



VILLAGE OF KINGDOM CITY

DESIGN STANDARDS AND SPECIFICATIONS

Larry P. Doyle

Larry Doyle, Public Works Director

Approval Date: 04-16-2025

TABLE OF CONTENTS

SECTION 1 – GENERAL REQUIREMENTS.....1

1.1 General Plan Requirements for Public Improvement Projects 1

1.2 Construction Drawings..... 2

SECTION 2 – SANITARY SEWER3

Section 2.1 General Requirements 3

Section 2.2 Design Guidelines..... 3

Section 2.3 Lift Stations..... 7

Section 2.4 Force Mains 8

Section 2.5 Grease, Oil and Sand Interceptors..... 9

SECTION 3 – WATER SYSTEM11

Section 3.1 General Requirements 11

Section 3.2 Design Guidelines..... 11

SECTION 4 – STORM WATER16

Section 4.1 General Requirements 16

Section 4.2 Approvals and Permits Required 16

Section 4.3 Coordination with Other Jurisdictions 16

Section 4.4 Ownership and Maintenance 17

Section 4.5 Drainage Easements 17

Section 4.6 Design Guidelines..... 17

Section 4.7 Rational Formula 17

Section 4.8 Time of Concentration..... 19

Section 4.9 Hydrograph Methods..... 20

Section 4.10 Inlets..... 20

Section 4.11 Types of Inlets Allowed 21

Section 4.12 Storm Sewers 21

Section 4.13 Design Standards for Culverts 27

Section 4.15 Design Standards for Open Channels..... 28

Section 4.16 Purpose 29

Section 4.17 Policy 29

Section 4.18 Methods of Analysis..... 29

Section 4.19 Design Criteria..... 30

Section 4.20 Goals and Objectives..... 32

Section 4.21 General Design Guidelines 33

Section 4.22 Permits 33

Section 4.23 Design Standards & Criteria 34

SECTION 5 – STREETS40

Section 5.1 General Design Guidelines 40

Section 5.2 Construction of Sidewalks, Gutters, Curbs & Roadway Entries in Public Right-Of-Way..... 43

Section 5.3 Design & Inspection of Sidewalks, Gutters, Curbs & Roadway Entries in Public Right-Of-Way
43

Section 5.4 Street Lighting 43

Section 5.5 Exceptions to Requirements 44

Section 5.6 Construction Cleanup on Public Property 44

Section 5.7 Permit Required 45

Section 5.8 Permit Conditions..... 45

Section 5.9 Completed Work 46

Section 5.10 Emergency Work 47

Section 5.11 Inspection..... 47

Section 5.12 Traffic Control..... 47

Section 5.13 Unauthorized Work or Excavation Prohibited..... 48

Section 5.14 Restoration 48

Section 5.15 Liability Insurance, Performance and Maintenance Bond Requirement 49

Section 5.16 Standard Details 50

GENERAL SPECIFICATIONS

Section 01100 Summary

Section 01330 Submittal Procedures

Section 01500 Mobilization and Traffic Control

Section 01770 Closeout Procedures

Section 01781 Project Record Documents

Section 01782 Operation and Maintenance Data

Section 02220 Site Demolition

Section 02230 Site Clearing

Section 02300 Earthwork

Section 02318 Rock Excavation

Section 02920 Finish Grading & Seeding

Section 02350 Erosion Control

Section 02822 Chain Link Fence and Gates

Section 02920 Finish Grading and Seeding

WATER SYSTEM SPECIFICATIONS

Section 02510 Water System Specifications

SANITARY SEWER SPECIFICATIONS

Section 02530 Sewer System Specifications

Section 07115 Bituminous Damproofing

STORMWATER SPECIFICATIONS

Section 02630 Storm Drainage

Section 03410 Plant Precast Structural Concrete

STREET SPECIFICATIONS

Section 02700 Road and Driveway Crossings

Section 02715 Entrance and Gravel Area

Section 02751 Portland Cement Concrete

Section 02765 Pavement Markings

Section 02770 Curbs and Sidewalks

Section 04000 Asphalt Pavement

Lighting Details

APPENDIX A

Chapter 700 Utilities

APPENDIX B

Site Development Application for Plan Examination and Building Permit

SECTION 1 – GENERAL REQUIREMENTS

1.1 General Plan Requirements for Public Improvement Projects

The following criterion is established to provide a uniform system of plan preparation for submittal to the City. Applications and material submitted for processing under the provisions of this ordinance shall conform to the specifications prescribed in this Section.

