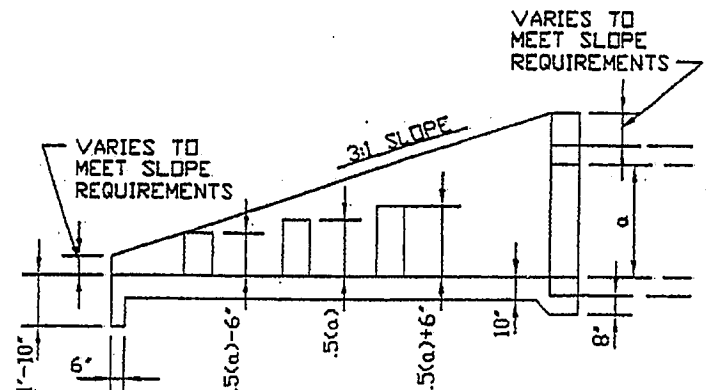


SLOPEWALL

SECTION C-C



SECTION B-B



SECTION A-A

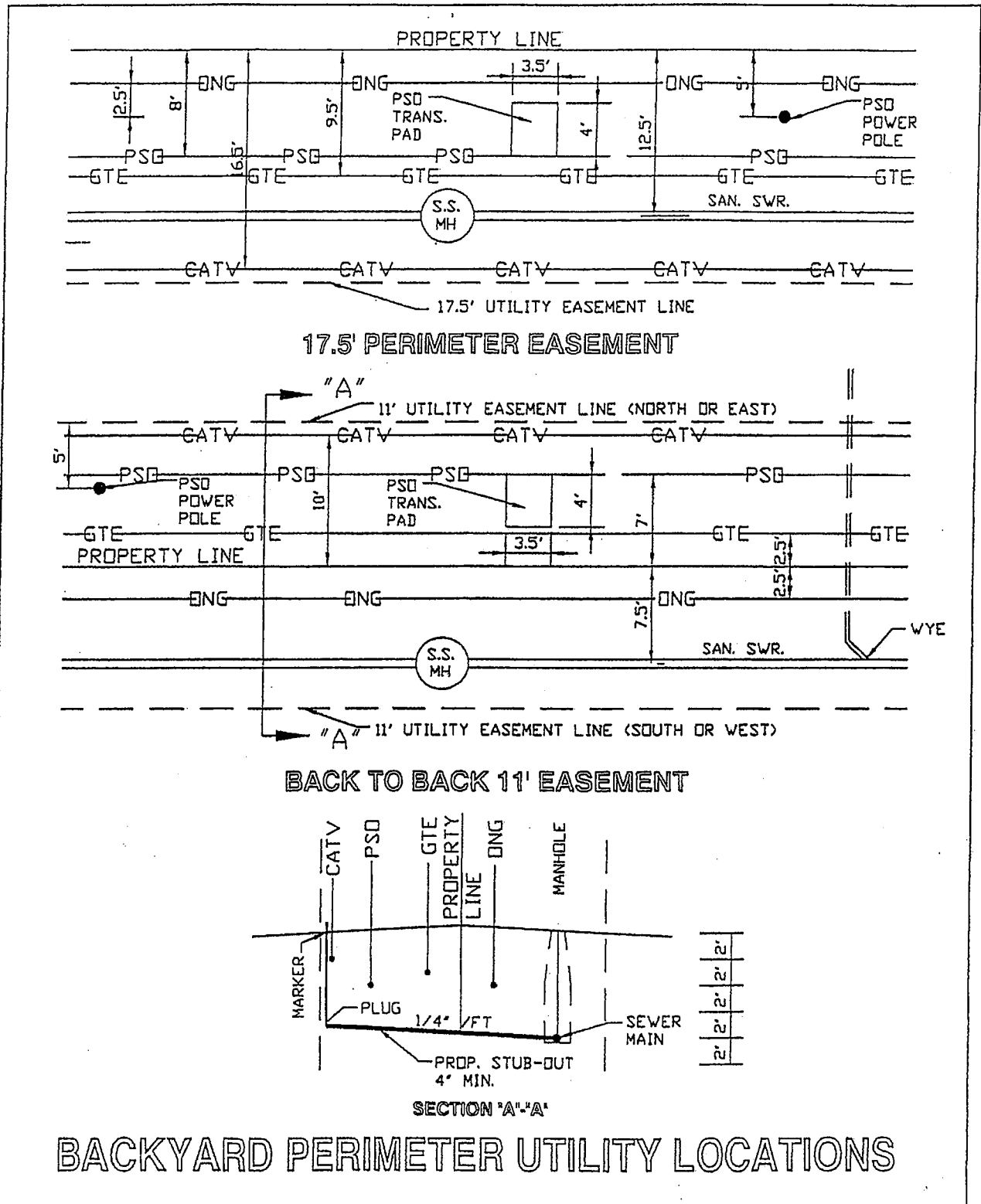
NOTES:

1. CONCTETE FC' = 3000 PSI MINIMUM @ 28 DAYS, WITH 5% + 1% AIR ENTRAINMENT.
 2. REINFORCING STEEL TO MEET ASTM A-615, #4 AND SMALLER GRADE 40, #5 AND LARGER GRADE 60.
 3. FOR DISSIPATOR BLOCKS ADDED TO EXISTING SLOPEWALLS ALL REINFORCING STEEL DRILLED INTO EXISTING CONCRETE TO BR ANCHORED WITH HILIT C-100 ADHESIVE OR EQUAL.
 4. SLOPEWALL AND HEADWALL TO BE CONSTRUCTED TO ODOT SPECIFICATIONS,
- * ON ROW 2, CUT #4 HORIZ. BARS OFF 3' FROM EACH SIDE OF DISSIPATOR WALL.

SLOPEWALL WITH DISSIPATER DETAIL

CITY OF BROKEN ARROW		STANDARD DRAWING: STD ST26	
		LAST REVISION DATE: 8/01/99	
DRAWN BY: ADN	CHECKED BY: DLW	APPROVED: MDK	DATE: 8/01/99

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CITY OF BROKEN ARROW

STANDARD DRAWING: STD UL 01

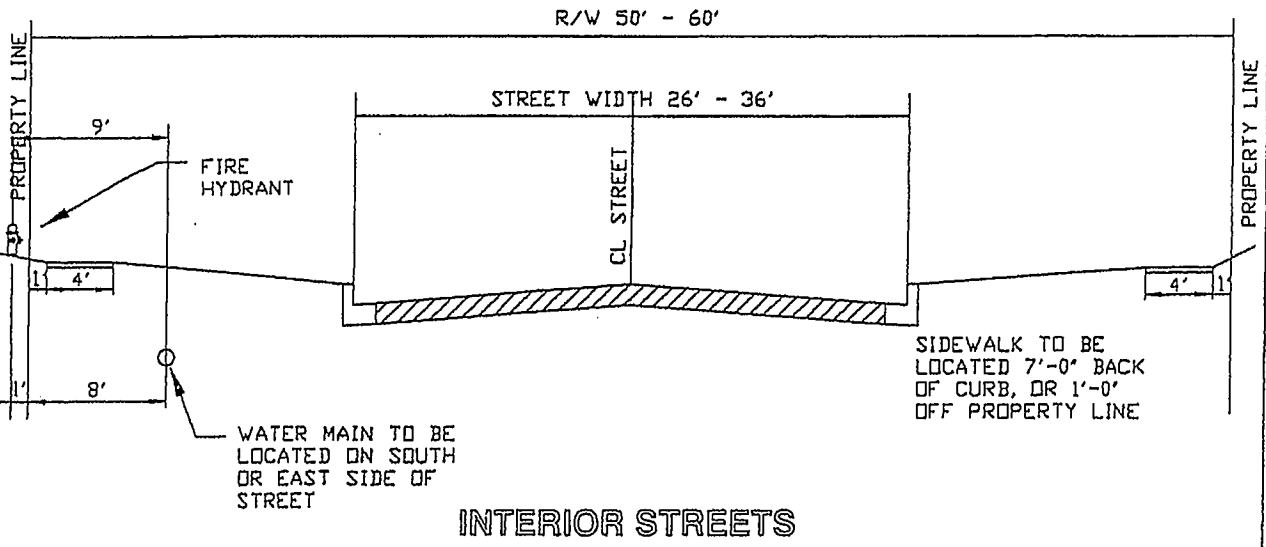
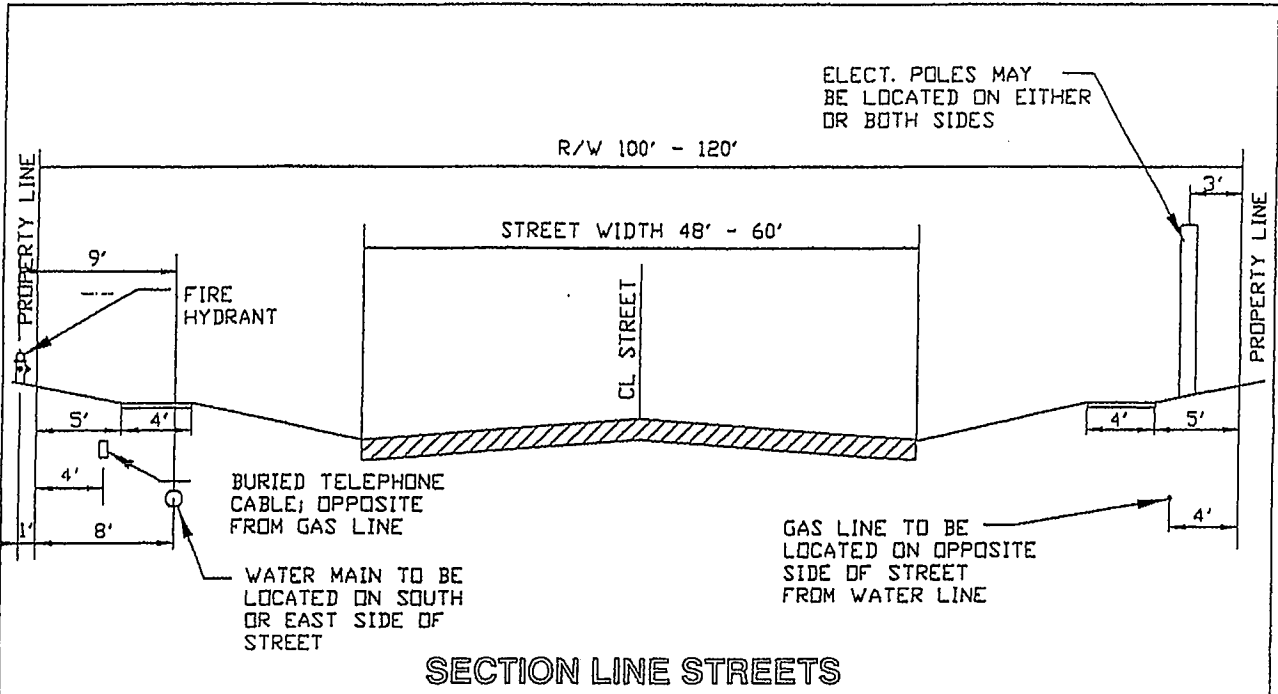
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DRAWN BY: ADN

CHECKED BY: DLW

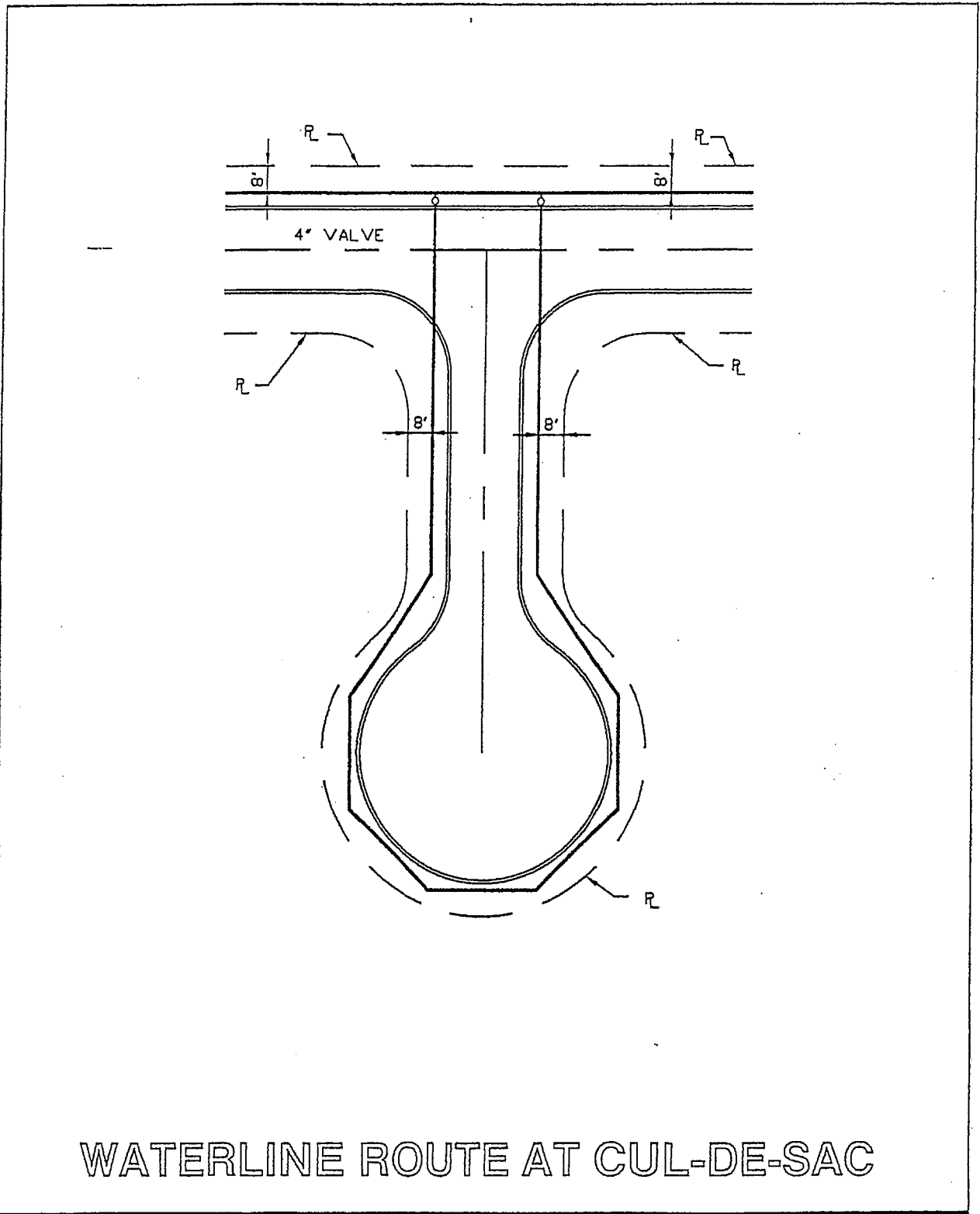
APPROVED: MDK

DATE: 8/01/99



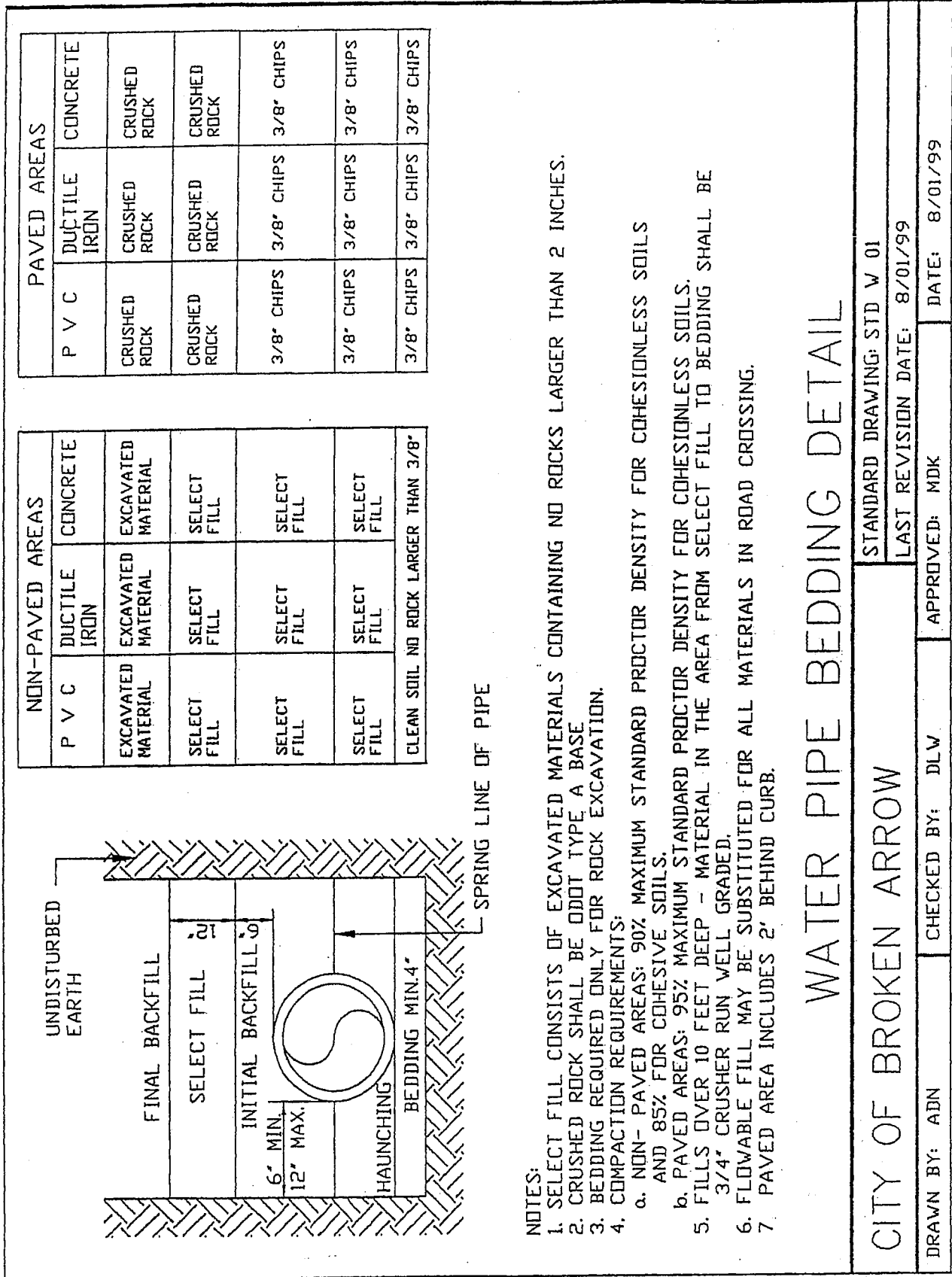
STREET UTILITY LOCATION

CITY OF BROKEN ARROW		STANDARD DRAWING: STD UL 02	
		LAST REVISION DATE: 8/01/99	
DRAWN BY: ADN	CHECKED BY: DLW	APPROVED: MDK	DATE: 8/01/99



CITY OF BROKEN ARROW		STANDARD DRAWING: STD UL 03	
		LAST REVISION DATE: 8/01/99	
DRAWN BY: ADN	CHECKED BY: DLW	APPROVED: MDK	DATE: 8/01/99

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- NOTES:
1. SELECT FILL CONSISTS OF EXCAVATED MATERIALS CONTAINING NO ROCKS LARGER THAN 2 INCHES.
 2. CRUSHED ROCK SHALL BE ODOT TYPE A BASE
 3. BEDDING REQUIRED ONLY FOR ROCK EXCAVATION.
 4. COMPACTION REQUIREMENTS:
 - a. NON-PAVED AREAS: 90% MAXIMUM STANDARD PROCTOR DENSITY FOR COHESIONLESS SOILS AND 85% FOR COHESIVE SOILS.
 - b. PAVED AREAS: 95% MAXIMUM STANDARD PROCTOR DENSITY FOR COHESIONLESS SOILS.
 5. FILLS OVER 10 FEET DEEP - MATERIAL IN THE AREA FROM SELECT FILL TO BEDDING SHALL BE 3/4" CRUSHER RUN WELL GRADED.
 6. FLOWABLE FILL MAY BE SUBSTITUTED FOR ALL MATERIALS IN ROAD CROSSING.
 7. PAVED AREA INCLUDES 2' BEHIND CURB.

WATER PIPE BEDDING DETAIL

CITY OF BROKEN ARROW

STANDARD DRAWING: STD W 01

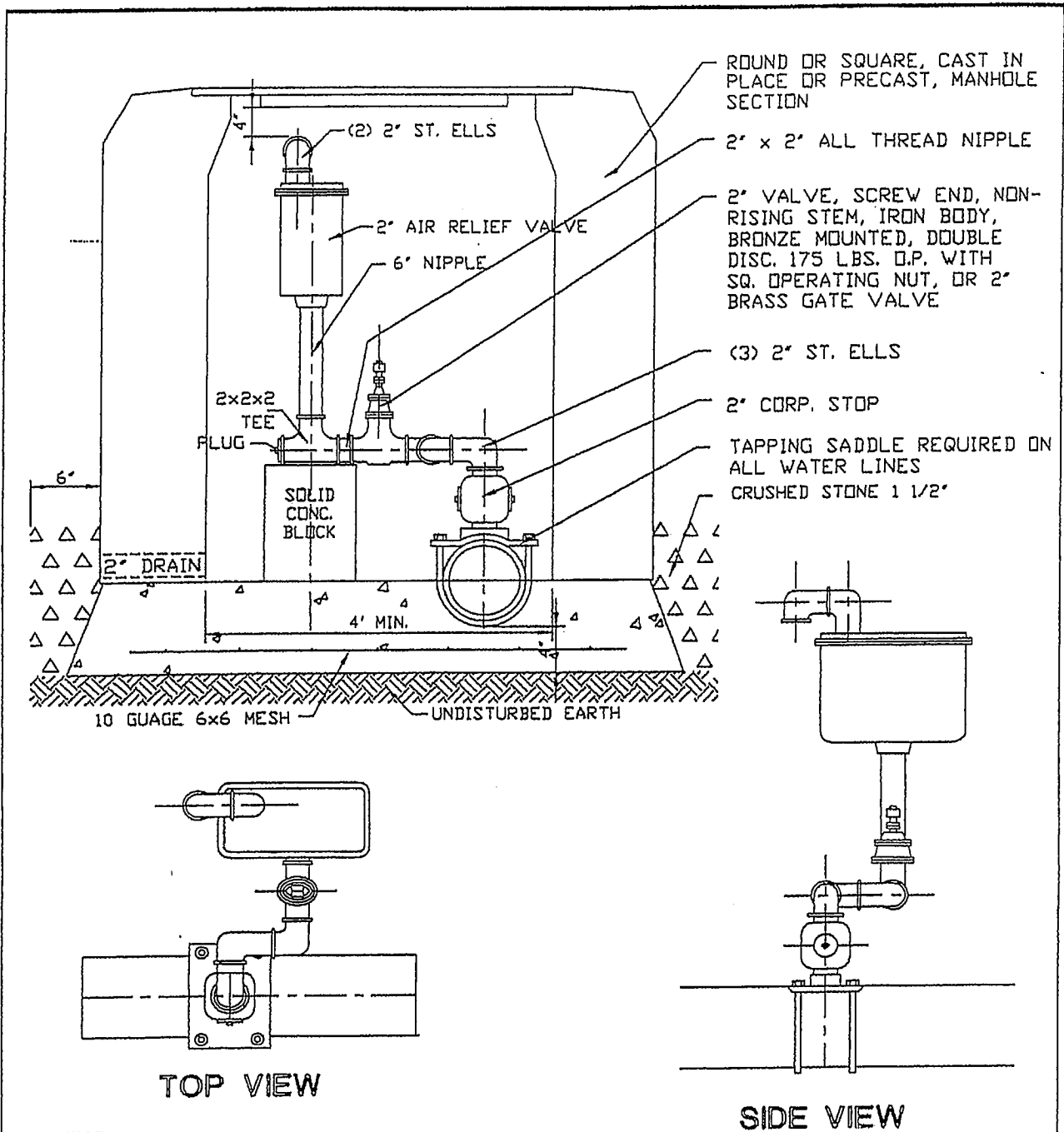
LAST REVISION DATE: 8/01/99

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CHECKED BY: DLW

APPROVED: MDK

DATE: 8/01/99

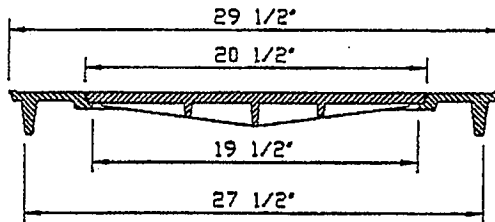
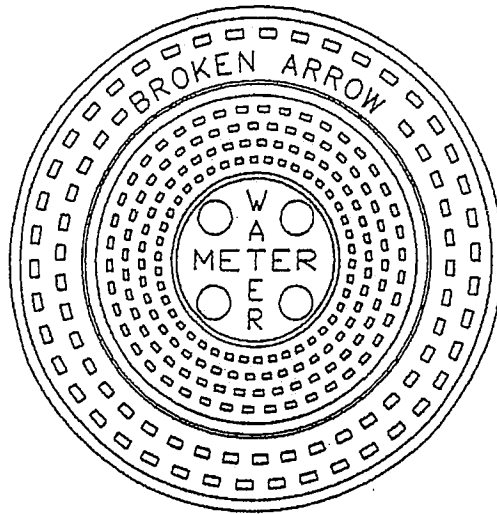


NOTES:

1. ALL PIPING AND CONNECTORS SHALL BE BRONZE, EXCEPT TAPPING SADDLE.
2. STAINLESS STEEL BOLTS WILL BE USED ON TAPPING SADDLES.
3. FRAME AND LID FOR VAULT SHALL BE AS SHOWN ON STANDARD DRAWING W 03.