- A. A Site Development Application for Plan Examination and Building Permit is required to be completed and submitted to the City. See Appendix B.
- B. All plans and reports submitted shall be prepared by, or under the direction of, a Professional Engineer, licensed in the State of Missouri, and shall be reviewed by the City for compliance with the minimum design requirements as established in the Design Standards and with all other applicable City's codes and standards.
- C. Assumed elevations are not permitted. All benchmark references shall be noted on drawings. All surveys shall be accomplished in accordance with Missouri Minimum Standards for property boundary surveys. All survey data shall be vertically and horizontally tied to a minimum of two City's Geographic Reference System (GRS) Geodetic Control Points established by the MoDNR Land Survey Program and shall be shown on submitted digital and paper copies. Coordinates shall be provided for all exterior property corners on surveys and plats. Legal descriptions shall be written by a Registered Land Surveyor or an attorney, licensed to practice in the State of Missouri, and shall comply with the minimum standards as provided for in the Missouri State Statutes for such descriptions.
- D. Attention is directed to the design engineer that whenever extraordinary or unusual problems are encountered in conjunction with a proposed project, additional information and analysis beyond the minimum requirements of these standards and criteria may be required.
- E. The City is not responsible for the accuracy and the adequacy of the design or dimensions and elevations as depicted on the plans (which shall be confirmed and correlated at the site of the work).
- F. Review and approval of drawings and calculations by City is conceptual in nature only and does not imply detailed approval to any particular design item or data shown on the drawings, nor does it give implied approval for any variance from any City regulations or design standards. The design professional whose seal appears on the plans is responsible for all lines and grades, field data, and constructability of the design in compliance with the City's standards and regulations.
- G. Prior to approval of a Preliminary Plat, it will be the individual developer's/owner's/engineer's responsibility to acquire all required off-site water, sewer, drainage, access and other utility easements required to serve the proposed development. All required off-site easements shall be recorded with copies provided to the City prior to approval of the preliminary plat. Easements dedicated to the City shall be provided to the City as an original copy.

1.2 Construction Drawings

- A. The owner of the tract proposed for subdivision or public infrastructure improvements shall have an engineer licensed in the State of Missouri prepare and submit construction drawings to the City.
- B. Construction drawings shall clearly show the location and extent of proposed construction in relation to existing and proposed property lines, physical features, and utilities. They shall include all details necessary to properly construct the proposed improvements. Line-work and lettering shall be neat and clear. Copies shall be free from smudges, tears, folds, and other imperfections which affect the legibility of the drawings.
- C. Two (2) paper copies and one (1) Adobe pdf digital copy and one AutoCAD dwg. file shall be submitted to the City for review and approval.
- D. All design changes that occur during the review process shall be incorporated into the bound construction drawing set as revised redrafted full size sheets. Addendums and loose unbound sheets are not acceptable. Addendums will only be acceptable for field changes after final approval of the construction drawings. A response letter shall be provided by the design professional indicating the response to each review comment. If the response letter is not included in the resubmittal, no action will be taken until the response letter is received by the City.
- E. After approval and required revision, three (3) paper copies and one (1) Adobe pdf digital copy and one AutoCAD dwg. file shall be submitted to the City.

SECTION 2 – SANITARY SEWER

Section 2.1 General Requirements

- A. All developments/public improvements shall be provided with an approved system for wastewater disposal in accordance with this Article and subsequent sections of this Design Standard.
- B. All sanitary sewer main extensions, pump stations, appurtenances, and all collection and treatment systems shall be designed and constructed in accordance with the most current regulation of the MoDNR's rules, regulations, and Statutes of the State of Missouri.
- C. All sanitary sewer improvement plans including all gravity and pressure systems within the City, shall be submitted to the City for review and approval. The developer/applicant shall be responsible for all costs associated with the required review and approval of submitted plans.
- D. Any review by the City, or approval of construction shall not relieve the developer or the developer's engineer from complying with all rules, regulations, ordinances, laws or statutes that are in effect at the time of design or construction.
- E. Also see Chapter 700 Utilities included in Appendix A.