AIR RELIEF VALVE AND VAULT DETAIL

CITY OF BROKEN ARROW	STANDARD DRAWING: STD W 02		
	LAST REVISION DATE: 8/01/99		
DRAWN BY: ADN	CHECKED BY: DLW	APPROVED: MDK	DATE: 8/01/99

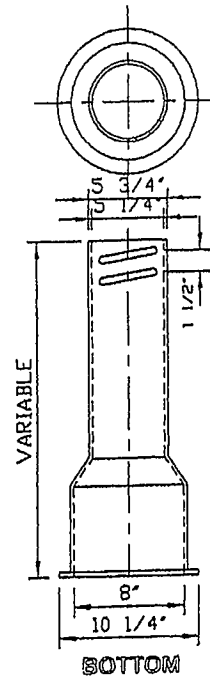
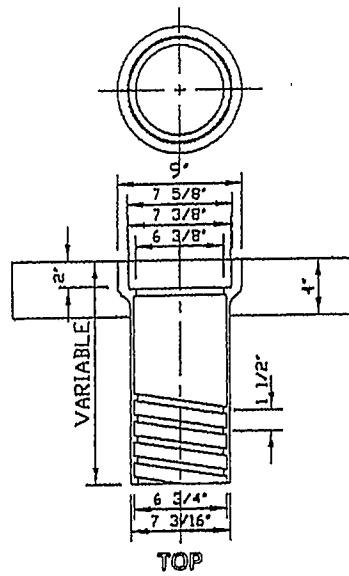
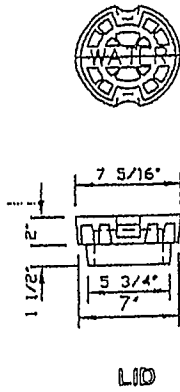


1. METER RING IS CAST WITH SIX BOLT/RIVET HOLES THROUGH THE SKIRT FOR ATTACHMENT TO 28' DIAMETER CORRUGATED STEEL METER CAN. SPECIFY CAN HEIGHT WHEN ORDERING.
2. METER LID TO HAVE KEYED LOCKING MECHANISM.

	WEIGHT
LID	46 LBS
RING	61 LBS
SET	107 LBS

WATER VALVE VAULT FRAME AND LID DETAIL

CITY OF BROKEN ARROW		STANDARD DRAWING: STD W 03	
		LAST REVISION DATE: 8/01/99	
DRAWN BY: ADN	CHECKED BY: DLW	APPROVED: MDK	DATE: 8/01/99



4" - 12" VALVE BOX DETAIL

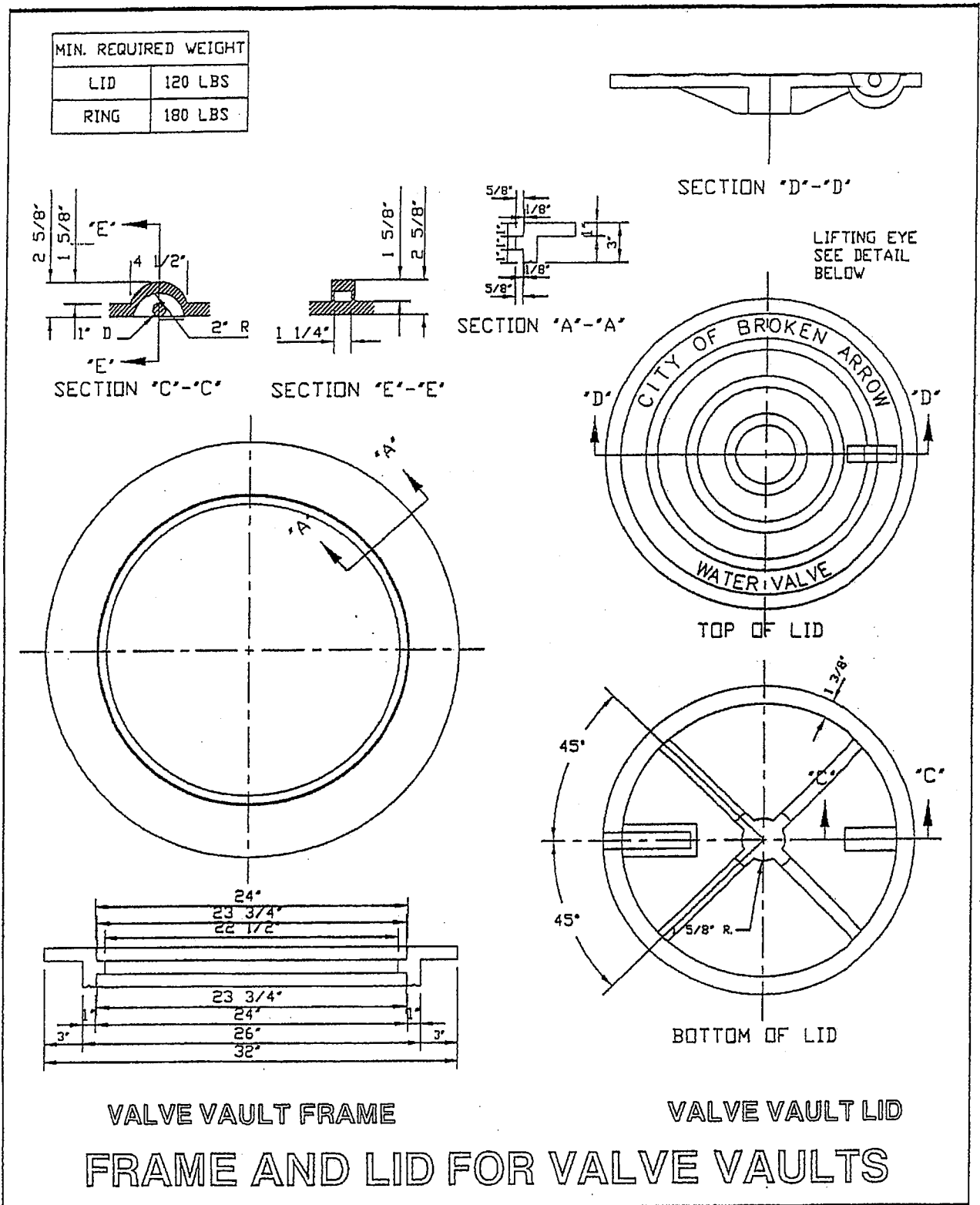
REQUIRED WEIGHTS	
LID	15 LBS
TOP (16")	30 LBS
BOTTOM (24")	35 LBS

NOTES:

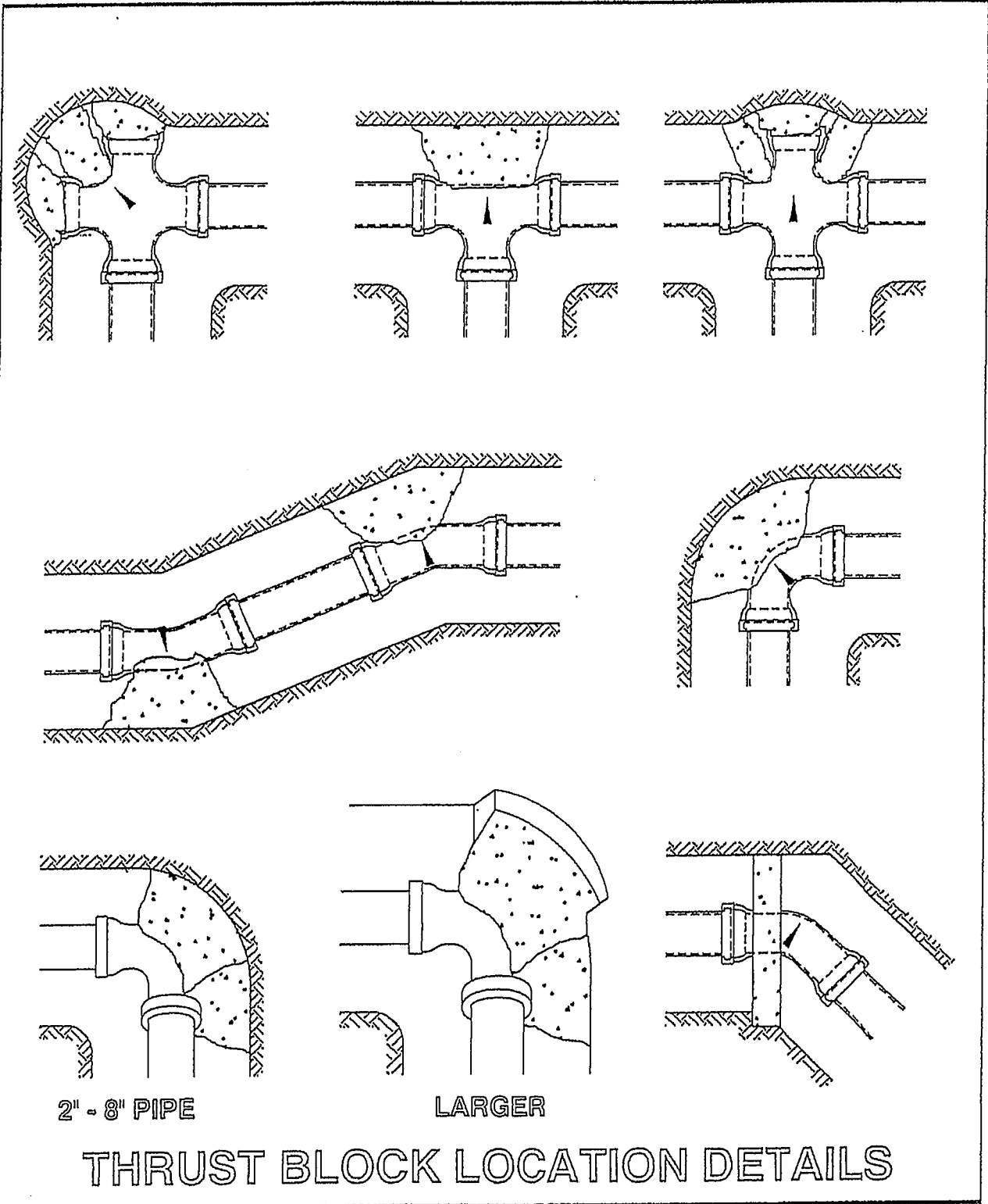
1. WATER LINE CONTRACTOR TO PLACE 2 FOOT SQUARE CONCRETE PAD AROUND EACH WATER VALVE AFTER FINAL GRADING HAS BEEN COMPLETED AND TRENCHES HAVE SETTLED.
2. VALVE BOXES REQUIRING OVER 2 ADDITIONAL BOTTOM SECTIONS SHALL BE EXTENDED USING C900 DR14 PVC PIPE WITH A BOTTOM AND TOP SECTION PLACED ON TOP OF THE C900 DR14 PVC PIPE.

VALVE BOX DETAIL

CITY OF BROKEN ARROW	STANDARD DRAWING: STD W 04		
	LAST REVISION DATE: 8/01/99		
DRAWN BY: ADN	CHECKED BY: DLW	APPROVED: MDK	DATE: 8/01/99



CITY OF BROKEN ARROW		STANDARD DRAWING: STD W 05	
		LAST REVISION DATE: 8/01/99	
DRAWN BY: ADN	CHECKED BY: DLW	APPROVED: MDK	DATE: 8/01/99



2" - 8" PIPE

LARGER

THRUST BLOCK LOCATION DETAILS

CITY OF BROKEN ARROW

STANDARD DRAWING: STD W 06

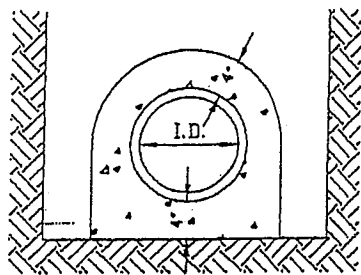
LAST REVISION DATE: 8/01/99

DRAWN BY: ADN

CHECKED BY: DLW

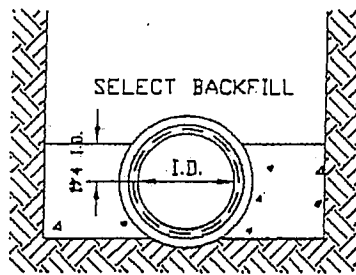
APPROVED: MDK

DATE: 8/01/99



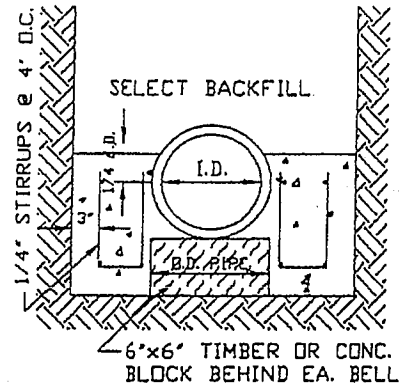
CONCRETE ENCASEMENT
CONCRETE PER LF

8" I.D.	DIP, RCP	1.41 CF
10" I.D.	DIP, RCP	1.67 CF
12" I.D.	DIP, RCP	1.93 CF
15" I.D.	DIP, RCP	2.36 CF
18" I.D.	DIP, RCP	2.81 CF
21" I.D.	DIP, RCP	3.27 CF
24" I.D.	DIP, RCP	3.76 CF
27" I.D.	DIP, RCP	4.26 CF
30" I.D.	DIP	4.78 CF
30" I.D.	RCP	5.09 CF
36" I.D.	DIP, RCP	5.80 CF
36" I.D.	RCP	6.20 CF



CONCRETE GRADLE
CONCRETE PER LF

8" I.D.	DIP, RCP	1.09 CF
10" I.D.	DIP, RCP	1.23 CF
12" I.D.	DIP, RCP	1.33 CF
15" I.D.	DIP, RCP	1.66 CF
18" I.D.	DIP, RCP	2.00 CF
21" I.D.	DIP, RCP	1.96 CF
24" I.D.	DIP, RCP	2.69 CF
27" I.D.	DIP, RCP	3.52 CF
30" I.D.	DIP	3.38 CF
30" I.D.	RCP	4.40 CF
36" I.D.	DIP, RCP	4.12 CF
36" I.D.	RCP	5.26 CF



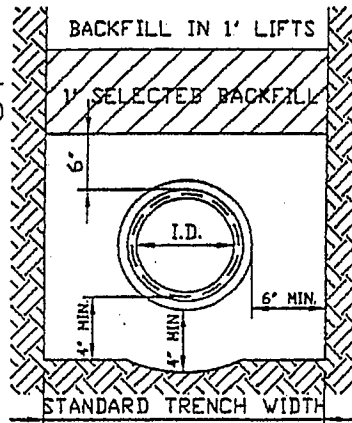
WATER TABLE GRADLE
CONCRETE PER LF

8" I.D.	DIP, RCP	2.34 CF
10" I.D.	DIP, RCP	2.48 CF
12" I.D.	DIP, RCP	2.58 CF
15" I.D.	DIP, RCP	3.04 CF
18" I.D.	DIP, RCP	3.50 CF
21" I.D.	DIP, RCP	3.46 CF
24" I.D.	DIP, RCP	4.44 CF
27" I.D.	DIP, RCP	5.52 CF
30" I.D.	DIP	5.38 CF
30" I.D.	RCP	6.65 CF
36" I.D.	DIP, RCP	6.37 CF
36" I.D.	RCP	7.76 CF

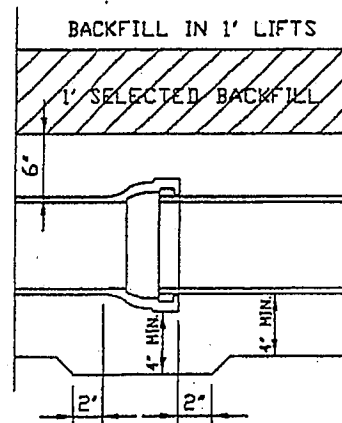
CONCRETE ENCASEMENT & CRADLES

NOTES:

1. ALL FINISHED SUB-GRADES SHALL BE PREPARED ACCURATELY BY MEANS OF HAND TOOLS.
2. TRENCH WIDTHS ARE DETAILED IN SPECIFICATION 311 EXCAVATION.



CROSS SECTION



LONGITUDINAL SECTION

TRENCH CONDITIONS

CITY OF BROKEN ARROW

STANDARD DRAWING: STD W 07

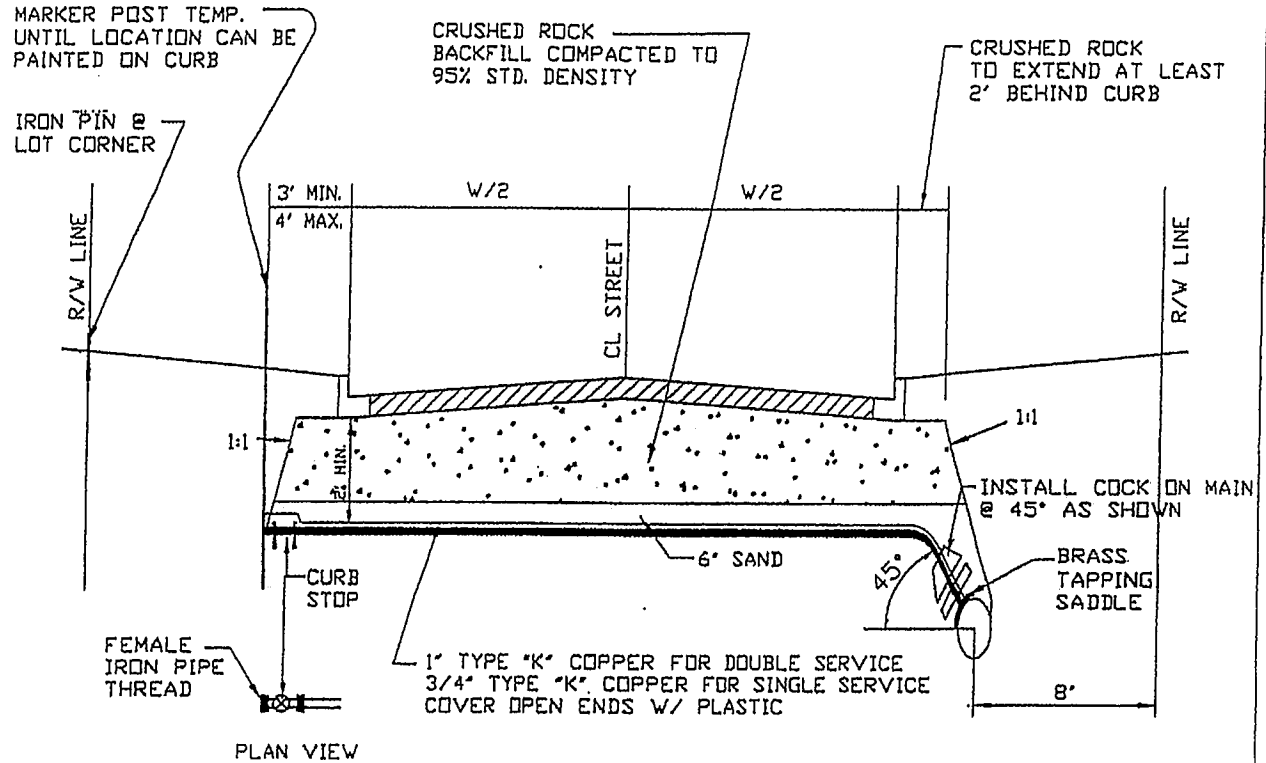
LAST REVISION DATE: 8/01/99

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DATE: 8/01/99

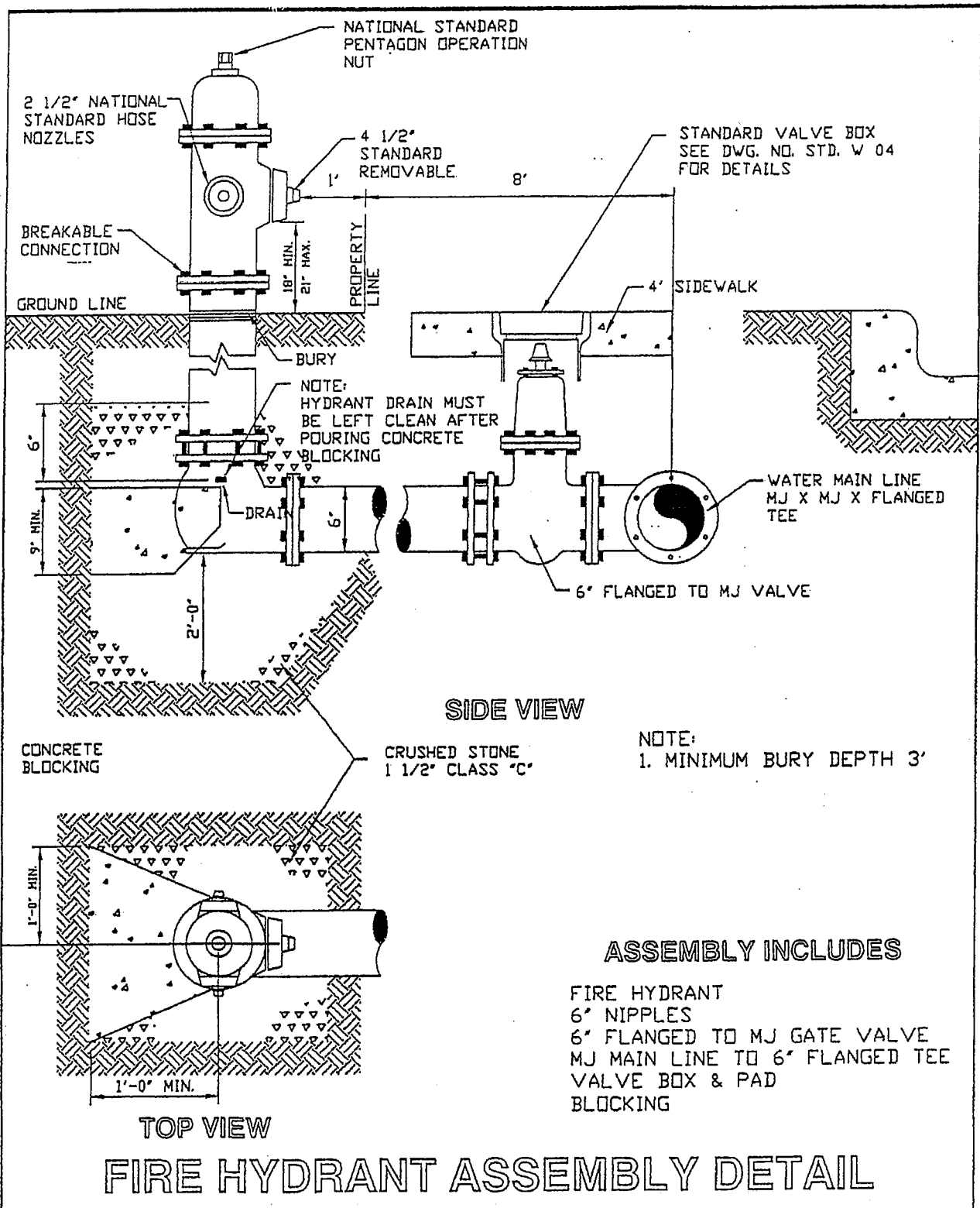


NOTES:

1. LOT CORNERS SHALL BE STAKED PRIOR TO CONSTRUCTION OF SERVICE LINES, CROSSING TO BE ON LOT LINE.
2. DETECTABLE MYLAR MARKING TAPE (LIFEGUARD TYPE II OR EQUAL) TO BE INSTALLED OVER COPPER SERVICE AS SHOWN.
3. CROSSING NOT REQUIRED IN LOOPED CUL-DE-SAC.
4. COPPER SHALL NOT BE SPLICED.
5. CROSSING TO BE INSPECTED BEFORE TRENCH IS BACKFILLED.
6. IF ROCK IS USED IN BACKFILL, COPPER SHALL BE PLACED IN SCHEDULE 40 PVC SLEEVE

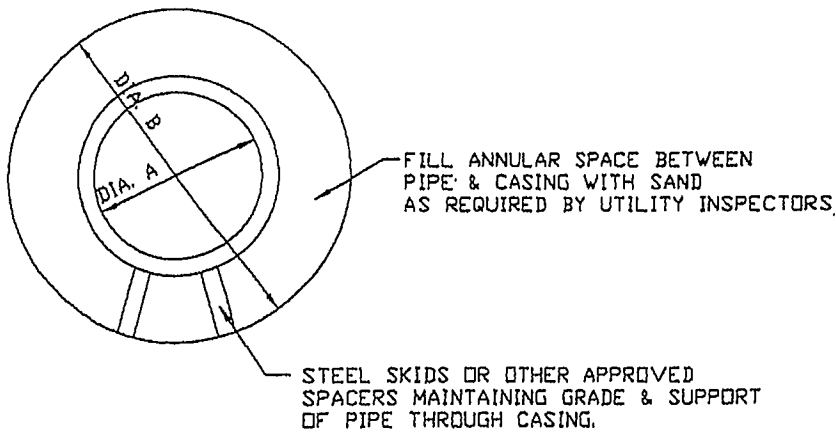
WATER LINE STREET CROSSING DETAIL

CITY OF BROKEN ARROW		STANDARD DRAWING: STD W 08	
		LAST REVISION DATE: 8/01/99	
DRAWN BY: ADN	CHECKED BY: DLW	APPROVED: MDK	DATE: 8/01/99



- ASSEMBLY INCLUDES**
- FIRE HYDRANT
 - 6" NIPPLES
 - 6" FLANGED TO MJ GATE VALVE
 - MJ MAIN LINE TO 6" FLANGED TEE
 - VALVE BOX & PAD
 - BLOCKING

CITY OF BROKEN ARROW		STANDARD DRAWING: STD W 09	
		LAST REVISION DATE: 8/01/99	
DRAWN BY: ADN	CHECKED BY: DLW	APPROVED: MDK	DATE: 8/01/99



PIPE & STEEL CASING SCHEDULE	
PIPE DIA. A	CASING DIA. B
4"	10"
6"	12"
8"	14"
10"	18"
12"	20"
16"	24"
18"	26"
20"	30"
24"	33"

RAILROAD & STREET CROSSING CONDUIT DETAIL

CITY OF BROKEN ARROW

STANDARD DRAWING: STD W 10

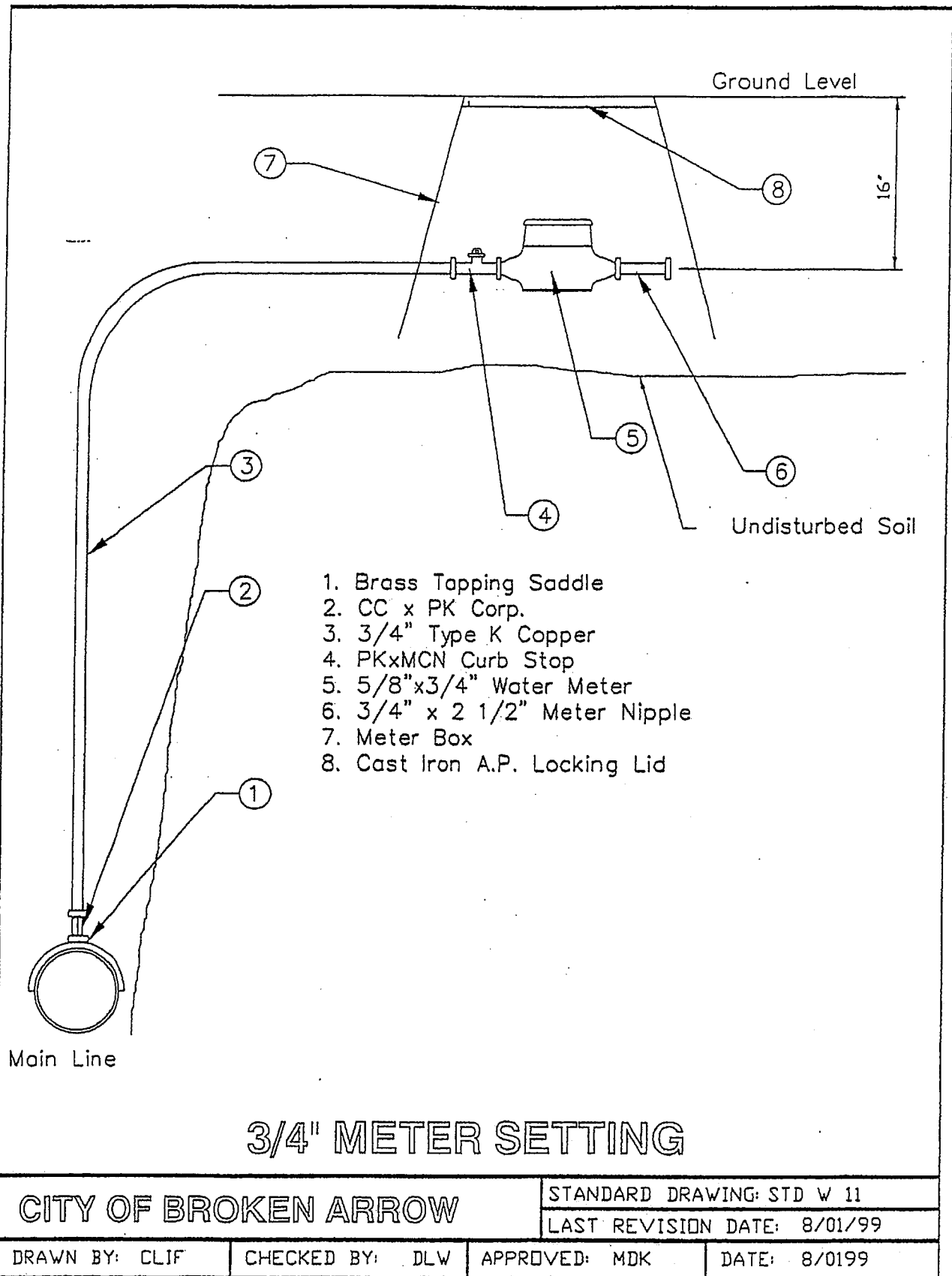
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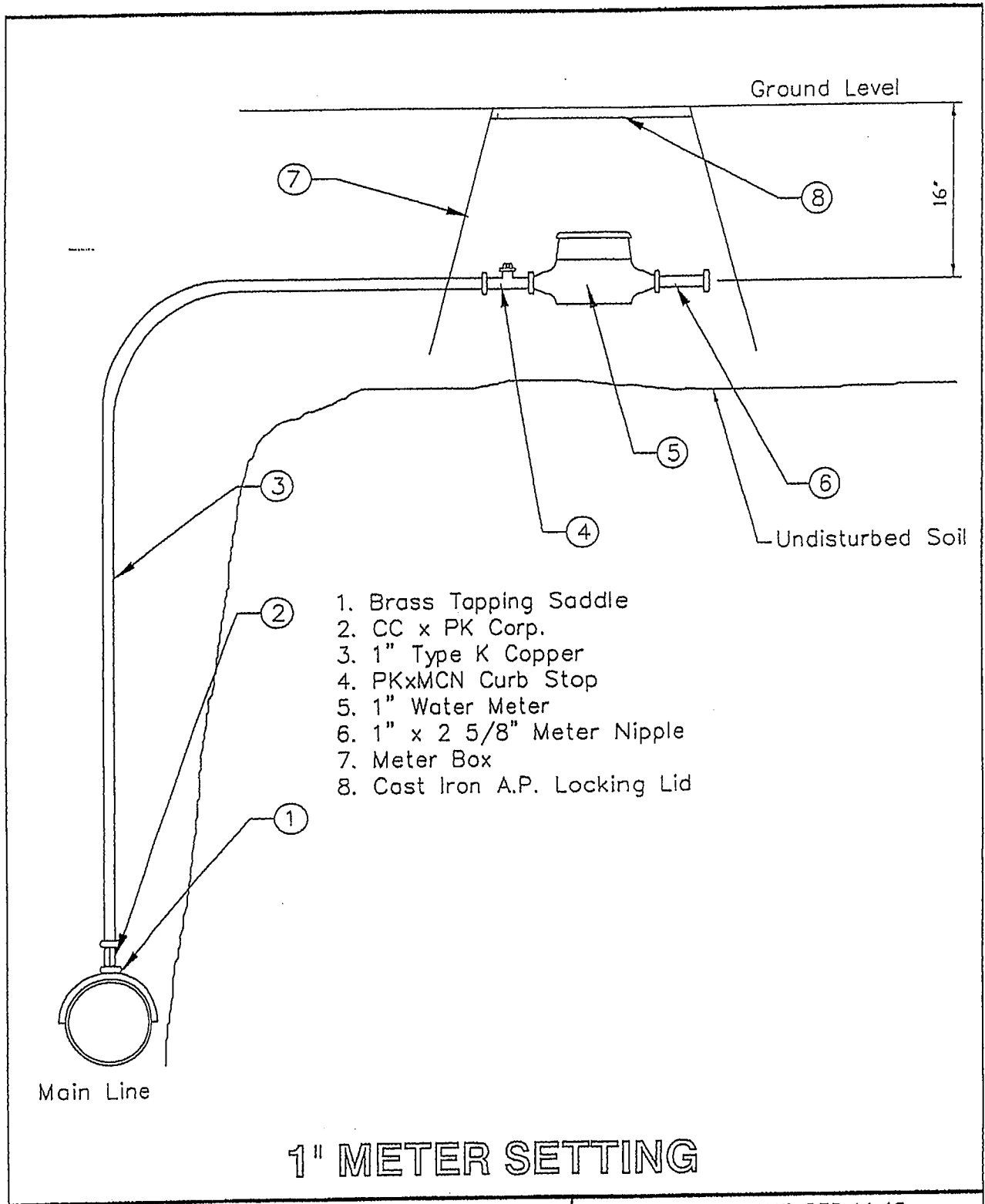
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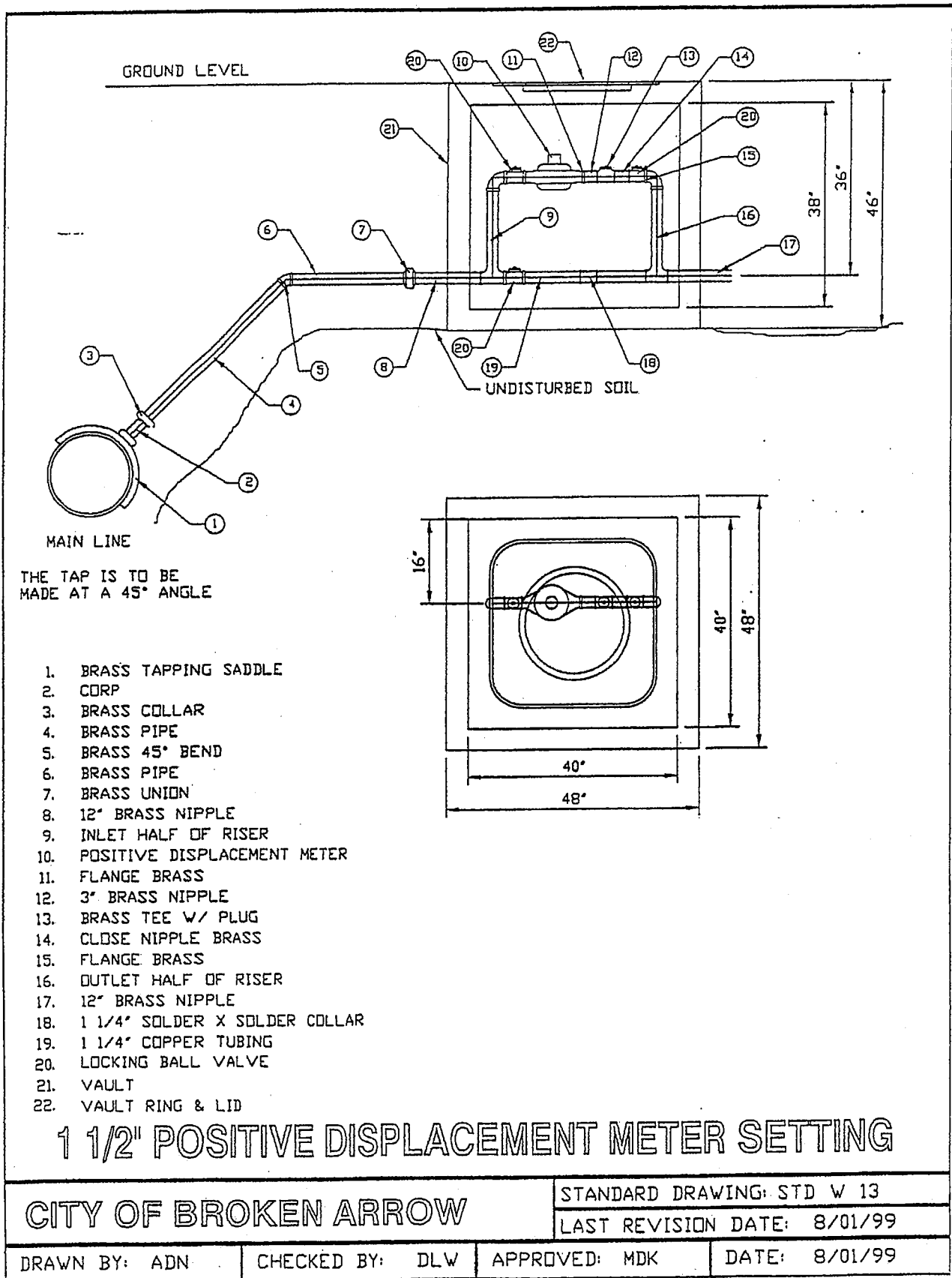
DATE: 8/01/99





1" METER SETTING

CITY OF BROKEN ARROW		STANDARD DRAWING: STD W 12	
		LAST REVISION DATE: 8/01/99	
DRAWN BY: CLIF	CHECKED BY: DLW	APPROVED: MDK	DATE: 8/01/99



THE TAP IS TO BE
MADE AT A 45° ANGLE

1. BRASS TAPPING SADDLE
2. CORP
3. BRASS COLLAR
4. BRASS PIPE
5. BRASS 45° BEND
6. BRASS PIPE
7. BRASS UNION
8. 12" BRASS NIPPLE
9. INLET HALF OF RISER
10. POSITIVE DISPLACEMENT METER
11. FLANGE BRASS
12. 3" BRASS NIPPLE
13. BRASS TEE W/ PLUG
14. CLOSE NIPPLE BRASS
15. FLANGE BRASS
16. OUTLET HALF OF RISER
17. 12" BRASS NIPPLE
18. 1 1/4" SOLDER X SOLDER COLLAR
19. 1 1/4" COPPER TUBING
20. LOCKING BALL VALVE
21. VAULT
22. VAULT RING & LID