Section 2.2 Design Guidelines

- A. Sanitary Sewers shall be designed for the ultimate tributary population. Due consideration shall be given to current zoning regulations and approved planning and zoning reports where applicable. The design engineer shall use sound professional judgment to establish proposed land uses in order to calculate anticipated flow rates. All planning interpretations and/or predictions shall be subject to the approval of the City. Whenever possible, actual platted land uses shall be used for calculations of ultimate tributary population flow rates. Sewer capacities shall be adequate to handle the anticipated maximum hourly quantities of sewerage and industrial waste together with reasonable consideration given to infiltration/inflow.
- B. Lift Station Pumping Rates: The capacity of proposed lift stations or modifications/upgrades to existing lift stations shall be calculated per the MoDNR Design Guide. In the absence of measured and accurate flow or data, the following shall be used, for the land uses indicated, for sizing calculations:
 - a. Single Family Residential: 3.7 persons/lot
 - b. Multi-Family (Duplex & Townhomes): 3.7 persons/unit
 - c. Multi-Family (Apartments, Condos): 3.0 persons/unit
 - d. Commercial/Industrial: Unit flow rates shall be established by the design engineer for the proposed facility to be constructed, and shall be approved by the City.

- C. The diameter of proposed sewers shall not exceed the diameter of the existing or proposed outlet, whichever is applicable, unless otherwise approved by the City. No public sewer shall be less than eight (8) inches in diameter.
- D. Stublines for service connections shall not be less than four (4) inches in diameter for residential lots. Sewer services shall be Schedule 40 PVC. No split services, (except for multi-family), or 90° turns are permitted. Service connections on the mains shall have a minimum of five (5) feet of separation and shall be located a minimum of five (5) feet from the exterior wall of a manhole. Service connections shall be provided for every lot and every structure and shall be centered in the lot frontage where feasible. Tracer wire and indicator tape shall be provided for all service connections as per Details in the Standard Drawing Details.
- E. Sanitary sewers shall be constructed of SDR 35 Gravity Sewer/SDR 21 Pressure pipe material resistant to or protected from bacterial degradation, acid and alkaline solutions, normal sewer temperature variation, abrasion, and industrial wastes or other material which may be transmitted by the collection system.
- F. All sewers shall be designed to give mean velocities when flowing full of not less than 2.0 feet per second. Sewer design shall meet MoDNR Standards and Guidelines.
- G. The velocity of flow in sewers shall not exceed 12 feet per second.
- H. Sewers mains shall be laid with uniform slope and straight alignment between manholes.
- I. Steep slope protection. Sanitary sewers on twenty percent (20%) slope or greater shall be anchored securely with concrete slope anchors or equal.
- J. When a sewer joins a larger one, the invert of the larger sewer should be lowered sufficiently to maintain a continuous energy gradient.
- K. The angle for gravity sewer mains and branch lines intersecting at manholes shall not be less than 90 degrees to minimize junction losses.
- L. Manholes shall be installed at the end of each line; at all changes in grade, size, or alignment; at all intersections; and at a distance not greater than four hundred (400) feet.
- M. The construction of all manholes and castings shall conform to the specifications and details shown in the Construction Specifications and Standard Drawing Details. Where corrosive conditions due to septicity or other causes are anticipated, corrosion protection on the interior of the manholes shall be provided. Corrosive conditions are considered to be present where sewer mains are 12" or larger in size or where discharge is occurring from a force main. Where discharge is from a force main an additional two manholes downstream shall be lined. The lining shall be an epoxy with a minimum of 90% solids by volume. A three-layer polyurea and polymer protective lining system can be substituted for the epoxy lining. The manhole lining system shall pass a Severe Wastewater Analysis Test (SWAT), coating manufactured in an ISO 9001 certified facility and a 10-year warranty of the product.