1 1/2" POSITIVE DISPLACEMENT METER SETTING

CITY OF BROKEN ARROW

STANDARD DRAWING: STD W 13

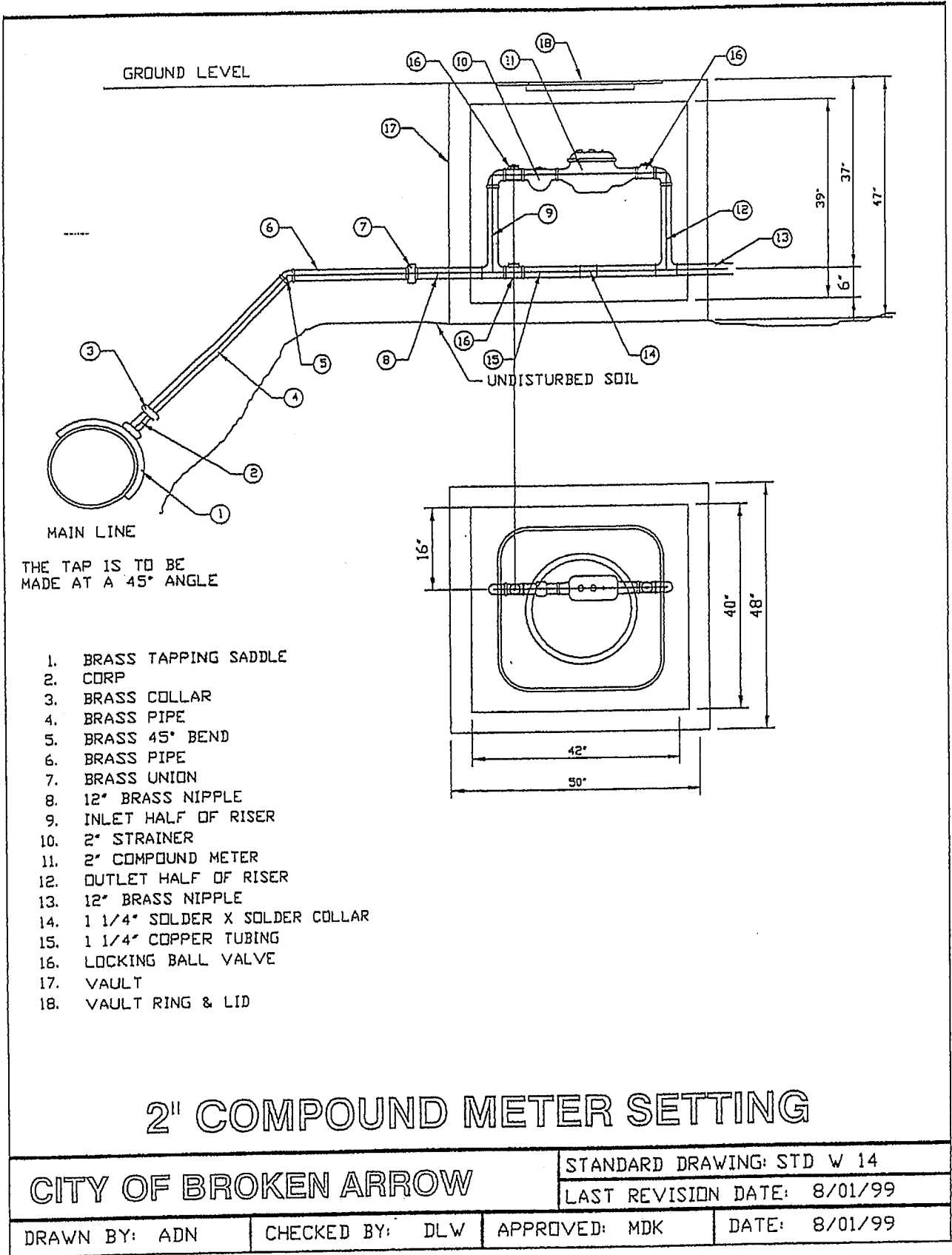
LAST REVISION DATE: 8/01/99

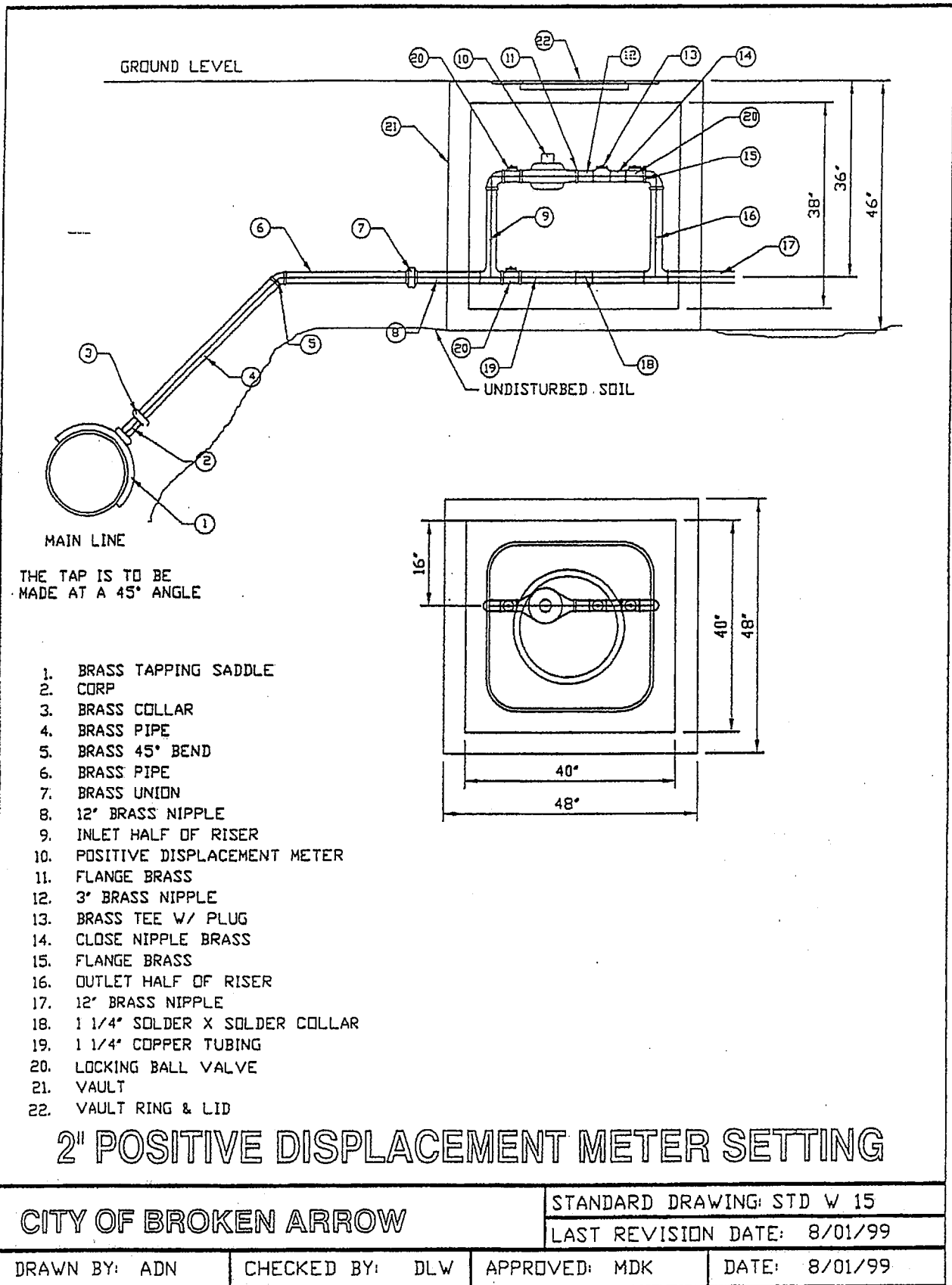
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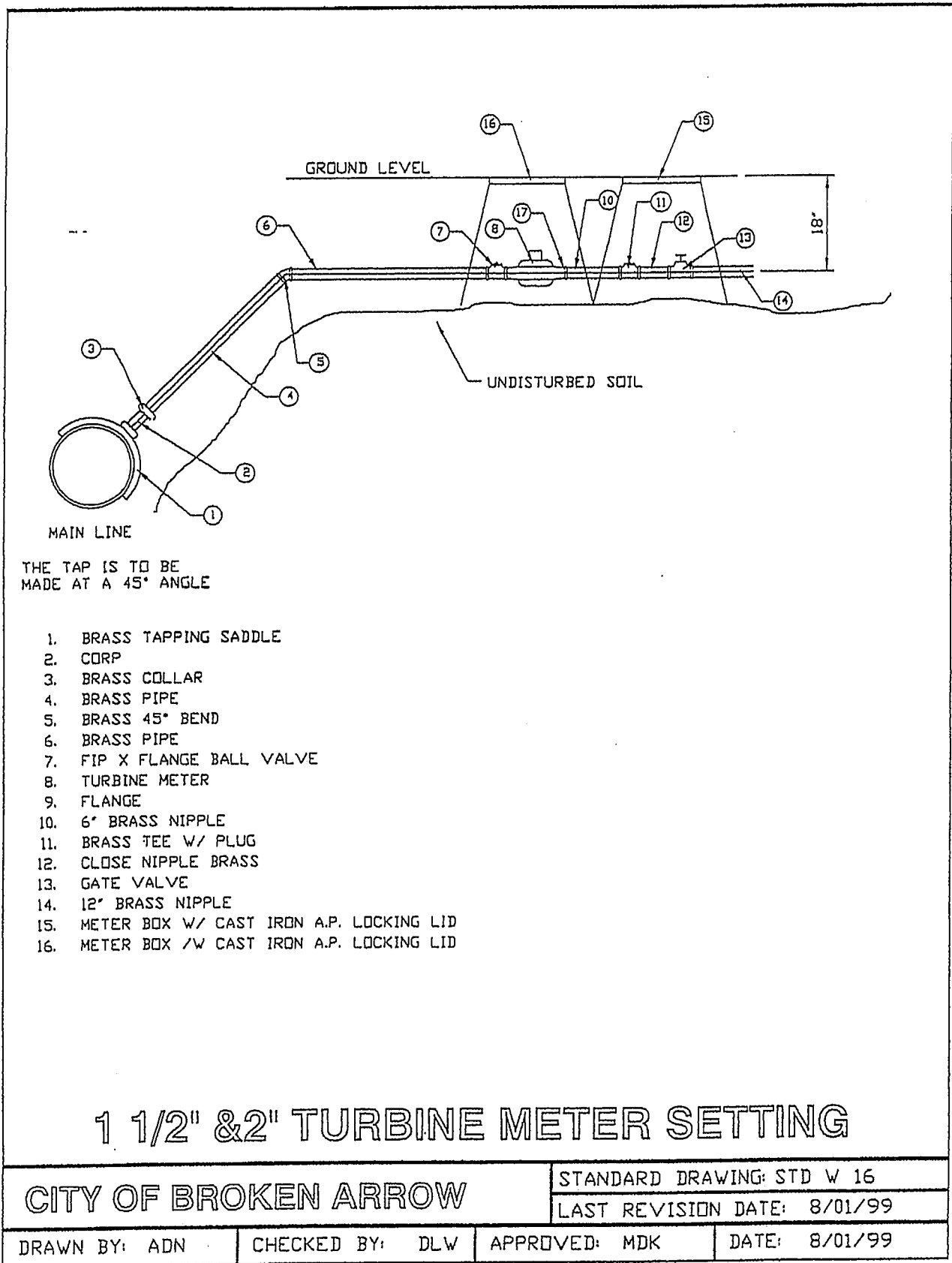
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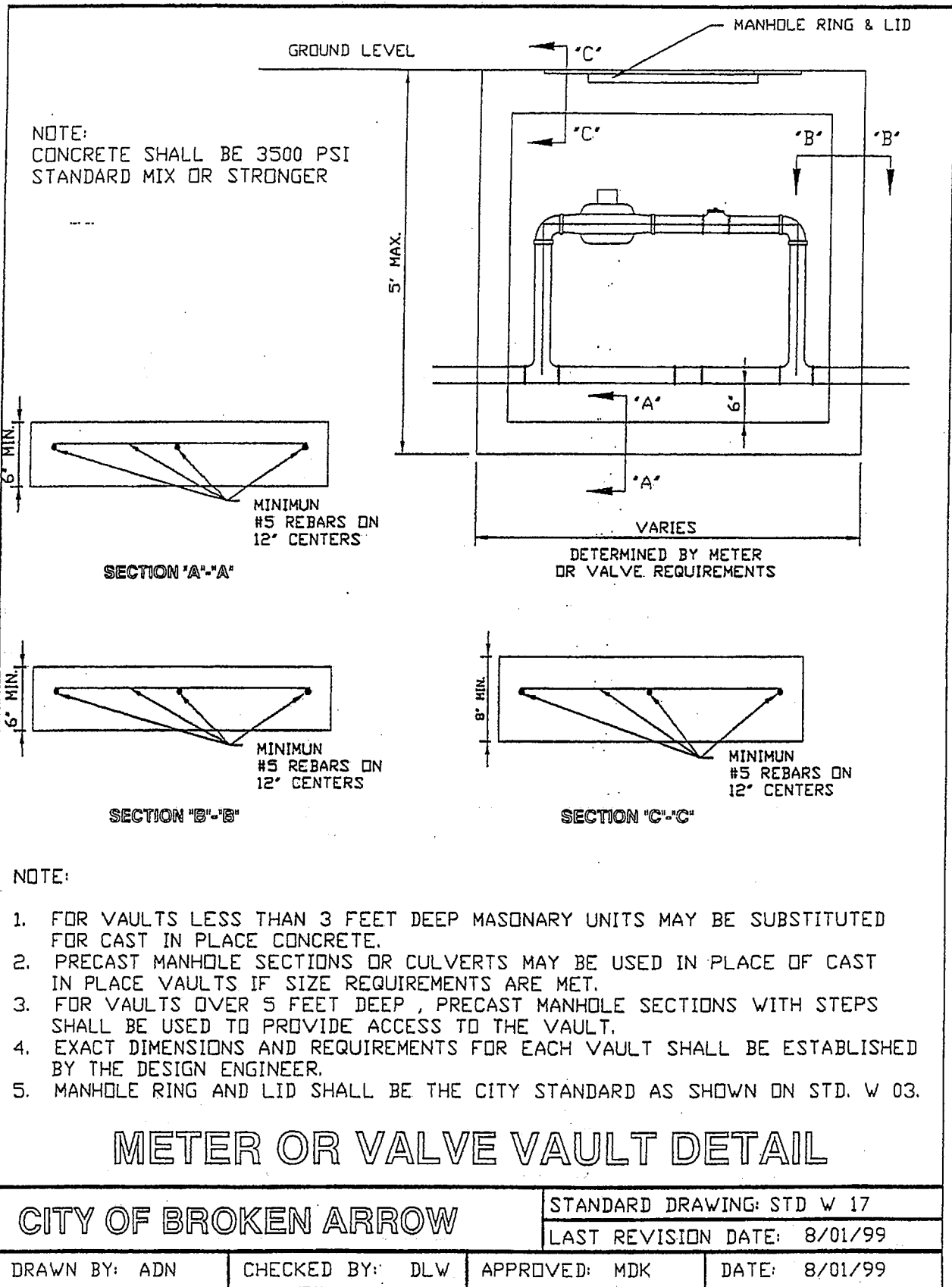
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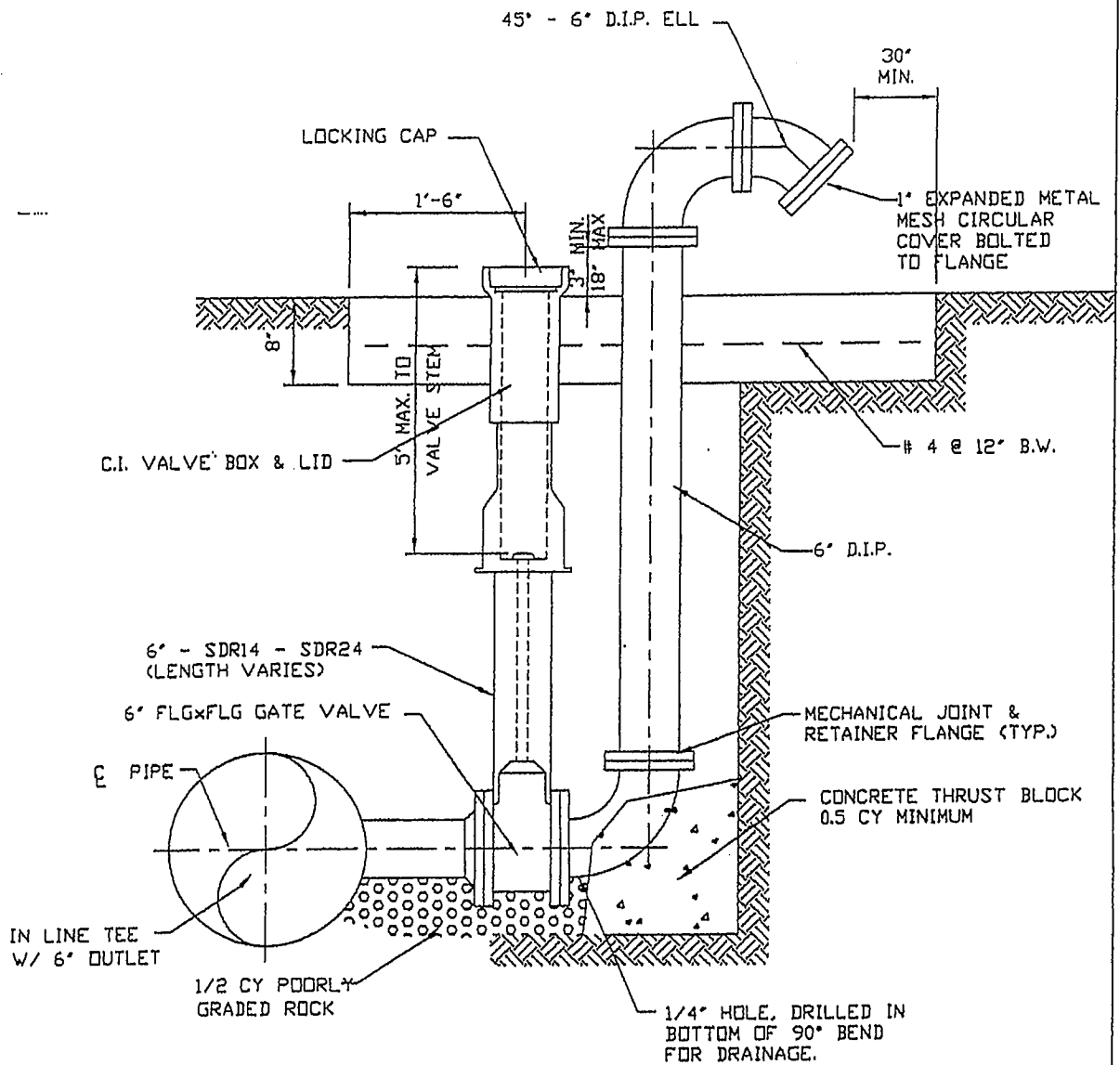
DATE: 8/01/99











NOTES:

1. ALL EXPOSED METAL TO RECEIVE 2 COATS OF ALUMINUM INDUSTRIAL GRADE PAINT.
2. CONCRETE PAD TO BE 2' - 8" X 8' X 8"
3. ALL ITEMS REQUIRED TO INSTALL BLOW-OFF VALVE ASSEMBLY SHALL BE PROVIDED BY CONTRACTOR AND ALL COST FOR SUCH SHALL BE INCLUDED IN BLOW-OFF VALVE ASSEMBLY PAY ITEM.

BLOW OFF VALVE ASSEMBLY DETAIL

CITY OF BROKEN ARROW

STANDARD DRAWING: STD W 18

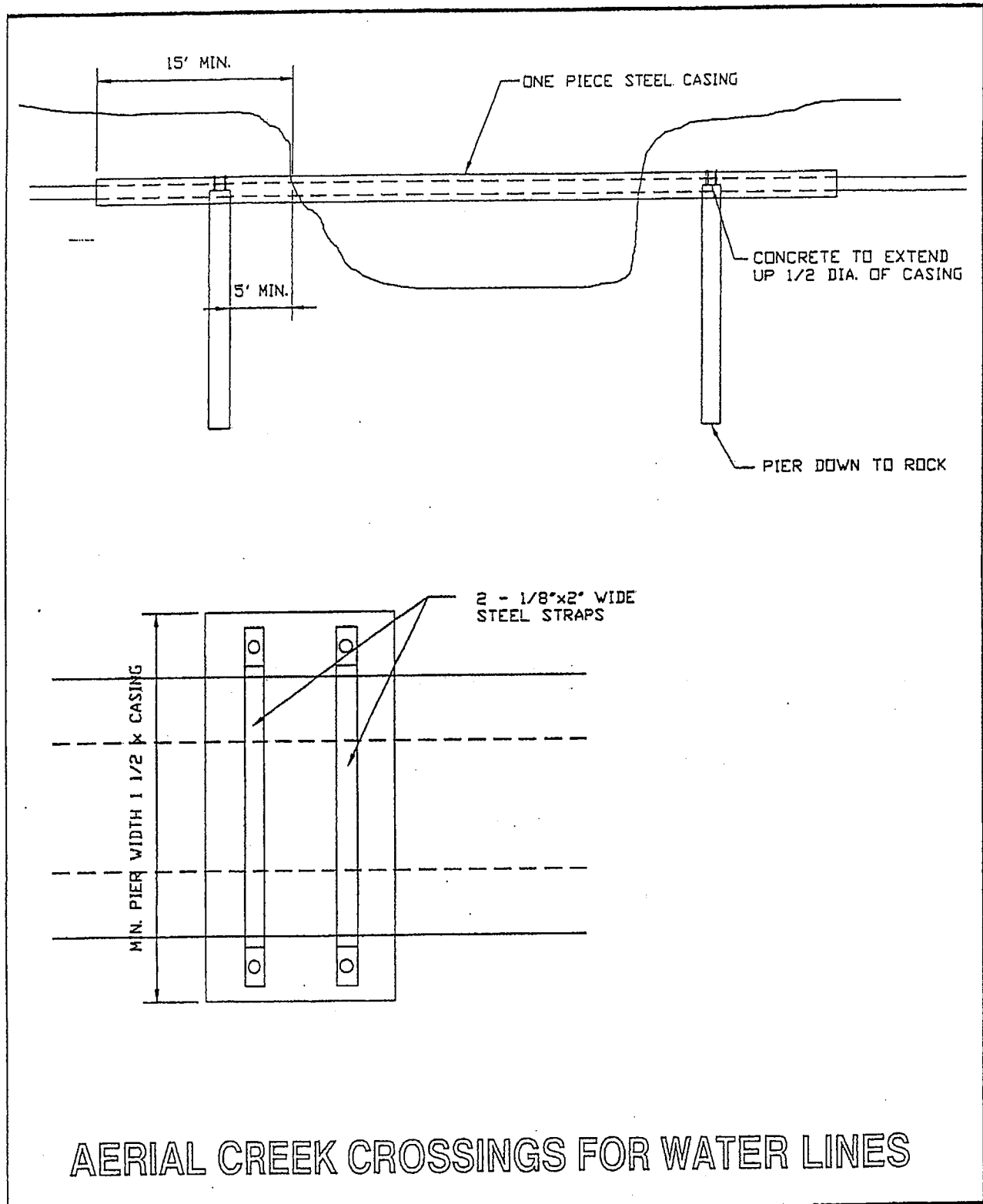
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APPROVED: MDK

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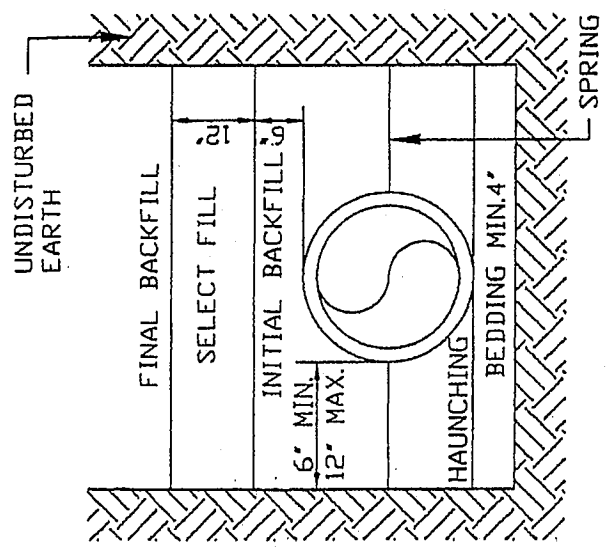
AERIAL CREEK CROSSINGS FOR WATER LINES

CITY OF BROKEN ARROW		STANDARD DRAWING: STD W 19	
		LAST REVISION DATE: 8/01/99	
DRAWN BY: ADN	CHECKED BY: DLW	APPROVED: MDK	DATE: 8/01/99

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NON-PAVED AREAS			PAVED AREAS		
P V C	DUCTILE IRON	CONCRETE	P V C	DUCTILE IRON	CONCRETE
EXCAVATED MATERIAL	EXCAVATED MATERIAL	EXCAVATED MATERIAL	CRUSHED ROCK	CRUSHED ROCK	CRUSHED ROCK
SELECT FILL	SELECT FILL	SELECT FILL	CRUSHED ROCK	CRUSHED ROCK	CRUSHED ROCK
SAND	SAND	SAND	3/8" CHIPS	3/8" CHIPS	3/8" CHIPS
SAND	SAND	SAND	3/8" CHIPS	3/8" CHIPS	3/8" CHIPS
3/8" CHIPS	3/8" CHIPS	3/8" CHIPS	3/8" CHIPS	3/8" CHIPS	3/8" CHIPS

NON-PAVED AREAS			PAVED AREAS		
P V C	DUCTILE IRON	CONCRETE	P V C	DUCTILE IRON	CONCRETE
EXCAVATED MATERIAL	EXCAVATED MATERIAL	EXCAVATED MATERIAL	CRUSHED ROCK	CRUSHED ROCK	CRUSHED ROCK
SELECT FILL	SELECT FILL	SELECT FILL	CRUSHED ROCK	CRUSHED ROCK	CRUSHED ROCK
SAND	SAND	SAND	3/8" CHIPS	3/8" CHIPS	3/8" CHIPS
SAND	SAND	SAND	3/8" CHIPS	3/8" CHIPS	3/8" CHIPS
3/8" CHIPS	3/8" CHIPS	3/8" CHIPS	3/8" CHIPS	3/8" CHIPS	3/8" CHIPS



- NOTES:
1. SELECT FILL CONSISTS OF EXCAVATED MATERIALS CONTAINING NO ROCKS LARGER THAN 2 INCHES.
 2. CRUSHED ROCK SHALL BE ODOT TYPE A ROCK.
 3. BEDDING REQUIRED FOR ALL SANITARY SEWER REPLACEMENT PROJECTS IN ROCK EXCAVATION AND FOR LEVELING TRENCH IN NEW INSTALLATION.
 4. COMPACTION REQUIREMENTS:
 - a. NON-PAVED AREAS: 90% MAXIMUM STANDARD PROCTOR DENSITY FOR COHESIONLESS SOILS AND 85% FOR COHESIVE SOILS.
 - b. PAVED AREAS: 95% MAXIMUM STANDARD PROCTOR DENSITY FOR COHESIONLESS SOILS.
 5. FILLS OVER 10 FEET DEEP - MATERIAL IN THE AREA FROM SELECT FILL TO BEDDING SHALL BE 3/4" CRUSHER RUN, WELL GRADED.
 6. FLOWABLE FILL MAY BE SUBSTITUTED FOR ALL MATERIALS IN ROAD CROSSING.

SANITARY SEWER PIPE BEDDING DETAIL

CITY OF BROKEN ARROW

STANDARD DRAWING: STD SS 01

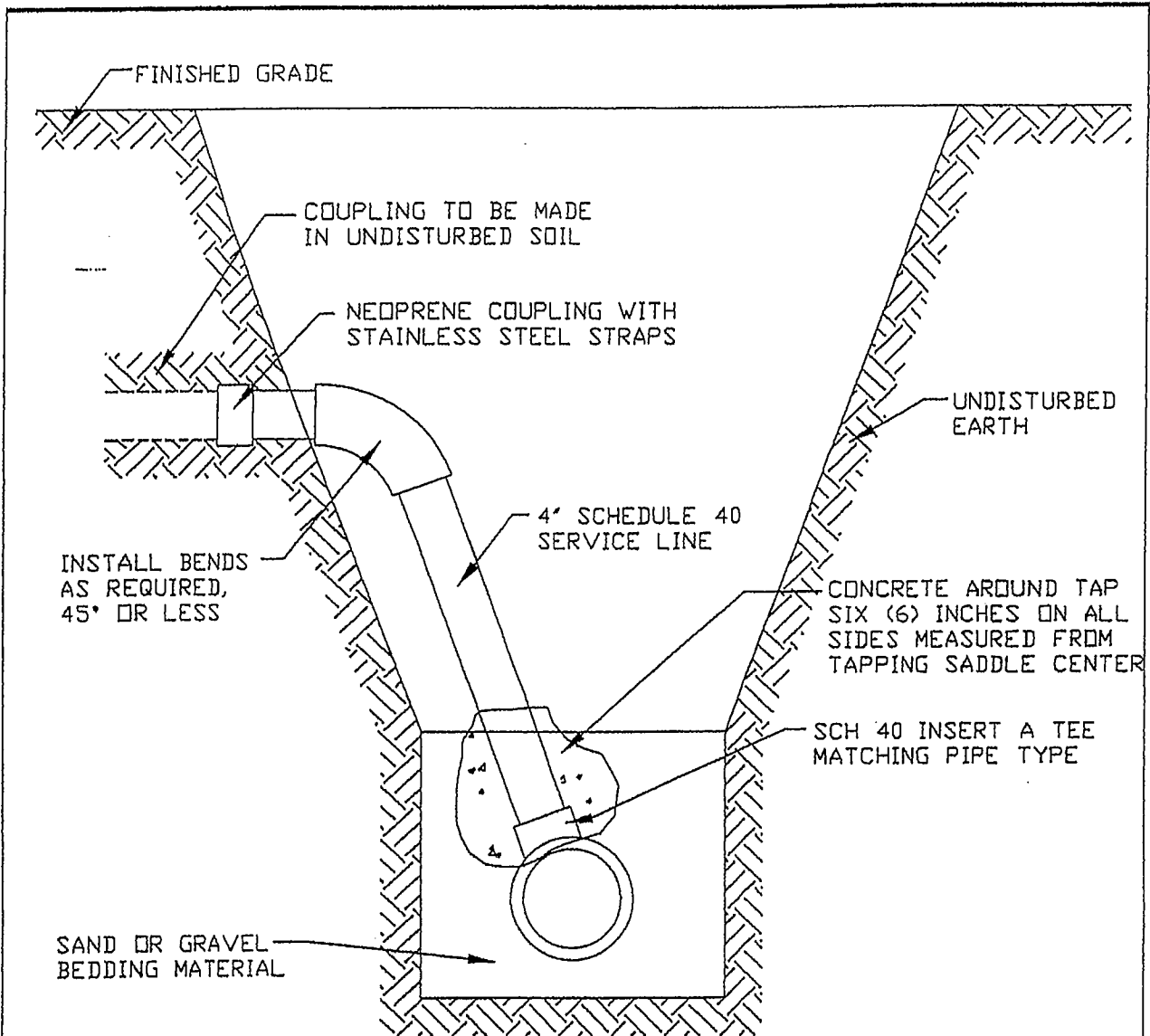
LAST REVISION DATE: 8/01/99

DRAWN BY: ADN

CHECKED BY: DLW

APPROVED: MDK

DATE: 8/01/99

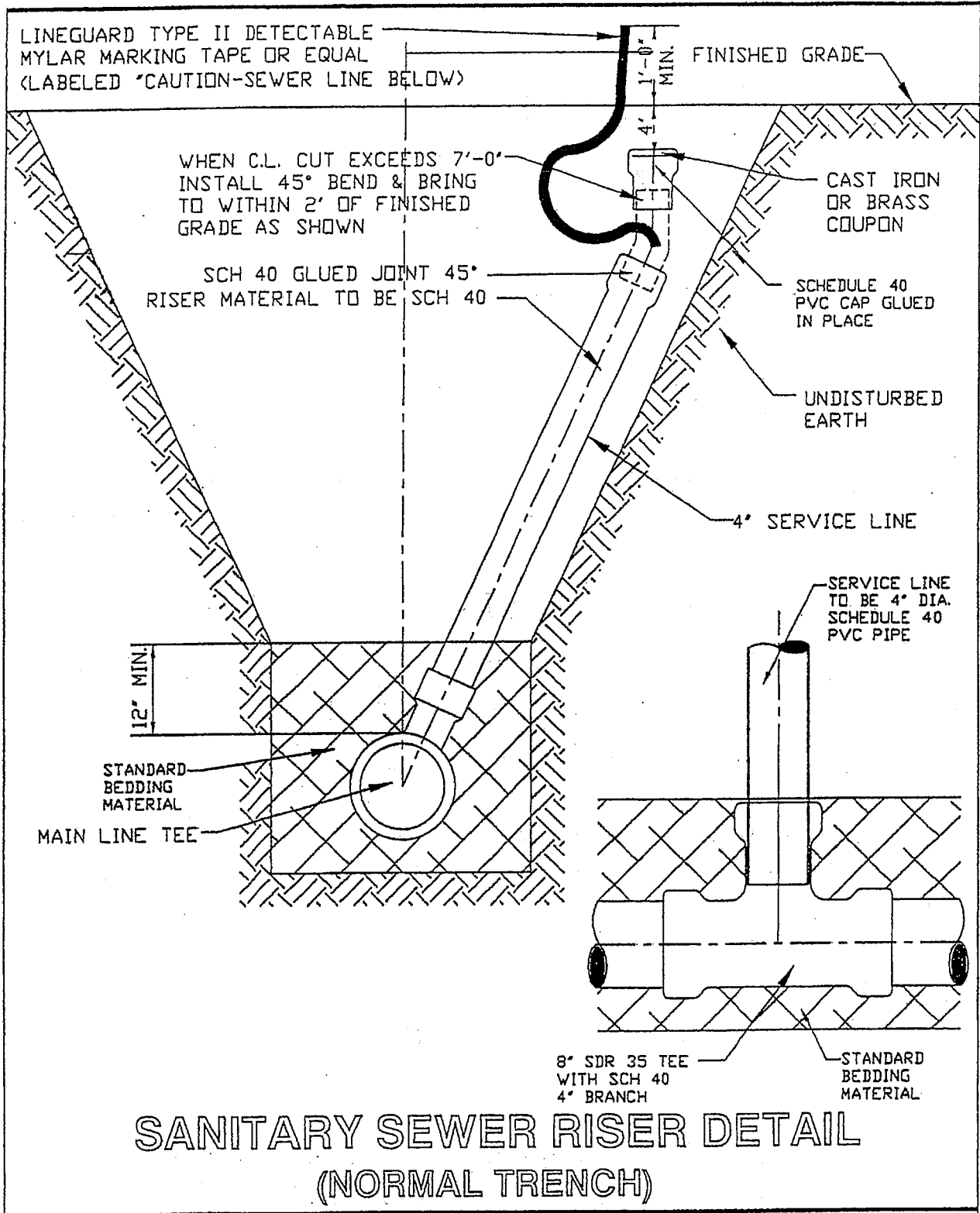


NOTES:

1. PVC SHOWN, HOWEVER, CLAY TILE, CONCRETE, AND DUCTILE IRON SHALL BE TAPPED IN SAME MANNER WITH CHANGE OF TAPPING SADDLE AND EXPANDING POLYURETHANE IN PLACE OF SOLVENT WELDING.
2. ALL MAIN LINE HOLES TO BE SAWED OR DRILLED AND COUPON PRESENTED AT TIME OF INSPECTION.
3. TAPS SHALL BE LEFT UNCOVERED FOR ONE (1) FOOT ON EACH SIDE OF SADDLE, UNTIL TAP IS INSPECTED.

SANITARY SEWER TAP DETAIL (EXISTING SEWER)

CITY OF BROKEN ARROW		STANDARD DRAWING: STD SS 02	
		LAST REVISION DATE: 8/01/99	
DRAWN BY: ADN	CHECKED BY: DLW	APPROVED: MDK	DATE: 8/01/99



CITY OF BROKEN ARROW

STANDARD DRAWING: STD SS 03

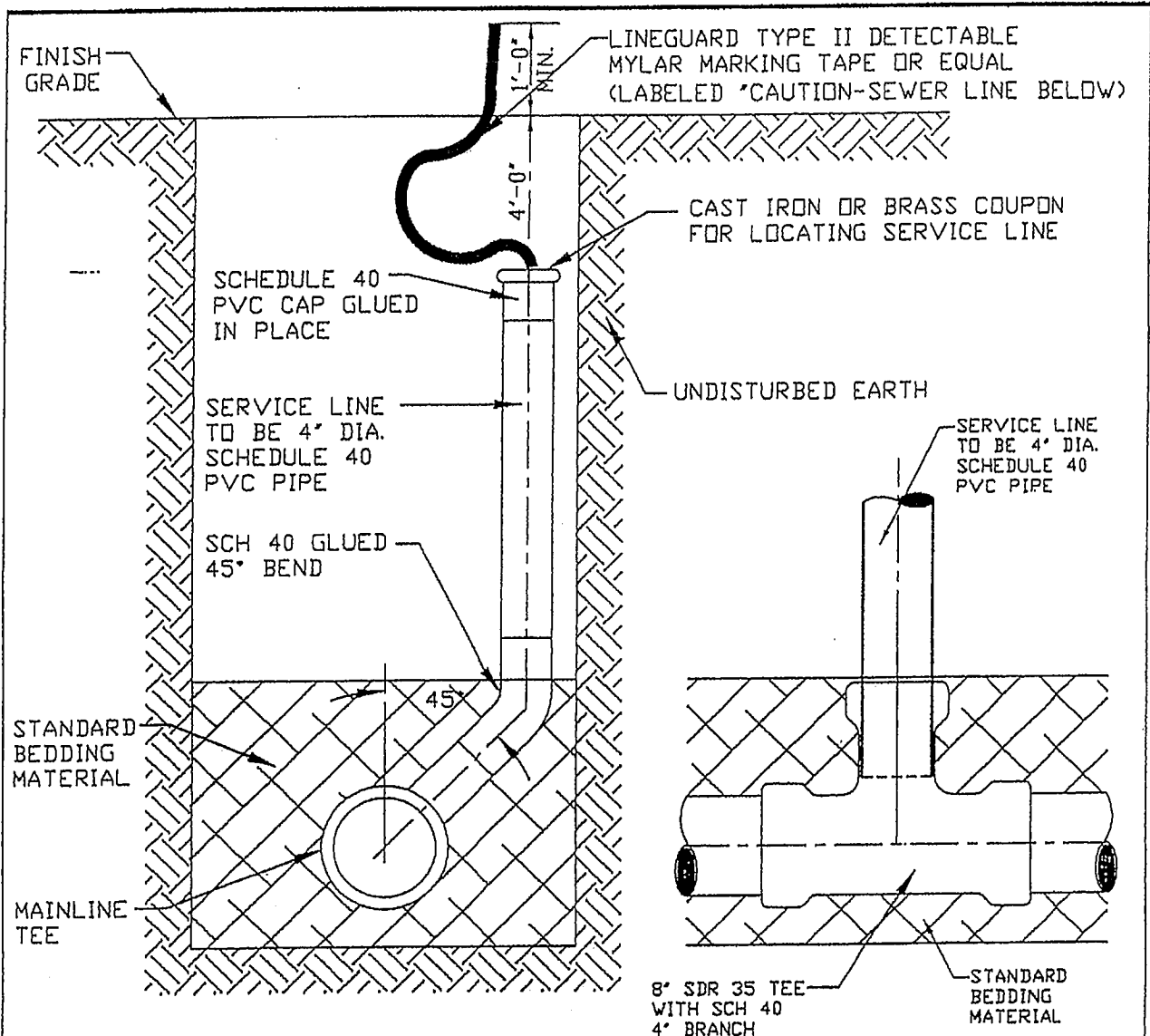
LAST REVISION DATE: 8/01/99

DRAWN BY: ADN

CHECKED BY: DLW

APPROVED: MDK

DATE: 8/01/99

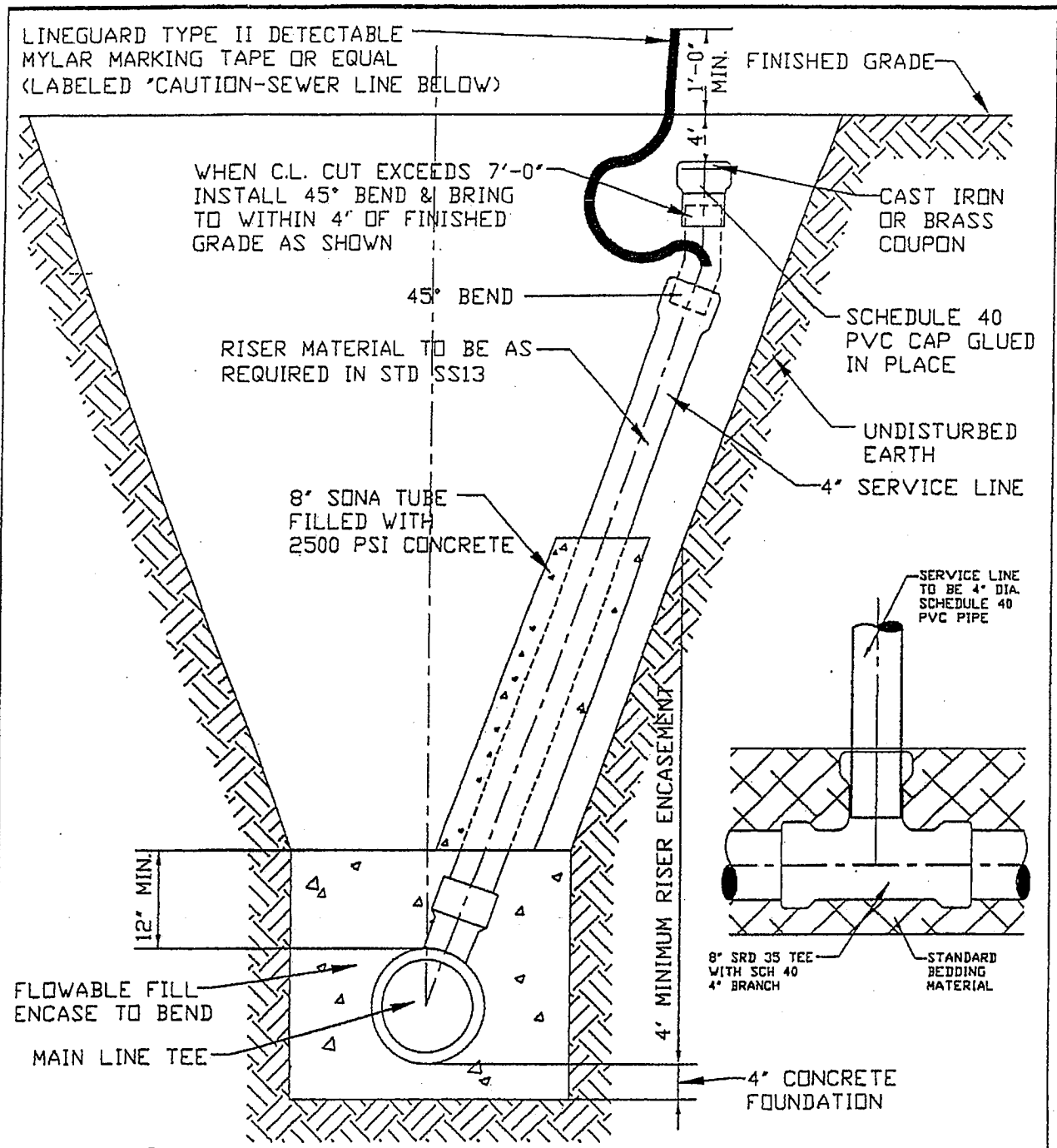


NOTES:

1. ALL NEW SANITARY SEWER LINES SHALL HAVE TAPS INSTALLED AS SHOWN ON THIS DETAIL FOR LINES UP TO 12 FEET DEEP. OVER 12 FEET DEEP STANDARD DRAWINGS SS 04 AND SS 05 WILL BE USED.
2. THE TAP SHALL BE LOCATED AT THE FIRST JOINT AT LEAST FIVE (5) FEET UPSTREAM FROM THE DOWNSTREAM PROPERTY LINE. THE EXACT LOCATION SHALL BE NOTED ON THE AS-BUILT PLANS AS A DISTANCE IN FEET FROM THE NEAREST MANHOLE.
3. FOR WIDE TRENCHES THE LAYOUT ON STANDARD DRAWING SS 04 WILL BE USED.

SANITARY SEWER TAP DETAIL (NARROW TRENCH NEW CONSTRUCTION)

CITY OF BROKEN ARROW		STANDARD DRAWING: STD SS 03A	
		LAST REVISION DATE: 8/01/99	
DRAWN BY: ADN	CHECKED BY: DLW	APPROVED: MDK	DATE: 8/01/99



SANITARY SEWER RISER DETAIL OVER 15' DEEP (WIDE TRENCH)

NOTE:
PIPE TYPE BASED ON
PIPE REQUIRED ON
STD SS13

CITY OF BROKEN ARROW

STANDARD DRAWING: STD SS 04

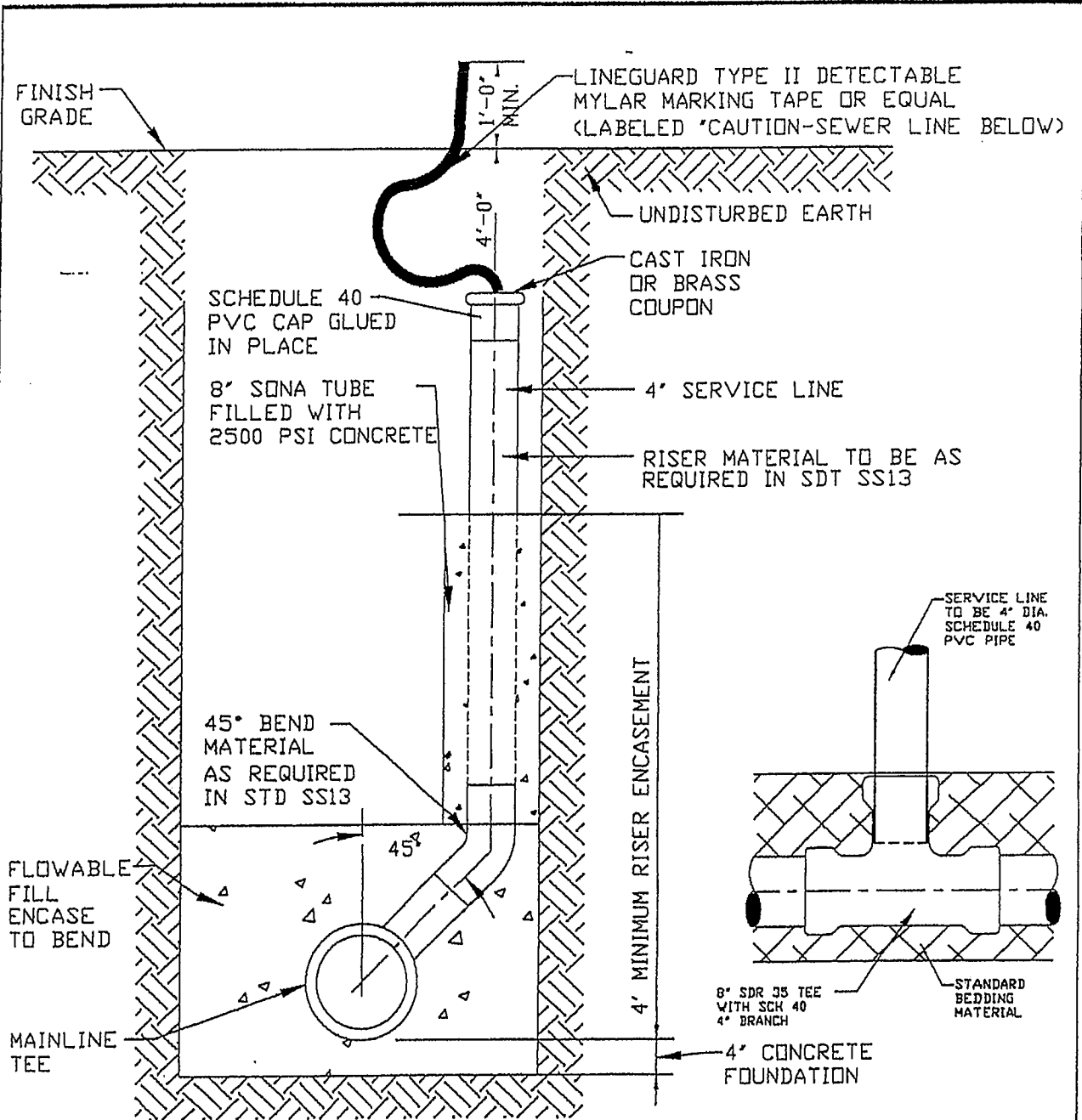
LAST REVISION DATE: 8/01/99

DRAWN BY: ADN

CHECKED BY: DLW

APPROVED: MDK

DATE: 8/01/99

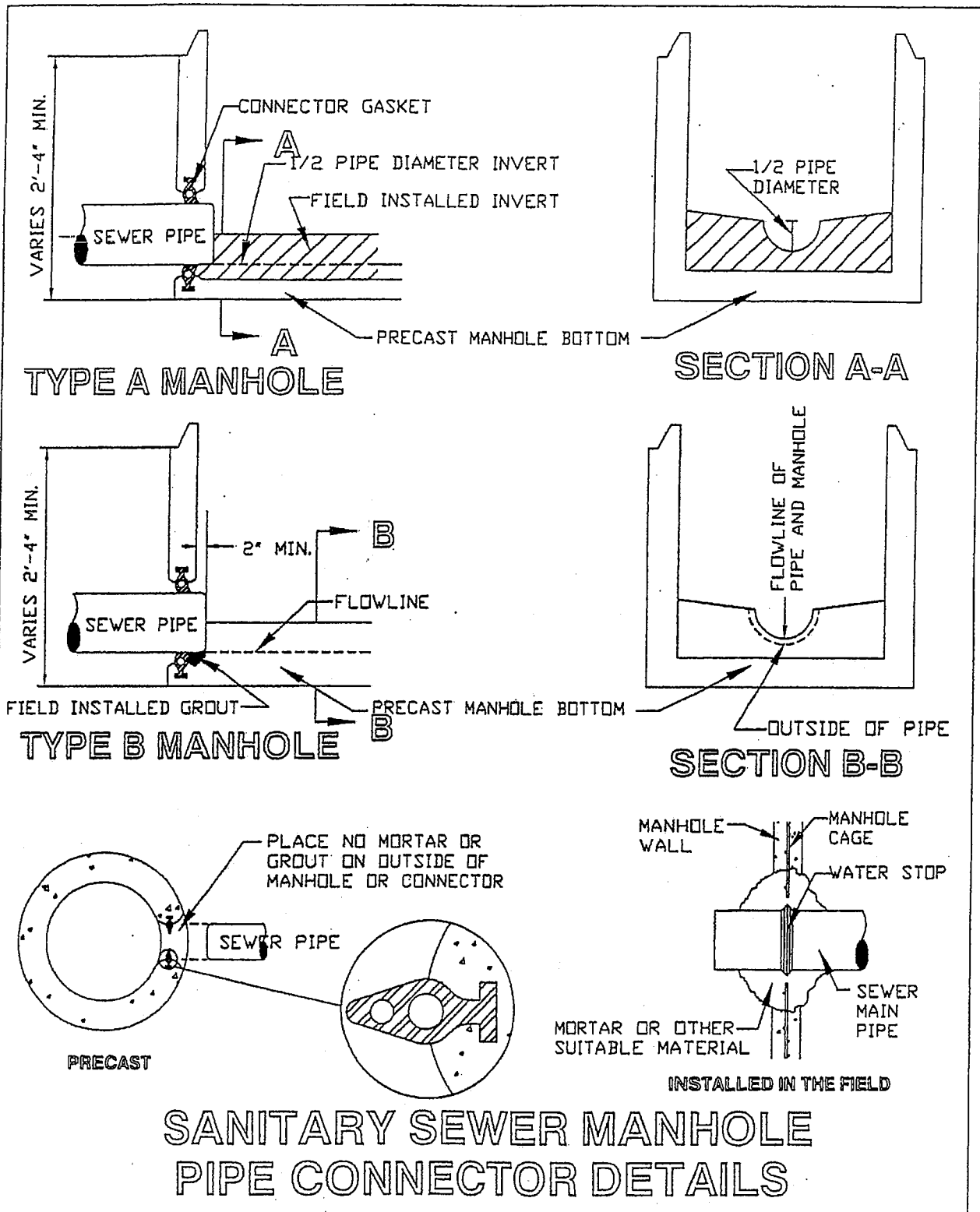


SANITARY SEWER RISER DETAIL

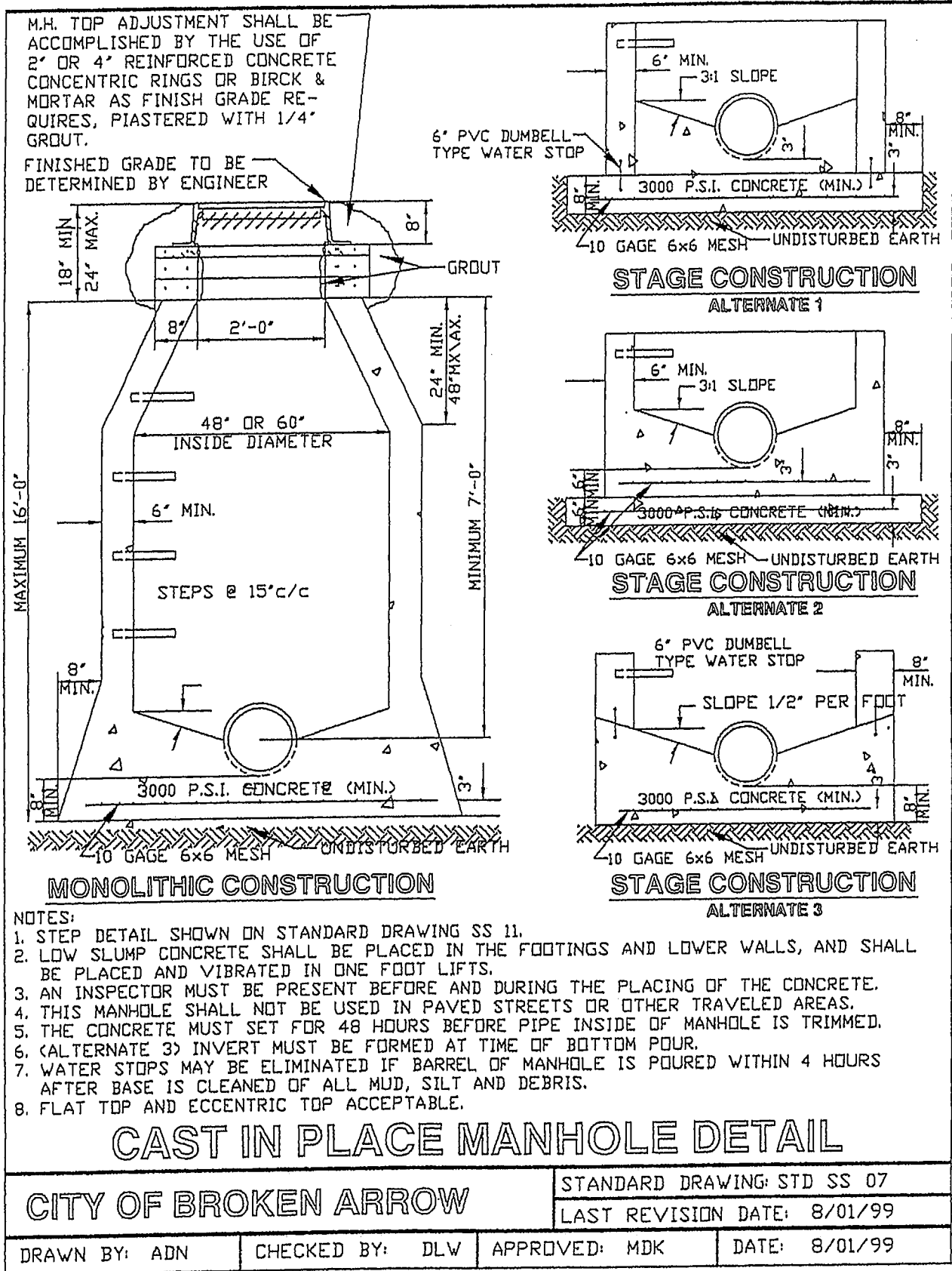
OVER 15' DEEP
(NARROW TRENCH)

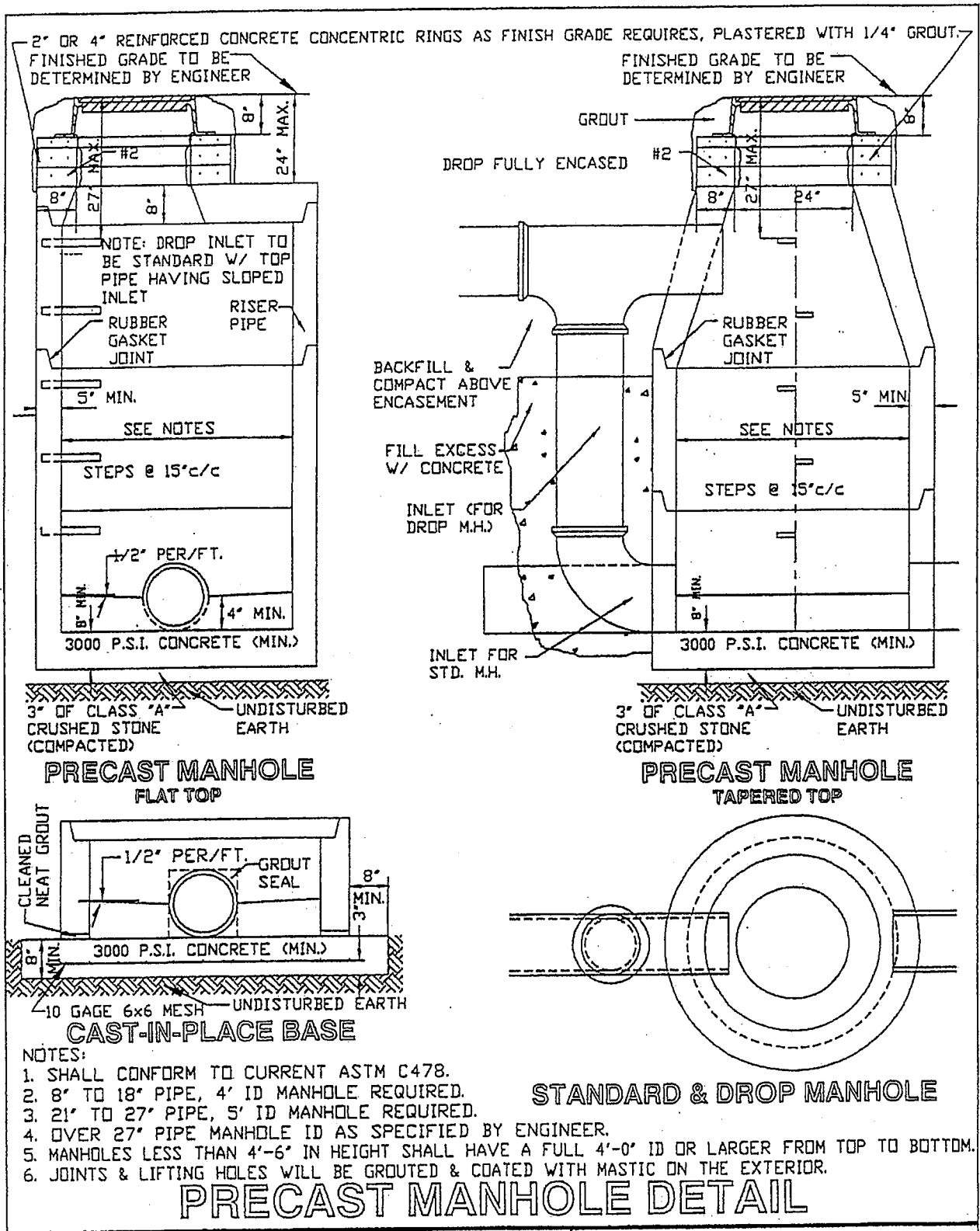
NOTE:
PIPE TYPE BASED ON
SEWER PIPE AS REQUIRED
ON STD SS13

CITY OF BROKEN ARROW		STANDARD DRAWING: STD SS 05	
		LAST REVISION DATE: 8/01/99	
DRAWN BY: ADN	CHECKED BY: DLW	APPROVED: MDK	DATE: 8/01/99