- N. The minimum horizontal clear distance within the barrel of standard manholes shall not be less than four (4) feet. Manholes with connecting pipe diameters greater than eighteen, (18) inches shall have a minimum inside clear dimension of five (5) feet and manholes with connecting pipe diameters greater than 30 inches shall have a minimum inside clear dimension of six (6) feet.
- O. Drop manholes should be where possible. However, an outside drop pipe shall be provided for a sewer entering a manhole at an elevation of twenty-four (24) inches or more above the manhole invert. The outside drop pipe shall be protected against breaking or settling by the use of concrete encasement. The drop pipe shall have the same nominal diameter as that of the incoming sewer.
- P. Without utilizing drop manholes, the difference in elevation between the invert of any incoming sewer and the invert of the outgoing sewer should not exceed twenty-four (24) inches. The minimum drop through manholes shall be 0.2 feet.
- Q. All other sanitary sewer lines (sewer lines across unplatted land, etc.) shall have the tops of manholes set 2" above the existing ground elevation.
- R. Sanitary sewers mains shall be located within easements to provide the least interference with the location of other utility lines unless topography dictates otherwise. A 15' minimum easement width shall be provided for all sanitary sewer mains and normally shall be centered on the main. The planting of trees in sanitary sewer easements is not permitted. Temporary construction easements shall also be provided as necessary. Sanitary sewer lines shall be constructed on the opposite sides of streets from water lines. Construction of sidewalks longitudinally above sanitary sewers is not permitted. No sanitary sewer main shall be constructed under storm boxes. Instances where sewer main is required to be constructed in Right-of-Ways shall be reviewed and approved by the City Manager on a case by case basis.
- S. A tracer wire and indicator tape shall be provided for all sewer mains and services per details in Standard Drawing Details. Access boxes for tracer wire splices not corresponding to a manhole or other structure shall be provided. No buried splices or below grade splice kits shall be allowed for use.
- T. End lines with easements shall be extended to provide access from street rights-of-way where possible.
- U. Not less than 36" of cover shall be provided over top of pipe in all areas unless otherwise approved by the City.
- V. Open cutting of streets shall be permitted only where approved by the City or the local agency responsible for the roadway. At locations where open cutting is not permitted, the crossing shall be made by boring or tunneling. Crossings made by boring or tunneling shall require a casing pipe unless otherwise approved by the City. All work and materials shall be in conformity with all requirements of the Construction Specifications. The diameter and length of the casing pipe to be used shall be in accordance with details in the Standard Drawing Details.
- W. Cleanouts and lampholes are not permitted on gravity sanitary sewer mains.

- X. There shall be no physical connection between a public or private potable water supply system and a sewer, or appurtenance thereto, which would permit the passage of any wastewater or polluted water into the potable water supply.
1. Horizontal Separation:
 - a. All sanitary sewers, storm sewers, or manholes shall be laid at least 10 feet, horizontally, from a water main. The distance shall be measured from edge to edge of pipes. In cases where it is not practical to maintain a ten-foot separation, deviation may be allowed on a case-by-case basis, if supported by data from the design engineer. Such a deviation may allow installation of the sewer closer to a water main, provided that the water main is in a separate trench or on an undisturbed earth shelf located on one side of the sewer and at an elevation so the bottom of the water main is at least 18" above the top of the sewer.
 2. Vertical Separation:
 - a. Water mains crossing sanitary sewers, house sewers, or storm sewers shall be constructed to provide a minimum clear distance of 18 inches between the outside of the water main and the outside of the sewer. This clearance is required whether the water main is above or below sewer pipes. The designer shall make every effort to install proposed water lines at sanitary sewer crossing above the sanitary sewer pipe, whenever practical. At crossings, the full length of water pipe shall be located so that both joints will be as far from the sewer as possible but in no case less than 10 feet. Special structural support for the upper pipe may be required. In areas where the proper separation cannot be maintained as stipulated above, either the water main or sewer line must be constructed of mechanical joint pipe or cased in a continuous casing.
- Y. Adequate support shall be provided at all joints in pipes utilized for aerial crossings. Precautions against freezing, such as insulation and increased slope, shall be provided. Expansion jointing shall be provided between above-ground and below-ground sewers. Where buried sewers change to aerial sewers, special construction techniques shall be used to minimize frost heaving. For aerial stream crossings, the impact of flood waters and debris shall be considered. The bottom of the pipe shall be placed no lower than the elevation of the fifty-year flood. Only ductile-iron pipe with restrained joints shall be used. Otherwise, they shall be constructed so that they will remain watertight and free from changes in alignment of grade.
- Z. Aerial sewers will not be allowed unless reviewed and approved by the City and only in extreme circumstances.
- AA. Sewer systems shall be designed to minimize the number of stream crossings. Sewer crossings shall be designed to cross a stream as nearly perpendicular as possible and shall be free from change in grade. All structures, such as manholes and etc. shall be located so they do not interfere with the free discharge of flood flows of the stream. Sewers entering or crossing streams shall be constructed of restrained joint PVC or ductile iron carrier pipe in either a welded steel or restrained joint PVC encasement pipe 4" greater in diameter than the carrier pipe, they shall be constructed