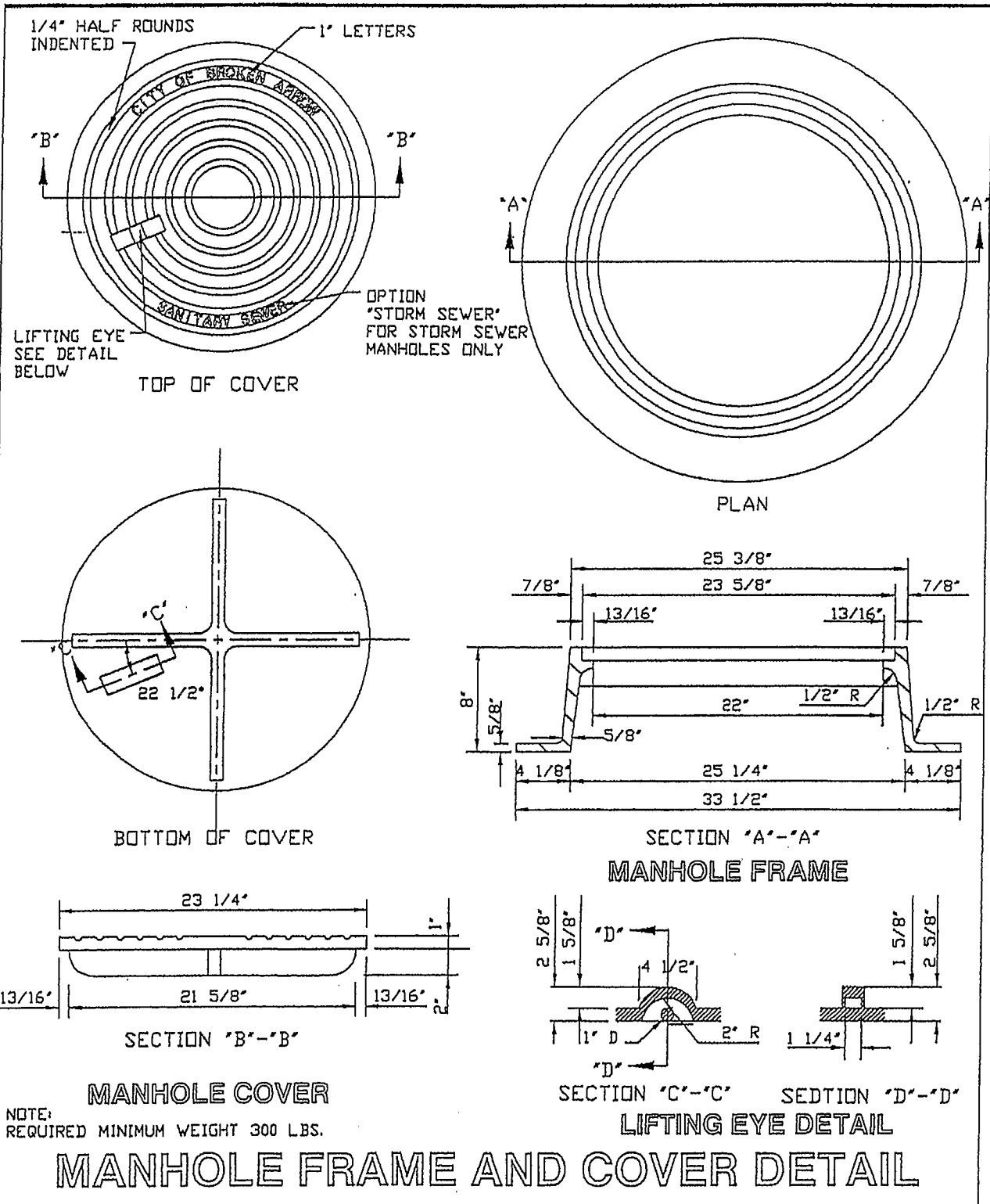


CITY OF BROKEN ARROW		STANDARD DRAWING: STD SS 06	
		LAST REVISION DATE: 8/01/99	
DRAWN BY: ADN	CHECKED BY: DLW	APPROVED: MDK	DATE: 8/01/99





CITY OF BROKEN ARROW		STANDARD DRAWING: STD SS 08	
		LAST REVISION DATE: 8/01/99	
DRAWN BY: ADN	CHECKED BY: DLW	APPROVED: MDK	DATE: 8/01/99



MANHOLE FRAME AND COVER DETAIL

CITY OF BROKEN ARROW

STANDARD DRAWING: STD SS 09

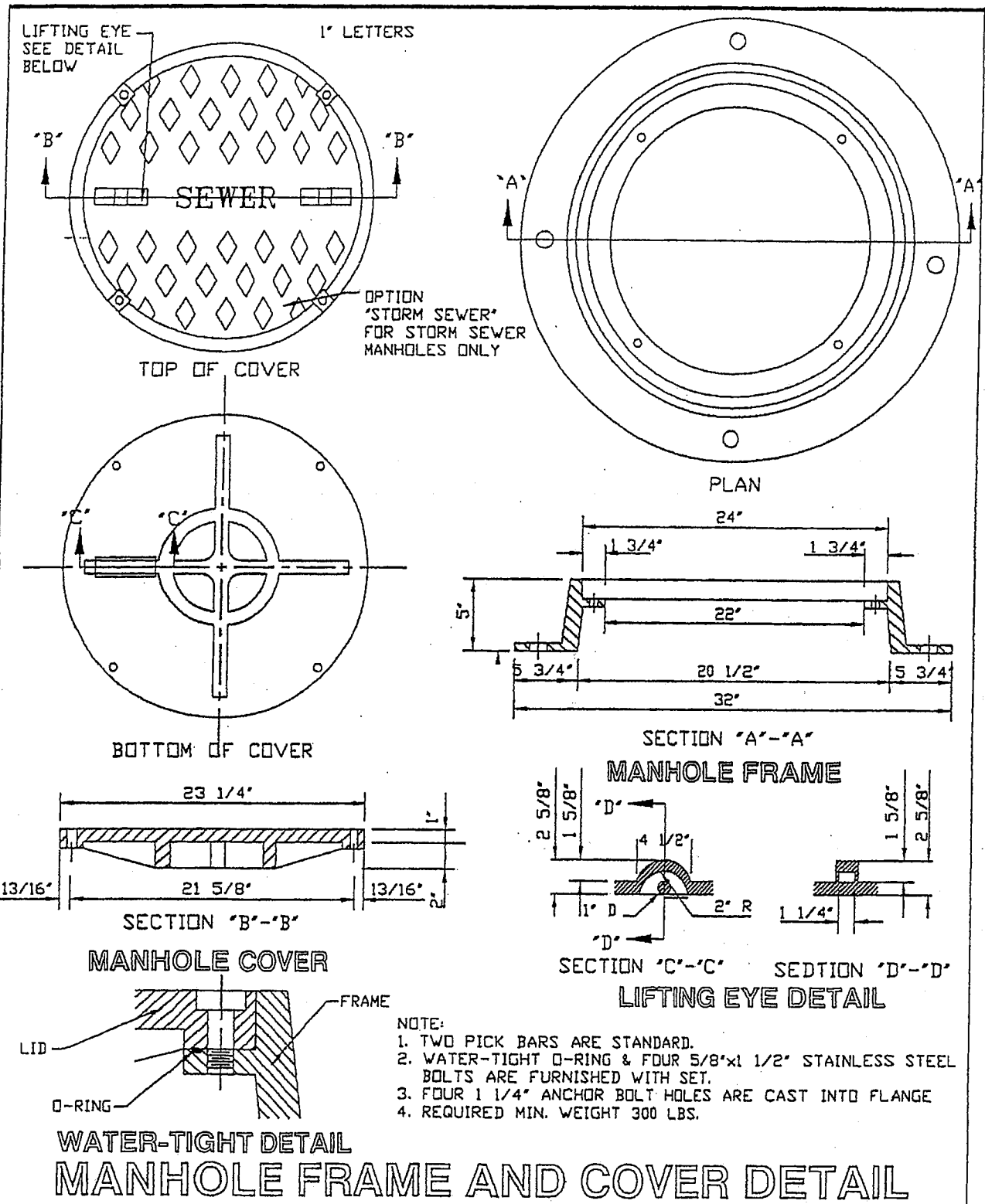
LAST REVISION DATE: 8/01/99

DRAWN BY: ADN

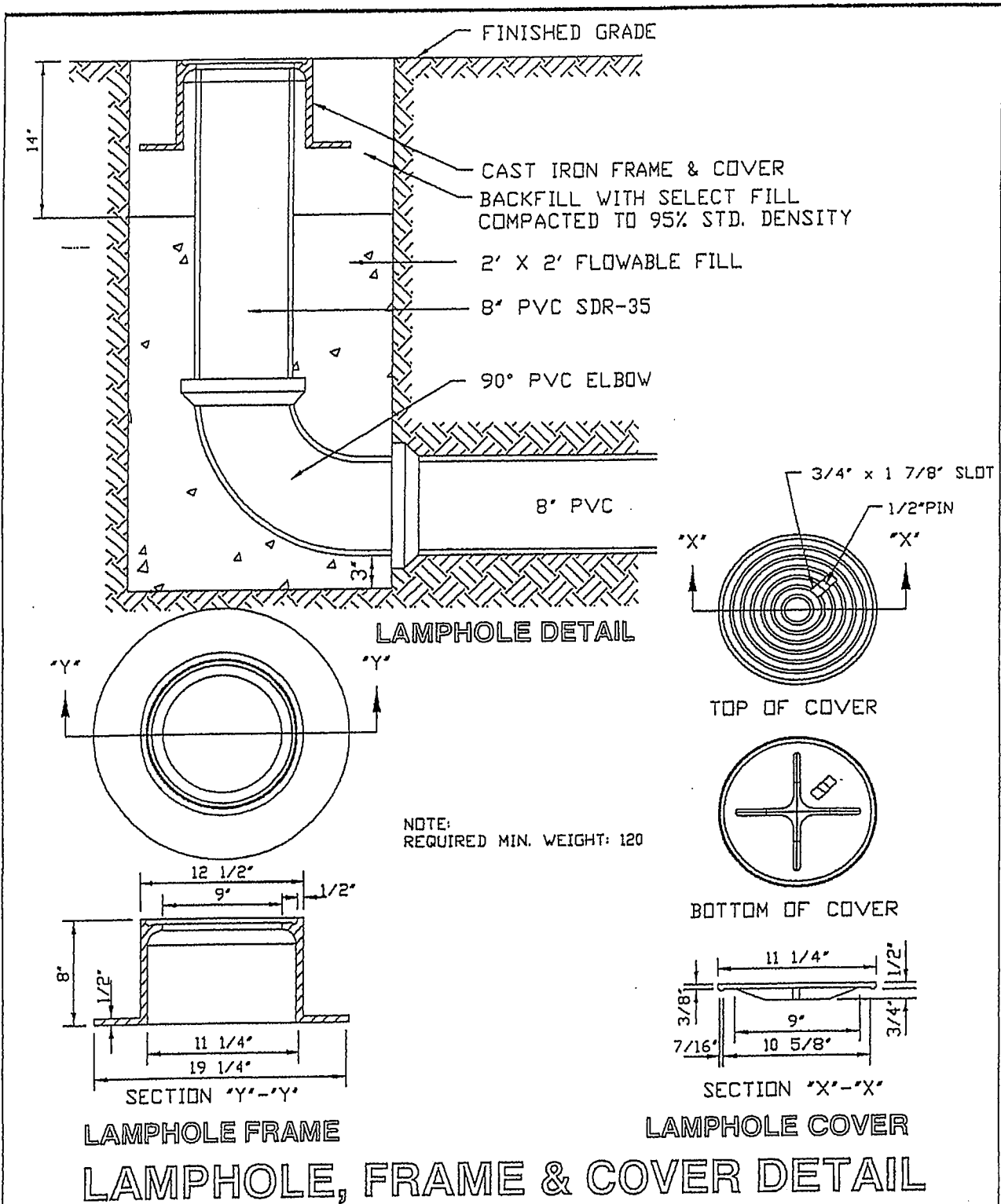
CHECKED BY: DLW

APPROVED: MDK

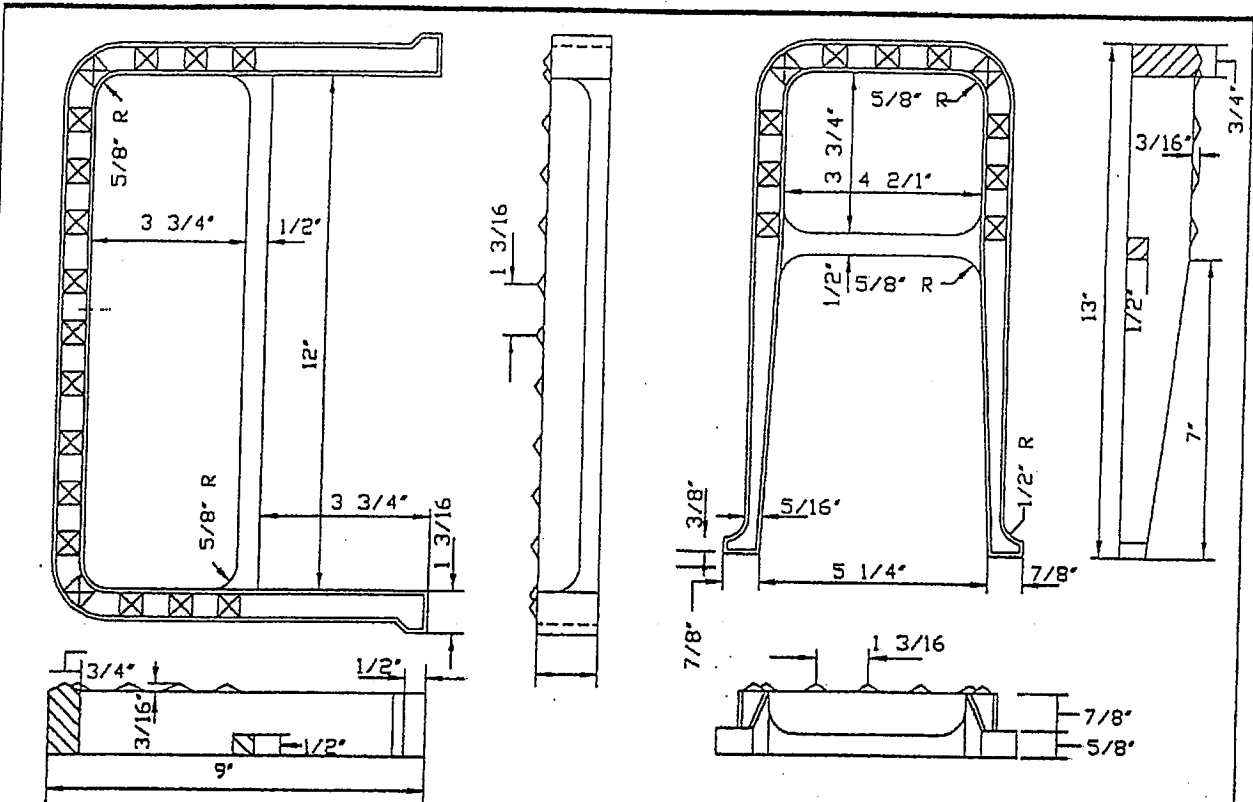
DATE: 8/01/99



CITY OF BROKEN ARROW		STANDARD DRAWING: STD SS 09a	
		LAST REVISION DATE: 8/01/99	
DRAWN BY: ADN	CHECKED BY: DLW	APPROVED: MDK	DATE: 8/01/99

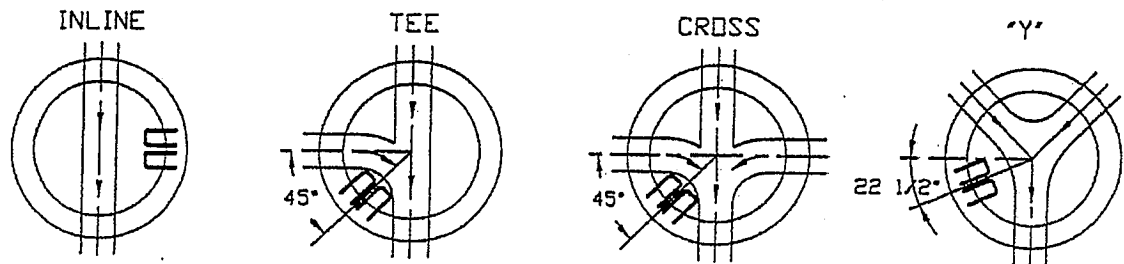


CITY OF BROKEN ARROW		STANDARD DRAWING: STD SS 10	
		LAST REVISION DATE: 8/01/99	
DRAWN BY: ADN	CHECKED BY: DLW	APPROVED: MDK	DATE: 8/01/99

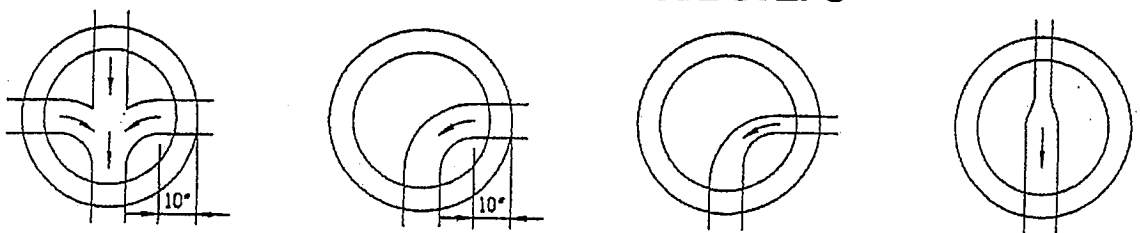


LARGE STEP

STANDARD STEP



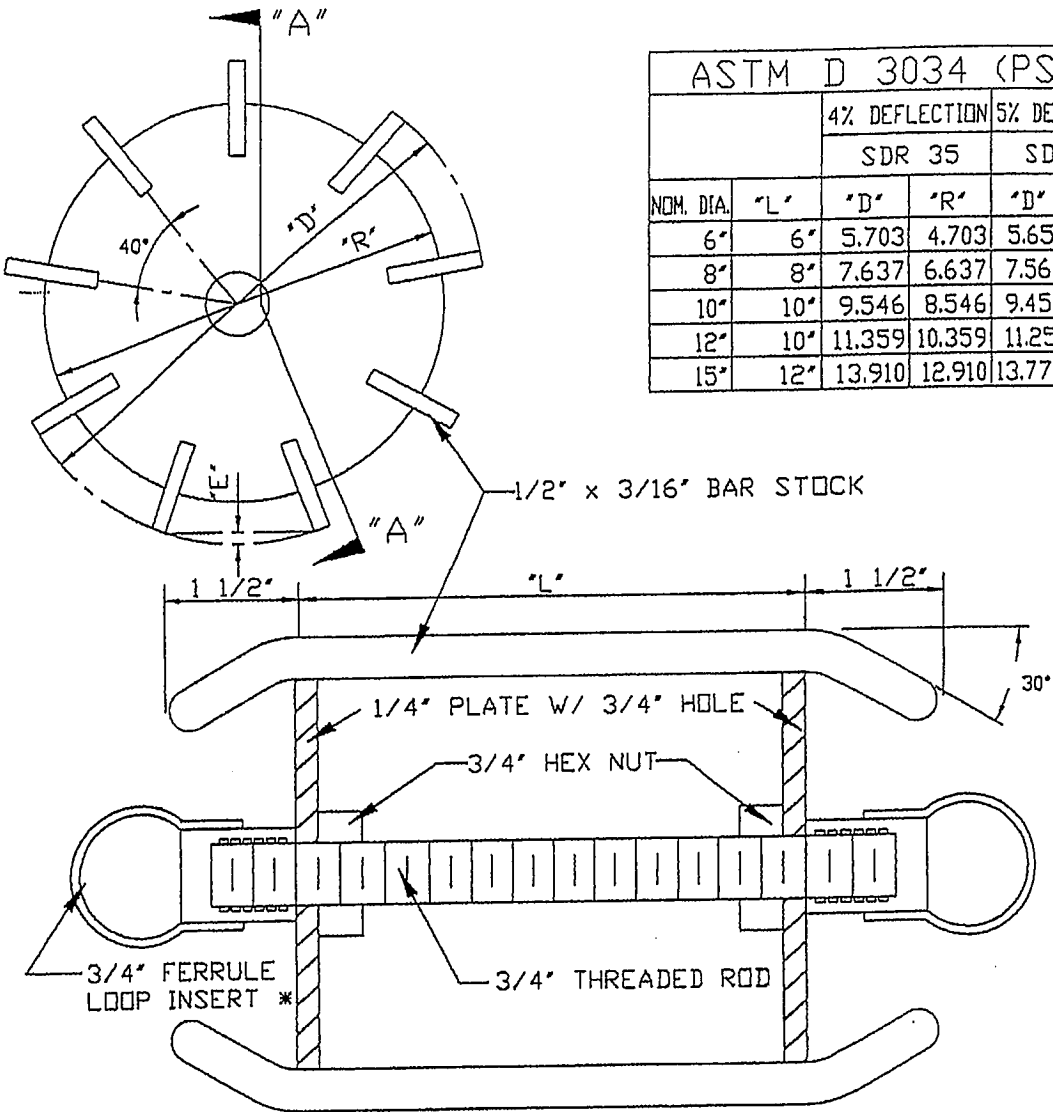
LOCATION OF MANHOLE STEPS



TYPICAL MANHOLE INVERT DETAIL

MANHOLE STEPS & INVERT DETAILS

CITY OF BROKEN ARROW		STANDARD DRAWING: STD SS 11	
		LAST REVISION DATE: 8/01/99	
DRAWN BY: ADN	CHECKED BY: DLW	APPROVED: MDK	DATE: 8/01/99



ASTM D 3034 (PSM)					
		4% DEFLECTION		5% DEFLECTION	
		SDR 35		SDR 35	
NOM. DIA.	"L"	"D"	"R"	"D"	"R"
6"	6"	5.703	4.703	5.650	4.650
8"	8"	7.637	6.637	7.565	6.565
10"	10"	9.546	8.546	9.456	8.456
12"	10"	11.359	10.359	11.251	10.251
15"	12"	13.910	12.910	13.779	12.779

SECTION "A"-"A"

MIN. PLA. DIAMETER
GAGE DIAMETER HAS BEEN CALCULATED TO CORRECT CHORD LENGTH ERROR "E"

NOTES:

1. USE 4% GAGE IF DEFLECTION TEST IS MADE WITHIN 6 MONTHS OF INSTALLATION. USE 5% THEREAFTER
2. MARK ALL GAGES WITH ASTM SPECIFICATION NUMBER, SDR NUMBER AND DEFLECTION.
3. THE 1/2" BAR STOCK ON THE EDGE PROVIDES CLEARANCE TO PASS SMALL AMOUNTS OF SOIL WHICH MAY BE IN PIPE.

* BURKE CONCRETE ACCESSORIES INC.