so they will remain watertight and free from changes in alignment or grade. Material used to backfill the trench shall be stone, coarse aggregate, washed gravel, or other materials which will not readily erode, cause siltation, damage pipe during placement, or corrode the pipe. The design engineer shall include in the project specifications the method(s) to be employed in the construction of sewers in or near streams. Such methods shall provide adequate control of siltation and erosion by limiting unnecessary excavation, disturbing or uprooting trees and vegetation, dumping of soil or debris, or pumping silt-laden water into the stream.

Aerial sewer crossings shall be reviewed by the City and approved on a case by case basis.

1. (1). The pipe shall be of special construction, having watertight joints. Restrained joint or fusion welded pipe may be used for open cut crossings, provided it is encased in a welded steel casing below the stream bed. Restrained joint or fusion weld pipe shall be used for bored crossings.
2. Adequate support and anchorage shall be provided on both sides of the stream.
3. Valves shall be provided at both ends of water crossings so that the section can be isolated for testing or repair; the valves shall be easily accessible and should not be subject to flooding.
4. Bank erosion is a major cause of stream crossing failures, and erosion protection measures such as rip rap have limited success. Stream movement and the history of bank erosion must be considered when choosing the length that the crossing pipe or casing shall extend beyond the upper edge of the stream channel. The stream crossing pipe or casing shall extend at least 15 feet beyond the upper edge of the stream channel on each side of the stream.

Section 2.3 Lift Stations

- A. In the design of sanitary sewer systems, it is the policy of the City that lift stations will not be acceptable when gravity flow is reasonably available. Advance coordination with the City is required prior to proceeding with any lift station plans. Design details, criteria and capacities for any sanitary sewer lift station shall be determined during that coordination.
- B. Developers or property owners who desire to utilize a lift station and force main for the development of property within the city limits, shall submit to the City, through the normal processes, a plan for the lift station and force main. This plan shall include the following:
 1. A certification by an engineer registered in the state of Missouri that a gravity flow connection to the sewer system is not reasonably available to service the subject property, with the reasons that gravity flow is unavailable stated with particularity and to include calculation of costs for installation of gravity flow sewer for the proposed development, prepared by the developer's engineer.
 2. A certification by an engineer registered in the state of Missouri that the lift station, as proposed, is sufficient to perform the desired functions for the entire proposed development and that the force main and wetwell are sufficient to service the entire drainage area.
 3. A certification by an engineer registered in the state of Missouri what the costs of construction of the proposed lift station and force main will be.