PVC SEWER DEFLECTION GAGE

CITY OF BROKEN ARROW		STANDARD DRAWING: STD SS 12	
		LAST REVISION DATE: 8/01/99	
DRAWN BY: ADN	CHECKED BY: DLW	APPROVED: MDK	DATE: 8/01/99

SEWER PIPE REQUIREMENTS

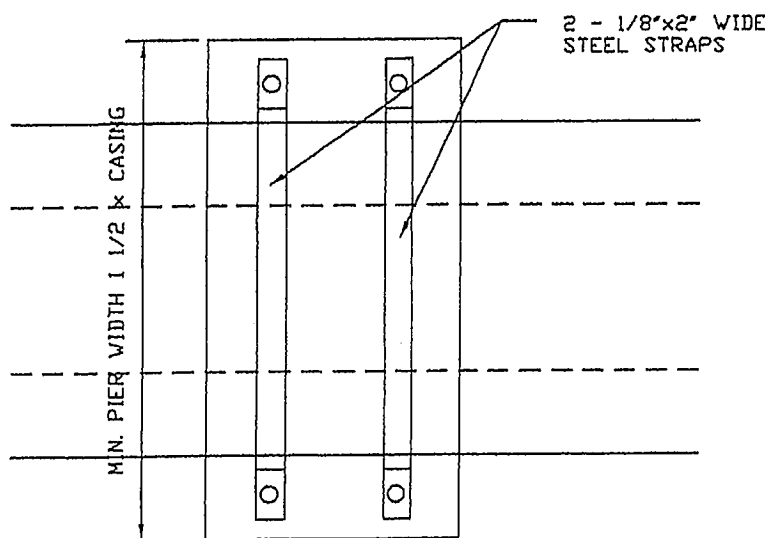
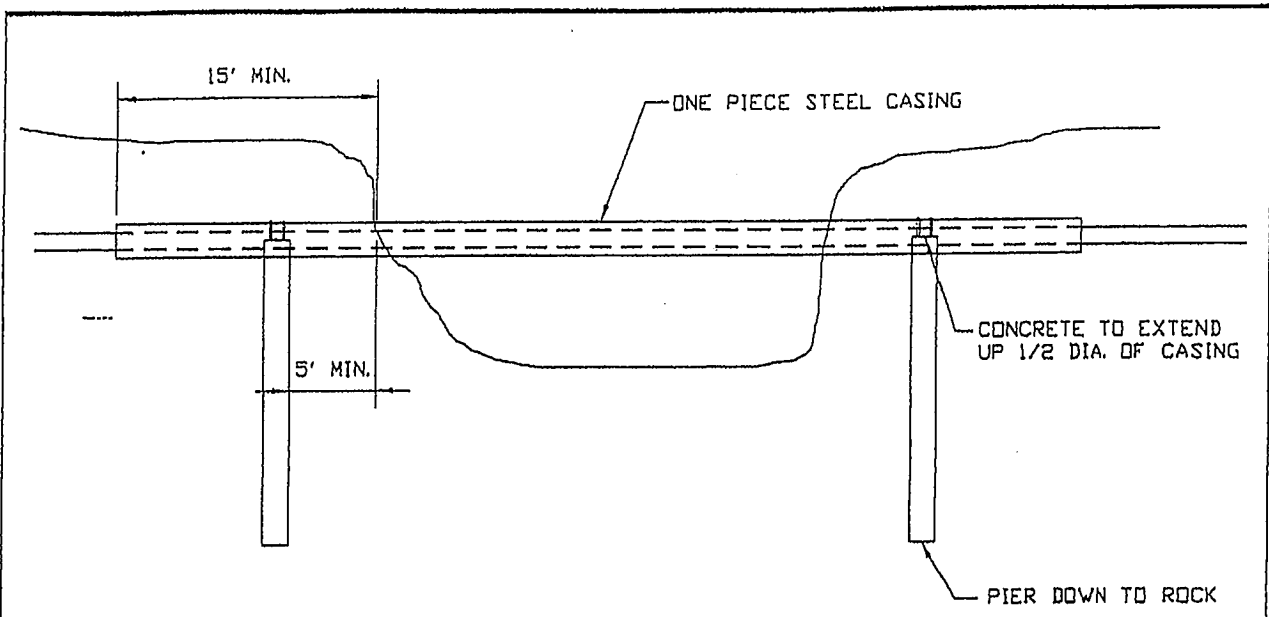
LOCATION/DEPTH	SIZE	PIPE TYPE	NOTES
≤ 30' cover	8"-12"	C-900 PVC DR18	Conc. Encase
≤ 30' cover	>12"	C-900 PVC DR18	Conc. Encase
31' to 15.9'	All	SDR 35 PVC	
16' to 25'	8"-15"	SDR 26 PVC	
16' to 25'	>15"	C-905 PVC DR18	
25' or deeper	8"-12"	C-900 PVC DR18	
25' or deeper	>12"	C-905 PVC DR18	
Under Streets (open cut)	8"-12"	Same as required above	
Under Streets (bore)	All	SDR 35 PVC	
Creek Crossings	8"-12"	C-900 PVC DR18	Conc. Encase
Creek Crossings	>12"	C-905 PVC DR18	Conc. Encase
W.L. within 2' vertical	8"-12"	C-900 PVC DR18	
W.L. within 2' vertical	>12"	C-905 PVC DR18	
Service lines to 15' deep	4"-6"	Schedule 40	
Risers over 15' deep	4"-6"	Same as main line	

NOTES:

- 1.) Ultra-Rib Pipe can be substituted for SDR 35 on sizes 15' or larger

SEWER PIPE TABLE

CITY OF BROKEN ARROW		STANDARD DRAWING: STD SS 13	
		LAST REVISION DATE: 8/01/99	
DRAWN BY: ADN	CHECKED BY: DLW	APPROVED: MDK	DATE: 8/01/99



AERIAL CREEK CROSSINGS FOR SANITARY SEWER

CITY OF BROKEN ARROW		STANDARD DRAWING: STD SS 14	
		LAST REVISION DATE: 8/01/99	
DRAWN BY: ADN	CHECKED BY: DLW	APPROVED: MDK.	DATE: 8/01/99

SECTION 800 - VERTICAL CONSTRUCTION

801 ADOPTION OF STANDARD SPECIFICATIONS/CODES (05/16/94): The City of Broken Arrow, Oklahoma, in Chapter 6 of the Code of Ordinances, has adopted the standards for vertical construction listed below. The edition or effective year of each of the following is the same as shown in Chapter 6, of the Code of Ordinances:

801.01 PLUMBING: The Building Officials and Code Administrators International (BOCA) National Plumbing Code.

801.02 MECHANICAL: The BOCA National Mechanical Code.

801.03 BUILDING: The BOCA National Building Code.

801.04 FIRE PREVENTION: The BOCA National Fire Prevention Code.

801.05 EXISTING STRUCTURES: The BOCA National Existing Structures Code.

801.06 ELECTRICAL: The National Electrical Code.

801.07 DWELLING: The CABO One and Two Family Dwelling Code.

802 CHANGES TO STANDARD SPECIFICATIONS/CODES (05/16/94): If there is a reference that requires clarification and it is not covered in the Special Provisions of the contract, the Contract Administrator will provide the contractor with a written clarification upon request.

803 PROCEDURE FOR USING STANDARD SPECIFICATIONS/CODES IN CITY CONTRACTS (05/16/94): The person preparing the contract will cite the appropriate code and supporting specification (If Required). Normally citing the appropriate code is sufficient as the supporting specification requirements are cited in the codes. All citations will include sufficient information to ensure that the contractor will understand the requirements. When pay items are not included in the supporting specifications, the person preparing the contract will develop appropriate pay items. When a Standard Specification/Code requires clarification the person preparing the contract will provide additional clarification by referencing the specification/code by number and description and then providing the required clarification.

SECTION 900 - OTHER INFORMATION

901 STREET AND UTILITY INSPECTION CHECKLIST

901.01 Introduction: This section is designed to provide the developer and his contractor with an overview of requirements for construction and inspection of subdivision utilities. Detailed information on utility design and construction is contained in the applicable city codes and specifications. This section is to be used with the City of Broken Arrow Administrative Regulation Number 11.15. Together these documents provide a basic outline for the construction of utilities in a subdivision. Should there be a perceived conflict between this document and the City Codes, Regulations, and/or Specifications the user is requested to bring this conflict to the attention of the Public Works Department. The Public Works Department will clarify these conflicts as quickly as possible. Any suggestions for additions to or improvements in this section will be accepted and acted on by the Public Works Department.

901.02 Organization: This section is organized around the basic utilities common to most subdivisions. Under the utility heading the section is further subdivided into the following topics:

Submittals/Permits Required Prior to Construction

Submittals Required During Construction

Required Inspections

Key Items Checked by Inspectors

901.03 Site Preparation:

a. Submittals/Permits Required Prior to Construction:

1. Approved Preliminary Plat
2. Site Grading Plans
3. Earth Change Permit
4. Burning Permit (If Required)
5. Fill Material (If Required)
6. Flood Plain Board Approval (If filling in a flood plain or changing a creek)

b. Submittals Required During Construction:

1. Documentation of proper disposal of any hazardous items removed from site.
2. Compaction tests on any fill areas under future roads.

c. Required Inspections:

1. Pre-work inspection to locate potential future problems such as ponds, gullies to be filled in, drainage channels, and existing utilities.
2. Completion of site work.

d. Key Items Checked by Inspectors:

1. Are utilities flagged prior to starting excavation?
2. Is brush and refuse being disposed of properly?
3. Is cut and fill work in compliance with the approved plan?
4. Are proper fill and compaction procedures being used?
5. Are measures being taken to prevent erosion?
6. Is excess fill being disposed of properly?

901.04 Streets

a. Submittals/Permits Required Prior to Construction:

1. Approved Plans for Grading, Streets, Drainage, Water, and Sewer.
2. Street Construction Permit
3. Concrete Mix Design
4. Asphalt Mix Design (If Required)
5. Testing Laboratory

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b. Submittals Required During Construction:

1. Stabilization Reports on Subgrade
2. Compaction Reports on Subgrade
3. Compaction Reports on Base
4. Documentation of Concrete Mix
5. Documentation of Asphalt Mix (If Required)
6. Concrete test results
7. Asphalt test results (If Required)
8. Construction Staking

c. Required Inspections:

1. Subgrade prior to base work.
2. Street base prior to paving.
3. Form work for curb and gutters.
4. During start of paving operations.
5. Finished Roadway to include core samples.
6. Final Inspection.

d. Key Items Checked by Inspectors:

1. Are all soil tests and compactions tests within prescribed limits?
2. When proof rolled with a loaded scraper or dump truck does the subgrade pump?
3. Has all unsuitable material been removed from the subgrade?
4. Has all vegetable matter been removed from the subgrade?
5. Have all utility lines been properly compacted?
6. Are all manholes, valves, and inlets at the proper elevation?
7. Do all water valve boxes have a 2'X 2'X 6" concrete pad (Asphalt Streets Only)?
8. Are curb forms a minimum of 6" high and 6" wide?
9. Is the Street in the location and at the grade shown on the plans? And is the backside of the curb at least 12" deep?
10. Is the gutter at least 18" wide and the required thickness?
11. Are required wheel chair ramps formed into the curbs?
12. Does the concrete or asphalt delivered to the site conform to the approved mix?
13. Are expansion joints being placed at or less than the 105 feet maximum spacing?
14. Is the concrete being placed at the thickness required on the plans?
15. Is the type of asphalt being placed at the thickness required on the plans?
16. Are expansion joints being placed at all intersections and radius points?
17. Are dowel bars and reinforcement placed as required by the plans?
18. Is the ground and air temperature within the limits for paving?
19. Is the asphalt above 225 degrees Fahrenheit and below 300 degrees Fahrenheit when placed?
20. Are proper placement procedures being followed?
21. Are there any areas on the finished street that do not properly drain?
22. Are saw joints placed at less than the maximum 15 feet in the curb and gutter and the street?
23. Is a "W" cut into the curb and painted blue at all water line crossings?
24. Were all required cylinders pulled, checked by the approved laboratory, and results of the tests given to the inspector?
25. Were required slump tests taken and results given to the inspector?

901.05 Storm Sewers

a. Submittals/Permits Required Prior to Construction:

1. Approved Plans for Grading, Streets, Drainage, Water, and Sewer.
2. Storm Sewer Construction Permit
3. Submittal for Piping, Manholes, Manhole Covers, Curb Inlets and Grates.
4. Concrete Mix Design
5. Testing Laboratory

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b. Submittals Required During Construction:

1. Compaction Reports on Cuts in Street
2. Documentation on Materials Used
3. Construction Staking

c. Required Inspections:

1. Materials Prior to Installation
2. Location and Elevation
3. Backfilling Procedures
4. Manhole and Inlet Construction and Connections
5. Forms and Rebar Prior to Concrete Placement
6. Final Inspection

d. Key Items Checked by Inspectors:

1. Do materials have any cracks or broken parts?
2. Do materials comply with submittals?
3. Are storm drains located properly and on grade?
4. Is 4" of sand bedding placed under the pipe?
5. Is the pipe backfilled with required material (rock or sand) to 1' over top of pipe?
6. Is crushed stone used in streets and compacted to 95% density?
7. Are manhole joints properly sealed?
8. Are pipe joints properly sealed?
9. Are pipes properly grouted at manholes and inlets?
10. Are lift pin holes properly grouted?
11. Is the manhole lid ring properly grouted inside and out?
12. Are the curb inlets properly positioned and attached?
13. Is reinforcing steel properly sized and placed?
14. Are all grates and manhole lids in place?
15. Are all lines clean?
16. Do all lines flow properly?
17. Is there any ponding in the lines?

901.06 Improved Drainage Channels

a. Submittals/Permits Required Prior to Construction:

1. Approved Plans for Grading, Streets, Drainage, Water, and Sewer.
2. Drainage Construction Permit
3. Concrete Mix (If Required)
4. Flood Plain Appeal Board Approval (If Required)
5. Vegetative Cover
6. Erosion Control Plan

b. Submittals Required During Construction:

1. Concrete Mix Used
2. Construction Staking

c. Required Inspections:

1. Form Work Prior to Concrete Placement
2. Final Inspection

d. Key Items Checked by Inspectors:

1. Does the work comply with Flood Plain Board Approval?
2. Does the ditch conform to planned slope?
3. Are side slopes 3 to 1 or flatter?
4. Was reinforcement placed as called for in the plans?
5. Were side channels properly tied into the ditch?
6. Was rip-rap placed at under street structures (If Required)?
7. Was the work area, that was not paved, properly seeded?
8. Was erosion control placed as required?

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9. Does the ditch drain properly?
10. Are there areas where water ponds?
11. Were fill areas properly compacted?

901.07 Detention Facilities

a. Submittals/Permits Required Prior to Construction:

1. Approved Plans for Grading, Streets, Drainage, Water, and Sewer.
2. Flood Plain Appeal Board Approval
3. Environmental Impact Statement (If Required)
4. Section 404 Permit from Corps of Engineers (If Required)
5. Concrete Mix
6. Materials Used in Structure
7. Vegetative Control
8. Erosion Control
9. Drainage Construction Permit

b. Submittals Required During Construction:

1. Compaction Reports
2. Documentation on Materials Used
3. Construction Staking

c. Required Inspections:

1. Location and Elevation of Facility
2. Materials Prior to Installation
3. Backfilling Procedures
4. Forms and Reinforcement Prior to Concrete Placement
5. Final Inspection

d. Key Items Checked by Inspectors:

1. Do materials have any cracks or broken parts?
2. Do materials comply with submittals?
3. Is the drainage structure located properly and on grade?
4. Are proper backfilling and compaction procedures being used around the drainage structure?
5. Are pipe joints properly sealed?
6. Is reinforcing steel properly sized and placed?
7. Does the drainage structure flow properly?
8. Is the drainage structure clean, and is there any ponding inside the drainage structure?
9. Does the trickle channel flow properly?
10. Is the trickle channel properly located, and on the proper slope?
11. Does the work comply with the Flood Plain Board Approval?
12. Was the work area, that was not paved, properly seeded?
13. Was erosion control placed as required?
14. Were fill areas properly compacted?

901.08 Greenbelts and Reserve Areas

a. Submittals/Permits Required Prior to Construction:

1. Approved Plans for Grading, Streets, Drainage, Water, and Sewer.
2. Drainage Construction Permit.

b. Submittals Required During Construction:

1. Landscape plans.
2. Landscape license agreement (If Required).

c. Required Inspections:

1. Preconstruction site inspection for tree size and condition and ground cover.
2. Final Inspection

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d. Key Items Checked by Inspectors:

1. Is there trash or cut brush in the greenbelt or reserve area?
2. Is there vegetative cover over the ground surface of the greenbelt or reserve area?
3. Are there any drainage problems inside the greenbelt or reserve area?
4. Inspect for any specific improvements outlined on the plans for the subdivision.

901.09 Water Lines

a. Submittals/Permits Required Prior to Construction:

1. Approved Plans for Grading, Streets, Drainage, Water, and Sewer.
2. Submittals for Pipe, Valves, Fire Hydrants, Valve Boxes, and Fittings.
3. Concrete Mix Design for Thrust Blocks
4. Testing Laboratory
5. Water Line Construction Permit from the City of Broken Arrow
6. Water Line Construction Permit for the State of Oklahoma

b. Submittals Required During Construction:

1. Documentation on Materials Used
2. Compaction Reports on Cuts in the Streets
3. Construction Staking

c. Required Inspections:

1. Materials Prior to Installation
2. Location and Elevation
3. Backfilling Procedures
4. Visual Inspection of All Valves, Fire Hydrants, Taps, and Bends Prior to Backfilling
5. Pressure and Testing and Sampling of the Completed Line: The steps below will be followed for pressure testing and sampling of a new water distribution line:
 - a) Contractor must flush the line of all dirt and air.
 - b) The Contractor must add chlorine to sanitize the line.
 - c) The Contractor will bring the line up to a pressure of 150 PSI and the line must maintain that pressure for a period of 30 minutes with not more than a 5 PSI drop. If the line does not make the pressure test, then the contractor must repair the lines so that it will meet the test requirements. Following completion of the pressure test the Contractor should add additional chlorine if necessary to sanitize the line.
 - d) Contractor must flush the chlorine out of the line. Once the line is flushed the Inspector will check the chlorine count to insure that it is in the range from 0 to 2.0 parts per million.
 - e) The line will be allowed to set for a period of 48 hours without adding additional chlorine or flushing water through the system.
 - f) The Inspector will take water samples after the 48 hour period for two (2) consecutive days and turn in the samples to the Health Department for testing. No samples will be taken after 12:00 p.m. on Thursday. This is because of requirements in dealing with the Health Department Lab.
 - g) If the samples from the line do not pass the Contractor must flush the line and add additional chlorine. Once this is done, the process of checking the line will start again at Paragraph 901.09 d).
 - h) If the samples in the line pass then the Contractor will flush the line completely and make sure that all valves are open.
 - i) The Contractor will then remove all sample points from the line and backfill it in preparation for acceptance.

d. Key Items Checked by Inspectors:

1. Does the pipe used in the project match the size and class in the submittals?
2. Do the fittings and fire hydrants match the materials approved in the submittals?
3. Are the water lines being laid in the easement and at the required elevations?
4. Is sand bedding being placed 4" under the pipe and select fill a minimum of 6" over the pipe?
5. Is a #8 copper wire being taped to the top of the PVC water pipe and connected to fire hydrants and valves?
6. Are concrete thrust blocks being placed behind tees, fire hydrants, and bends?

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7. Is ductal iron pipe, valves, and fittings being polywrapped properly?
8. Is the backfill in street areas being properly compacted and tested?
9. Are casings being placed under roads as required by the plans?
10. Are fire hydrants oil filled as required by City Specifications?
11. Are fire hydrants being placed at a height of 16" minimum to 21" maximum from ground level to the 4" streamer cap?
12. Can a meter wrench be placed on the valve, and is the valve box properly positioned?
13. Are all valves open?
14. Is a 2'X 2'X (required thickness) concrete pad placed around all valve boxes?
15. Did the water line meet the pressure test requirements?
16. Did the water line pass the Health Department Test?
17. Are water line crossings properly marked on the street curb with a sawed in "W" painted blue?
18. Were all sample points removed and backfilled?
19. Was the backfill of the water line in easement areas completed properly.

901.10 Sanitary Sewers

a. Submittals/Permits Required Prior to Construction:

1. Approved Plans for Grading, Streets, Drainage, Water, and Sewer.
2. Submittals for Pipe, Manholes, Manhole Rings and Lids.
3. Concrete Mix
4. Sanitary Sewer Construction Permit
5. State Sanitary Sewer Construction Permit

b. Submittals Required During Construction:

1. Documentation on Materials Used
2. Compaction Reports on Cuts in Streets
3. Construction Staking

c. Required Inspections:

1. Material Prior to Installation
2. Location and Elevation
3. Backfilling Procedures
4. Lamp and Mandrel
5. Pressure Test
 - a) The Contractor must perform a pressure test on the line with the Inspector watching.
 - b) The line must hold 4 PSI of air pressure for 7 minutes.
 - c) Upon completion of the test the Contractor must remove all plugs from the line and replace the manhole covers.
6. Manhole Grouting Before Backfill
7. Taps Before Backfilling (If Required)
8. Grouting of Pipe flow lines inside Manholes
9. Final Inspection

d. Key Items Checked by Inspectors:

1. Does the pipe size and class match the submittals?
2. Are pipes broken or cracked?
3. Are the lines being laid at the proper elevation and in the easement?
4. Is sand or rock bedding laid 4" deep under the pipe and 6" over the pipe?
5. Is the line at least 3' below ground level?
6. Is the backfill in street cuts being properly compacted and tested?
7. Are service taps stubbed to within 4' of the surface and located accurately on as-builts?
8. Is cast iron or a brass plug placed on the stub out and marking tape laid to the surface?
9. Are manholes, rings, and lids as specified in submittals?
10. Are manhole joints properly sealed?

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11. Are lift pin holes properly grouted?
12. Are manhole lid rings properly grouted inside and out?
13. Are pipes properly grouted at flowline inside manholes?
14. Do manhole bottoms provide for free flow?
15. Are the manhole steps properly positioned?
16. Are all lines and manholes clean?
17. Do all lines flow properly without ponding?

901.11 Lift Stations

a. Submittals/Permits Required Prior to Construction:

1. Approved Plans for Grading, Streets, Drainage, Water, and Sewer.
2. Submittals for Pipe, Valves, and Fittings
3. Submittals for Electrical Gear and Pumps
4. Concrete Mix
5. Submittals for Structural Materials
6. Submittals for Force Main Pipe
7. Sanitary Sewer Construction Permit
8. State Sanitary Sewer Construction Permit

b. Submittals Required During Construction:

1. Documentation on Materials Used
2. Compaction Report on Cuts in Streets
3. Request for Telephone Line (If Required)
4. Request to Turn On Power to Station
5. Construction Staking

c. Required Inspections:

1. Materials Prior to Installation
2. Location and Elevation of Station and Force Main
3. Grouting of All Station Penetrations Before Backfilling
4. Force Main Pressure Test (Line to be tested at 1.5 times the working pressure)
5. Tie into Gravity Sewer Before Backfilling
6. Final Inspection

d. Key Items Checked by Inspectors:

1. Does the pipe size and class match the submittals?
2. Are materials in good condition and free of defects?
3. Is the force main at the proper elevation and location?
4. Are proper backfill and compaction procedures used?
5. Is the force main clean and free of obstructions?
6. Is the station at the proper location and elevation?
7. Is the wet well properly sealed to prevent I & I?
8. Are electrical controls positioned for easy access?
9. Are all safety guards in place?
10. Are fittings and valves properly restrained?
11. Is the emergency dialer programmed and tied in?
12. Do the float Switches operate properly?
13. Does the station operate properly?
14. Does the force main flow freely?
15. Was a #8 copper wire taped to the top of the force main and connected to the manhole ring?

901.12 Sidewalks and General Site Conditions

a. Submittals/Permits Required Prior to Construction:

1. Approved Plans for Grading, Streets, Drainage, Water, and Sewer.
2. Concrete Mix Design
3. Testing Laboratory
4. Street Construction Permit

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b. Submittals Required During Construction:

1. Documentation of Concrete Mix
2. Concrete Test Results
3. Construction Staking
4. Erosion Control

c. Required Inspections:

1. Forms and Reinforcement Prior to Placing Concrete
2. Erosion Control During Project
3. Construction Staking
4. Erosion Control

d. Key Items Checked by Inspectors:

1. Has unsuitable material been removed from sidewalk subgrade?
2. Is the sidewalk at least 4" thick and 4' wide?
3. Is reinforcement placed as called for in the plans?
4. Does the concrete conform to the submittal?
5. Are wheel chair ramps placed as required?
6. Are expansion joints placed at less than 30'?
7. Are sawed joints placed at 6' or less?
8. Is the proper finish being placed on the sidewalk?
9. Is the sidewalk in the proper location?
10. Is erosion control being used properly?
11. Is the development clean and trash free?
12. Have all brush piles been removed and disposed of properly?
13. Is construction debris properly disposed of?
14. Does the site entrance have the required structure?
15. Is there a landscape license agreement with the City for the right of way area?

902 WATER LINE TEST - ALLOWABLE LEAKAGE CHART

No pipe installation shall be accepted if the leakage is greater than that determined by the following formula:

$$L = \frac{S * D * (P)^{0.5}}{133,200}$$

Where :

L = Allowable leakage in gallons per hour

S = Length of pipe tested in feet.

D = Nominal diameter of pipe in inches.

P = Average test pressure during the leakage test, in pounds per square inch (gauge).

Allowable Leakage Per 1,000 Feet of Pipe in Gallons Per Hour

P(PST)	Nominal Pipe Diameter (Inches)										
	4	6	8	10	12	16	24	36	42	48	54
350				1.40	1.69	2.25	3.37	5.06	5.90	6.74	7.58
300				1.30	1.56	2.08	3.12	4.68	5.46	6.24	7.02
275				1.24	1.49	1.99	2.99	4.48	5.23	5.98	6.72
250				1.19	1.42	1.90	2.85	4.27	4.99	5.70	6.41
225				1.13	1.35	1.80	2.70	4.05	4.73	5.41	6.03
200				1.06	1.28	1.70	2.55	3.82	4.46	5.09	5.73
175	0.40	0.59	0.80	0.99	1.19	1.59	2.38	3.58	4.17	4.77	5.36
150	0.37	0.55	0.74	0.92	1.10	1.47	2.21	3.31	3.86	4.41	4.97
125	0.34	0.50	0.67	0.84	1.01	1.34	2.01	3.02	3.53	4.03	4.53
100	0.30	0.45	0.60	0.75	0.90	1.20	1.80	2.70	3.15	3.60	4.05
95	0.29	0.44	0.58	0.73	0.88	1.17	1.76				
90	0.02	0.03	0.04	0.05	0.06	0.08	0.13				
85	0.001	0.002	0.003	0.004	0.004	0.006	0.009				
80	0.0001	0.0002	0.0002	0.002	0.003	0.004	0.0006				
75	0.00001	0.00001	0.00001	0.00002	0.00002	0.00003	0.00004				

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903 THRUST BLOCK TABLE

This table shows the thrust on fittings at 150 PSI water pressure, in pounds.

Nominal Pipe Dia.	Dead End	90 Degree Bend	45 Degree Bend	22 Degree Bend	11 Degree Bend
4	2,715	3,839	2,078	1,059	533
6	5,609	7,932	4,293	2,189	1,100
8	9,650	13,646	7,385	3,765	1,892
10	14,516	20,528	11,109	5,664	2,846
12	20,528	29,302	15,711	8,010	4,025
14	27,578	39,002	21,108	10,761	5,406
16	35,669	50,442	27,299	13,917	6,992
18	44,798	63,353	34,287	17,480	8,783
20	54,966	77,733	42,069	21,447	10,775
24	78,418	110,901	60,025	30,597	15,374
30	120,633	170,607	92,331	47,070	23,649
36	172,814	244,397	132,266	67,428	33,878
42	233,292	329,925	178,554	91,026	45,734
48	304,025	429,956	232,691	118,625	59,600
54	384,108	543,210	293,984	149,871	75,299

904 PIPE FLUSHING REQUIREMENTS TABLE

REQUIRED OPENINGS TO FLUSH PIPELINES

Pipe Size (Inches)	Flow Required to Produce 2.5 fps (gpm)	Orifice Size (Inches)	Hydrant Nozzles (Number)	Outlet Size (Inches)
4	100	15/16	1	2
6	220	1 3/8	1	2
8	390	1 7/8	1	2
10	610	2 5/16	1	2
12	880	2 13/16	1	2
14	1200	3 1/4	2	2
16	1565	3 5/8	2	2
18	1980	4 2/30	2	2

905 PIPE DISINFECTION REQUIREMENTS TABLE

5-G HYPOCHLORITE TABLETS REQUIRED FOR 50 Mg/1 DOSE

Pipe Length	Diameter of Pipe Inches					
	2	4	6	8	10	12
13 or less	1	1	2	2	3	5
18	1	1	2	3	5	6
20	1	1	2	3	5	7
30	1	2	3	5	7	10
40	1	2	4	6	9	14

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906 BASE FIRE FLOW REQUIREMENTS TABLE

REQUIRED

BASE Fire Area (in square feet) for various construction types.

<u>FIRE FLOW</u> <u>GPM</u>	<u>FIRE</u> <u>RESISTIVE</u>	<u>NON-</u> <u>COMBUSTIBLE</u>	<u>ORDINARY* OR</u> <u>HEAVY TIMBER</u>	<u>WOOD</u> <u>FRAME</u>
500	3,300	1,900	1,200	500
750	6,600	3,700	2,400	1,100
1,000	10,900	6,100	3,900	1,700
1,250	16,200	9,100	5,800	2,600
1,500	22,700	12,700	8,200	3,600
1,750	30,200	17,000	10,900	4,800
2,000	38,700	21,800	13,900	6,200
2,250	48,300	27,200	17,400	7,700
2,500	59,000	33,200	21,300	9,400
2,750	70,900	39,700	25,500	11,300
3,000	83,700	47,100	30,100	13,400
3,250	97,700	54,900	35,200	15,600
3,500	112,700	63,400	40,600	18,000
3,750	128,700	72,400	46,400	20,600
4,000	145,900	82,100	52,500	23,300
4,250	164,200	92,400	59,100	26,300
4,500	183,400	103,100	66,000	29,300
4,750	203,700	114,600	73,300	32,600
5,000	225,200	126,700	81,100	36,000
5,250	274,700	139,400	89,200	39,600
5,500	271,200	152,600	97,700	43,400
5,750	295,900	166,500	106,500	47,400
6,000	greater	greater	115,800	51,500
6,250			125,500	55,700
6,500			135,500	60,200
6,750			145,800	64,800
7,000			156,700	69,600
7,250			167,900	74,600
7,500			179,400	79,800
7,750			191,400	85,100
8,000			greater	greater

* Fire flow not to exceed 6,000 gpm in one-story buildings not exceeding 16 feet in height.

Extracted from Fire Risk Analysis: A Systems Approach, National Fire Academy, National Emergency Training Center

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907 SECTIONS 1-8 AND 1-9 OF THE CITY CODE:

CODE OF ORDINANCES

CITY OF BROKEN ARROW

Section 1-8 GENERAL PENALTY FOR VIOLATIONS OF CODE AND ORDINANCES: CONTINUING VIOLATIONS

Whenever in this Code in any ordinance of the City an act is prohibited or is made or declared to be unlawful or an offense or misdemeanor, or wherever in such Code or ordinance the doing of any act is required or the failure to do any act is declared to be unlawful, the violation of any such provision of this Code or any such ordinance shall be punishable by a fine of not more than one hundred dollars (\$100.00) or by imprisonment for not more than thirty (30) days, or by both such fine and imprisonment. Each day on which any violation of this Code or of any ordinance shall continue shall constitute a separate offense and shall be punishable as such. (Code 1970, §14-1)

Section 1-9 CIVIL RELIEF FOR CODE AND ORDINANCE VIOLATIONS

No penalty imposed by and pursuant to this Code or other ordinance of the City shall interfere with the rights of the City to also apply to the proper courts of the State for a mandamus, injunction or other appropriate action against a person who violates or is about to violate any provision of this Code or other ordinance of the City.

908 ORDINANCE NO. 543 - USE OF EXPLOSIVES:

ORDINANCE NO. 543

AN ORDINANCE DEFINING EXPLOSIVES, CLASSIFYING EXPLOSIVES, PROHIBITING MANUFACTURE OF EXPLOSIVES, PROHIBITING CLASS 1 EXPLOSIVES, REGULATING STORAGE OF EXPLOSIVES, REGULATING MAGAZINE TYPE MARKING, SETTING FORTH RULES FOR MAGAZINES, REGULATING CAPPING OF EXPLOSIVES, REGULATING DETERIORATED EXPLOSIVES, REGULATING TRANSPORTATION OF EXPLOSIVES ON PUBLIC CONVEYANCE, REGULATING TRANSPORTATION OF EXPLOSIVES, REGULATING TRANSPORTATION OF CLASS 2 EXPLOSIVES AND REQUIRING SIGNS, REGULATING DRIVING REQUIREMENTS, REGULATING HAULING OTHER EXPLOSIVES OR MATERIALS, PROHIBITING DISCHARGE OF EXPLOSIVES IN CITY, DECLARING AN EMERGENCY AND PROVIDING FOR PENALTY.

BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF BROKEN ARROW, OKLAHOMA.

SECTION 1.

EXPLOSIVES DEFINED.

The term "explosive" or explosives," whenever used in this Ordinance shall be held to mean and include any chemical compound or mechanical mixture that is commonly used or intended for the purpose of producing an explosion, that contains any oxidizing and combustible units, or other ingredients, in such proportions, quantities or packing that an ignition by fire, by friction, by concussion, by percussion, or by detonator of any part of the compound or mixture which may cause a sudden generation of highly heated gases that the resultant gaseous pressures are capable of producing destructive effects on contiguous objects or of destroying life and limb.

SECTION 2.

CLASSIFICATION OF EXPLOSIVES.

Class 1 Explosives shall be liquid nitroglycerine; high explosives containing over 60 percent of nitroglycerine (except gelatin dynamite); high explosives having an unsatisfactory absorbent or that permit leakage of nitroglycerin under any conditions liable to exist during transportation or storage; nitro-cellulose in a dry and uncompressed condition, in quantity greater than ten (10) pounds in one exterior package; fulminate of mercury in bulk in a dry condition, and fulminate of all

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other metals in any condition, except as a component of manufactured articles not hereinafter forbidden; or explosives containing an ammonium salt and a chlorate.

Class 2 Explosives are black powder, high explosive (except as described in Class 1), dynamite, blasting caps and electric blasting caps, smokeless powder for small arms, wet fulminate of mercury and detonating fuses.

Class 3 Explosives are small arms ammunition (blank, ball, or shot), primers, fuses (except as described in Class 2), safety fuses, safety squibs, and any other explosives not enumerated in relatively safe.

SECTION 3.

MANUFACTURE PROHIBITED.

It is unlawful for any person to manufacture any explosive within the corporate limits of the City of Broken Arrow except that any explosives may be manufactured in laboratories in schools, colleges and similar institutions for the purpose of investigation and instruction and provided that hand loading of small arms ammunition for private use shall be allowed.

SECTION 4.

CLASS 1 EXPLOSIVES PROHIBITED.

It shall be unlawful for any person to have, keep, store, sell, offer for sale, give away, use, transport or have in his possession in the City of Broken Arrow any Class 1 Explosive.

SECTION 5.

STORAGE OF EXPLOSIVES.

Under no circumstances shall any person, firm, organization or other entity keep or store any explosives on any premises which are occupied as a dwelling, school, theater, or other place of public assembly.

No person shall keep or store any Class 2 Explosive, except in a properly authorized magazine. The type and location of storage magazines must be approved by the City Manager. The amount of Class 2 Explosives stored in any one magazine shall be limited to fifty (50) pounds.

SECTION 6.

MAGAZINE-TYPE-MARKING.

Magazines shall be made of fireproof material and shall be conspicuously marked "Magazine - Explosives."

SECTION 7.

MAGAZINES-RULES.

Each magazine shall be kept locked during the night, and at all times when the room in which it is kept is not occupied by safe and trustworthy persons; and all magazines must be kept clean and free from grit, paper, rubbish, and empty packages.

It shall be unlawful to place, keep or store any blasting caps or detonators of any kind in the same magazine with other explosives.

Packages of explosives in a magazine must be neatly piled in such a way that all of them may be easily examined, and packages of high explosives must always be placed right side up.

When any kind of explosive is removed from the magazine, the oldest of that particular kind must always be taken, and it shall be the duty of the magazine keeper to see that is done.

SECTION 8.

CAPPING.

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It shall be unlawful for any person to cap a cartridge within a radius for fifty (50) feet of magazine, or in any case to cap more cartridges than necessary for immediate use.

SECTION 9.

DETERIORATED EXPLOSIVES.

If any explosive is contained in a magazine so as to be in a dangerous condition, then the magazine keeper must immediately remedy the cause; or should the Fire Marshall receive a report of deteriorated or leaking explosives, said Fire Marshall must cause it to be removed outside the corporate limits of the City of Broken Arrow and disposed of as he may deem fit, at the expense of the magazine keeper.

SECTION 10.

TRANSPORTING ON PUBLIC CONVEYANCE.

It shall be unlawful for any person to transport or carry any Class 2 explosives within the limits of the City of Broken Arrow in or upon any public conveyance which is carrying passengers.

SECTION 11.

TRANSPORTATION OF EXPLOSIVES.

It shall be unlawful for any person in the transportation of Class 2 Explosives to stop such conveyance in any populated area within the City Limits of Broken Arrow, Oklahoma.

SECTION 12.

TRANSPORTING CLASS 2 EXPLOSIVES-SIGNS.

Every vehicle, while carrying Class 2 Explosives, shall display upon an erect pole at the front end of such vehicle and at such height that it shall be visible from all directions, a red flag with the word "DANGER" printed, stamped or sewed thereon in white letters at least six (6) inches in height, or in lieu of such flag the word "EXPLOSIVES" must be painted on, or attached to the rear end and each side of such vehicle in letters at least six (6) inches in height.

SECTION 13.

DRIVING REQUIREMENTS.

It shall be unlawful for any person in charge of a vehicle containing explosives, to smoke in, upon or near such vehicle, to drive, load or unload the vehicle while intoxicated, to drive the vehicle in a careless or reckless manner, or to load or unload such vehicle in a careless or reckless manner.

SECTION 14.

HAULING OTHER EXPLOSIVES OR MATERIAL.

It shall be unlawful for any person to place or carry or cause to be placed or carried, in any vehicle containing explosive, any exploders, detonators, blasting caps or other similar explosive material.

SECTION 15.

DISCHARGE IN CITY.

It shall be unlawful for any person to use or discharge any Class 2 Explosives within the corporate limits of the City of Broken Arrow except in connection with blasting operations or demolitions.

No person shall blast or carry on any blasting operations without first having obtained permission from the City Manager. The applicant for such permit must file a surety bond deemed adequate in each case, which bond shall become available for the payment of any real and actual damages arising from the blasting or from the neglect of the contractor or his agents or employees. The amount of the bond does not limit the liability of the contractor.

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In applying for a permit the contractor must present a plan showing the location, expected time of blasting, size of charge, type of explosive and any other information pertaining to the blasting operation.

All blasting shall be blanketed with mats, wire mesh, dirt or other material to prohibit any debris or material from being discharged into the air.

SECTION 16.

FEES.

In applying for a permit to discharge explosives in the City of Broken Arrow, the contractor shall pay to the City Clerk the sum of \$25.00 for each day of blasting.

SECTION 17.

PENALTY.

Any person violating any of the provisions of this Ordinance shall, upon conviction thereof, be fined not less than One Hundred Dollars (\$100.00), excluding the cost, for each violation.

SECTION 18.

That an emergency exists for the preservation of the public health, peace and safety, and by virtue thereof, this Ordinance shall become effective immediately upon its passage and approval.

PASSED And the emergency clause ruled on separately and approved this 18th day of March, 1974.

DATED This 18th day of March, 1974.

/s/ James R. Newcomb

Mayor

909 ORDINANCE NO. 936 - SECTION LINE WATER LINE MATERIAL AND SIZE REQUIREMENTS:

ORDINANCE NO. 936

AN ORDINANCE AMENDING THE LAND SUBDIVISION ORDINANCES OF THE CITY OF BROKEN ARROW (ORDINANCES NO. 260 AND 269) ARTICLE II SECTION 3, AS TO PRIOR APPROVAL OF PLANS AND SPECIFICATIONS, ARTICLE II, SECTION 8 AS TO PENALTY FOR VIOLATION OF THE ORDINANCE, REPEALING ALL ORDINANCES OR PARTS OF ORDINANCES IN CONFLICT HEREWITH, DIRECTION CODIFICATION WITHIN THE ZONING ORDINANCE AND DECLARING AN EMERGENCY.

BE IT ORDAINED BY THE COUNCIL OF THE CITY OF BROKEN ARROW, OKLAHOMA:

SECTION I. Article II Section 3 paragraphs B, C, D, and E, of Ordinances 260 and 269 are hereby amended to read as follows:

(B) If the plans and specifications of the proposed project meet with the construction standards for new streets and the construction standards for sidewalks as set forth in Article II Sections 5 and 6, the City Engineer or City Manager shall show his approval by affixing his signature and the date of approval to the plans and specifications. One (1) set of the approved plans and specifications shall be returned to the owner or developer of the proposed subdivision within ten (10) days and shall serve as his notice to commence work on the project.

(C) If the plans and specifications for the proposed project do not meet the construction standards for new streets or do not meet the construction standards for sidewalks as set forth in Article II Section 5 and 6, the City Engineer or City

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Manager shall so notify the owner or developer in writing within ten (10) days and this shall serve as his notice that work on the proposed project, as scheduled, is suspended pending approval of revised plans and specifications. Such suspension specifically includes suspension of work done by the owner or developer under contract, and further includes suspension of inspections, approvals, and services provided by the City.

(D) If the plans and specifications for the proposed project meet the construction standards for new streets and the construction standards for sidewalks as set forth in Article II Section 5 and 6 and the City Engineer or City Manager fails to notify the owner or developer of his approval or disapproval within ten (10) days, the owner or developer may proceed with the project as if approval had been given in writing. However, this provision shall not be construed to mean that waiver has been given to any of the provisions of Article II Sections 5 & 6.

(E) Failure of the owner or developer to submit plans and specifications for proposed sidewalks for approval by the City Engineer or City Manager prior to starting construction shall constitute an offense and he shall be subject to the penalties for violation of this ordinance as set forth in Section 8 of this Article.

SECTION II. Article II Section 4 paragraphs B and D of Ordinances 260 and 269 are hereby amended to read as follows:

(B) The City Engineer or City Manager shall cause the project to be inspected as necessary while work is in progress. Should the contractor be in violation of any of the provisions of the construction standards for new streets or the construction standards for sidewalks as set forth in Article II Sections 5 and 6, the City Engineer or City Manager shall have the authority and shall stop work on the project by issuing an order in writing and citing the violation therein. The Contractor shall not proceed with the work until the failure or fault cited in the stop order has been corrected and until he is so notified in writing by the City Manager or City Engineer to proceed.

(D) Failure to comply with any written order of the City Engineer or City Manager shall constitute an offense and shall be subject to the penalties for violation of this Ordinance as set forth in Section 8 of this Article.

SECTION III. Article II Section 8 of Ordinances 260 and 269 is hereby amended to read as follows:

Section 8. PENALTY

Any person, firm, or corporation violating any provisions of Ordinances 260 and 269 as amended, shall be deemed guilty of an offense, and upon conviction thereof, shall be punished by a fine not more than \$100.00 or by imprisonment in jail for not more than thirty (30) days or by both such fine and imprisonment. Each day during which a violation continues shall be deemed a separate offense.

SECTION IV. Any ordinance or parts of ordinances found to be in conflict herewith are hereby repealed.

SECTION V. An emergency exists for the preservation of the public health, peace, and safety and therefore this ordinance shall take effect from and after its passage and approval.

PASSED AND APPROVED and the emergency clause ruled upon separately this 19th day of October, 1981.

Dated this 19th day of October, 1981.

/s/ Nick Hood, Jr.
Mayor

910 ORDINANCE NO. 1011 - PRESSURE REGULATORS:

ORDINANCE NO. 1011

AN ORDINANCE AMENDING THE BROKEN ARROW CODE BY CREATING SECTION 24-73, REQUIRING APPROVED PRESSURE REDUCING VALVES TO BE INSTALLED IN THOSE AREAS OF THE CITY WHERE THE STREET MAIN PRESSURE EXCEEDS 80 POUNDS PER SQUARE INCH, REPEALING ALL ORDINANCES

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TO THE CONTRARY, AND DECLARING AN EMERGENCY.

BE IT ORDAINED BY THE COUNCIL OF THE CITY OF BROKEN ARROW, THE BROKEN ARROW CODE IS HEREBY AMENDED BY ADDING A SECTION TO BE NUMBERED 24-73, WHICH SAID SECTION READS AS FOLLOWS:

SECTION I.

24-73. In all areas of the City wherein the street main pressure of the water lines exceeds 80 pounds per square inch, an approved pressure reducing valve shall be installed near the building, in a meter can, or in any other enclosure approved by the City, with all working parts accessible for repair or replacement. Installation of these valves and all maintenance thereon shall be at the expense of the property owner.

SECTION II.

Any ordinance or parts of ordinances found to be in conflict herewith are hereby repealed.

SECTION III.

An emergency exists for the preservation of the public health, peace, and safety, and therefore this ordinance shall become effective from and after the time of its passage and approval.

PASSED AND APPROVED and the emergency clause ruled upon separately this 2nd day of August, 1982

DATED this 2nd day of August, 1982

/s/ Nick Hood, Jr.
Mayor

911 JOINT TESTING ON LARGE DIAMETER SANITARY SEWERS:

911.01 PIPELINE PREPARATION: Pipeline must be free of dirt, sand, gravel and debris in the area of the pipeline joint being tested. If surface porosity exists in the area of the pipe joint being tested, it should be corrected in the following manner. Minor surface porosity can be eliminated simply by thoroughly wetting the inner surface of the pipe with water. this will normally insure that the pores in the concrete are filled and will eliminate the possibility of false readings because of pressure leakage internally in the pipeline rather than through the joint area which is the only area of concern. An acceptable alternative to this is to coat the sealing area of the pipeline with a suitable concrete sealant or an epoxy or urethane based paint to completely seal the inner pipe surface.

911.02 TEST PROCEDURE: Inflate end elements of test equipment to 25 psig to isolate joint area. Inflate joint area to 3.5 psig and turn inflation valve to off to isolate joint area. Observe test pressure gauge for 10 seconds. If pressure drop does not exceed 1.0 psig (ie 3.5 psig - 2.5 psig) joint is considered acceptable. In essence, this test is a go/no go test. Previous experience has indicated that if pipeline sections have a broken, displaced or missing gasket, it will normally be impossible to achieve a pressure rise in the joint area.

PAVING, DRAINAGE AND EROSION CONTROL NOTES

August 19, 1999

1. All paving, drainage and erosion control shall be designed in accordance with the current City of Broken Arrow Land Subdivision Code and constructed in accordance with the current City of Broken Arrow Standard Construction Specifications.
2. Prior to starting construction the contractor shall participate in a Pre-Construction Conference with the Public Works Department. At this conference the contractor shall furnish certification from the manufacturer/supplier that all materials meet applicable specification. This information shall include moisture density curves for material to be used for embankment or subgrade construction, aggregate gradation tests, and mix designs for Portland cement concrete and/or asphaltic concrete. Certifications shall be supplied in five (5) copies with three (3) copies stamped and approved, by the City, returned to the contractor. Materials shall not be installed until they have been approved by the City.
3. All paving, drainage and erosion control construction shall be inspected by the Public Works Department Utility Inspectors, in accordance with City of Broken Arrow Administrative Regulation 11-15.
4. All utility construction (water, sewer, and storm water) shall be completed prior to subgrade preparation.
5. Subgrade shall be free of all organic matter, treated, and compacted according to the plans and specifications.
6. Sequence of construction for lime treated subgrades shall be blue top and fine grade, lime treated and stabilized, and then final fine grading.
7. Compaction tests shall be taken a minimum of once every 4,500 square feet for each eight (8) inch lift of material.
8. Subgrades shall be proof rolled if the stability of the material is questioned.
9. Paving shall be a minimum of 26' face to face of curb and centered in the right of way.
10. The Contractor shall furnish the following testing services by a reputable independent testing laboratory approved by the City:
 - a. Field density tests of embankment, subgrade, or base, at locations specified by the Inspector.
 - b. Stability, density, bitumen content and gradation tests of asphaltic concrete every 200 tons or daily which ever is less.
 - c. Compression test of concrete cylinders at seven (7) and twenty-eight (28) days with one (1) of each tests conducted for every 100 cubic yards placed.
 - d. One core sample, at a location specified by the inspector for every 8,000 square feet of pavement.
11. The paving contractor shall adjust all valve boxes to grade after paving of streets has been completed.
12. The paving contractor shall place a concrete collar two (2) feet square and equivalent in thickness to the street being constructed, around each valve box not located in a paved area. The valve box shall be adjusted to grade prior to placing of the concrete collar.
13. The paving contractor shall mark all water line crossings by cutting a "W" 1/4 inch deep in the face of the curb, over the crossing, and painting the "W" blue. The paving contractor shall mark all water valve locations by cutting a "V" 1/4 inch deep in the face of the curb, over the valve, and painting the "V" blue.
14. Storm sewer bedding, backfill, and compaction shall be in accordance with Standard Drawing ST01.
15. When storm sewers are constructed of material that does not have a locking band at the joints, each joint will be wrapped as shown in Standard Drawing ST02.
16. All drop inlets shall have cast iron hoods.
17. All culverts shall be furnished with headwalls on both ends, and an apron on the downstream side.
18. Erosion control shall start with initial construction and be practiced throughout the project.
19. Hay bale dikes or silt fences shall be constructed adjacent to all drainage ways.
20. Upon completion of the storm sewer, hay bale dikes or silt fences shall be constructed in all areas that will erode into the storm sewer system.
21. Vegetative cover shall be established on all disturbed areas as soon as the work is completed.
22. Road closures must be coordinated a minimum of twenty four (24) hours in advance. Roads will not be closed for over eight (8) hours without written permission from the Public Works Director.