- C. Upon review of the developer's plan the City shall make a determination if the lift station and force main may be utilized for the development.
- D. A request by a developer or property owner to connect a new development to a sewer system served by an existing lift station will be reviewed on a case-by-case basis by the City. The request will be accompanied by a certification with sufficient justifying calculations by an engineer registered in the state of Missouri hired by the Developer and reviewed by a third party engineer selected by the City that the existing lift station and force main are sufficient in capacity to serve the properties proposed to hook onto the existing lift station and force main. In the case where an existing lift station is found to have insufficient capacity for a proposed development, the Developer may propose potential upgrade to the existing lift station and force main to provide sufficient capacity. The Developer's engineer shall provide calculations and plans for the proposed improvements. All proposals, calculations, and plans are subject to review and approval by the City.
- E. Developers or property owners who have received approval from the Village of Kingdom City to utilize a lift station and force main shall be responsible for complying with all applicable requirements of the City.

Section 2.4 Force Mains

- A. At design average flow, a cleansing velocity of at least two (2) feet per second shall be maintained.
- B. The force main pipe and fittings shall be designed to withstand normal pressure and pressure surges. Force main pipe shall be designed and so constructed to provide a minimum cover of thirty-six (36) inches and a maximum cover of sixty (60) inches over the top of the pipe. Justification shall be provided where additional depth is required. Concrete thrust blocking and retainer glands shall be provided at all bends 11-1/4 degrees or greater. Force mains designed to cross public streets shall be encased with steel casing of adequate size to allow for future removal of the force main pipe.
- C. Include on the plans that testing of the force main shall be in accordance with the requirements of AWWA C-600. Testing pressure shall be: 150% great than the greatest pressure experienced by the main.
- D. Proper air release valve, or combination valves, shall be placed at high points in the force main to allow for proper operation. The air release valve shall be equipped with shutoff valve, blowoff valve and backflushing attachments. A standard four-foot diameter shallow manhole with standard frame and cover shall be installed around the force main relief valve for maintenance access to valve.
- E. Provide tracer wire and indicator tape at force mains as per details in Standard Drawing Details. Use access boxes for tracer wire splices when an air release valve is not available.

Section 2.5 Grease, Oil and Sand Interceptors

- A. General Provisions. Grease, oil, and sand interceptors shall be provided at the developer's or user's expense when the City determines that they are necessary for the proper handling of wastewater containing grease or any flammable wastes, sand, and other harmful ingredients, except that such interceptors shall not be required for private living quarters or dwelling units. All interceptors shall be of a type and capacity approved by the City and shall be so located as to be readily accessible for cleaning and inspection. Grease and oil interceptors shall be constructed of impervious materials capable of withstanding abrupt and extreme changes in temperature. They shall be of substantial construction, watertight, and equipped with easily removable covers which when butted in place shall be gas tight and water tight. When installed, all grease, oil and sand interceptors shall be maintained by the user, at his/her expense, in continuously efficient operation.
- B. Grease Interceptor Standards
1. Grease interceptors shall be provided on kitchen drain lines from institutions, hotels, restaurants, school lunch rooms, nursing homes and facilities, and other establishments from which significant amounts of grease may be discharged to the public sewer collection and treatment system.
 2. Grease interceptors should be located on the exterior of the facility but as close to the fixtures being served as possible and should receive only the waste streams from grease-producing fixtures. Sanitary waste streams, garbage grinder waste streams and other waste streams which do not include grease should be excluded from passing through the grease interceptors. This separation is mandatory for new construction or replacement facilities. Grease interceptors must be cleaned on a regular basis and must be readily accessible for this purpose.
 3. Grease interceptors shall be provided with a manhole or opening of sufficient size to permit inspection and cleaning. When the grease interceptor is located below ground, the access opening shall be extended to grade. The opening shall be fitted with a tight fitting cover which will prevent the entrance of insects and vermin. Sampling manholes shall be provided at the outlet of all grease interceptors as per details in the Standard Drawing Details.
 4. The grease interceptor should be constructed of materials similar to septic tanks and be properly baffled on both the inlet and outlet.
 5. The City shall have the right to inspect facilities from time to time, during regular business hours, to determine if the facility is in compliance with this provision. The City shall have the right to require regular sampling, to be conducted at the Owner's expense, should the City deem sampling activities necessary for compliance by the subject industry.
 6. Variances to Grease Interceptor Requirement. Under certain conditions, as indicated in this Subsection, a variance from the requirement of a grease interceptor of 1,000 gallon or more may be given after following the procedure set out for obtaining a variance.

Variance may be granted to a temporary food preparation and clean-up facility when:

- a. Food preparation and clean-up will be limited to a specific event or time
- b. It can be shown that only minor levels or incidental quantities of fats, oils and grease would be released into the sewer collection system.

SECTION 3 – WATER SYSTEM

Section 3.1 General Requirements

- A. All development shall be provided with an approved system for water service in accordance with this Article and subsequent sections of this Design Standards.
- B. All water wells, well houses, water storage tanks, water pumping facilities and related systems shall be designed and constructed in accordance with the latest edition of the MoDNR's "Minimum Design Standards for Missouri Community Water Systems".
- C. All water main extensions and appurtenances shall be designed and constructed in accordance with the Design Standards, Construction Specifications and the most current regulation of the MoDNR's rules, regulations, and Statutes of the State of Missouri.
- D. All water improvements plans shall be submitted to the City, for review and approval. The Developer/Applicant shall pay for costs associated with the required review and approval of submitted plans.
- E. Submittal of all engineering reports, plans and specifications to MoDNR shall comply with the requirements of the latest edition of the MoDNR's "Minimum Design Standards for Missouri Community Water Systems".
- F. Any review by the City, or approval of construction shall not relieve the developer or the developer's engineer from complying with all rules, regulations, ordinances, laws or statutes that are in effect at the time of design or construction.
- G. Also see Chapter 700 Utilities included in Appendix A.

Section 3.2 Design Guidelines

- A. All water systems shall be designed to provide adequate fire flow in accordance with the requirements of MoDNR. The plans for the water system must be submitted to the Fire District for review and the Fire District's recommendation must be provided to the City. Copies of any fire flow tests or calculations must be sent to the City. All fire hydrants installed by the contractor shall be flow tested following pressure testing and disinfection of the mains. This testing shall be done by the developer in the presence of the Fire District and the City's representative with the results forwarded to the City.
- B. No public water line shall be constructed less than six (6) inches in diameter with eight (8) inch diameter mains for primary mains.

- C. Appropriate water mains easements shall be extended to the property line for potential future extension. A gate valve the same size as the extended main shall be placed at the end of the line with a dead end assembly and a fire hydrant for flushing the main.
- D. Construction of sidewalks above water mains shall not be permitted, except for main crossings.
- E. All water mains shall have a minimum cover of forty-two (42) inches and a maximum cover of sixty (60) inches. Justification shall be provided where additional depth is required.
- F. Open cutting of streets shall be allowed only where permitted by the City or the local agency responsible for the roadway. At locations where open cutting is not permitted, the crossing shall be made by boring or tunneling. Crossings made by boring or tunneling shall require a casing pipe unless otherwise approved by the City. All work and materials shall be in conformity with all requirements of the Construction Specifications. The diameter and length of the casing pipe to be used shall be in accordance with details in the Standard Drawing Details.
- G. The design of all water systems shall provide for a complete loop-type water distribution system adequate to service the area with a connection, meter and meter setter for each lot.
- H. Water pressures in distribution systems below 35 PSIG are a violation of Missouri Safe Drinking Water Regulation 10 CSR 60-4.080 (9). All water mains shall be sized in accordance with a hydraulic analysis based on flow demands and pressure requirements. Distribution systems shall be designed to maintain at least 35 PSIG normal working pressure at ground level at all points in the distribution system under all conditions of design flow not including fire flow.
- I. Proposed water mains shall be so located within easements to provide the least interference with the location of other utility lines. A 15' minimum easement width shall be provided for all water mains and normally shall be centered on the main. Additional width may be required as determined by the City. This determination will be based on depth, location or presence of adjacent utilities. Planting of trees within water main easements is not permitted. Temporary construction easements shall also be provided as necessary. Water lines shall be constructed on the opposite sides of streets from sewer lines. Construction of sidewalks longitudinally above water mains is not permitted. No water main shall be constructed under storm boxes. Street grades and elevations of proposed main shall be taken into consideration so that once constructed they will not require regrading or relocation. In areas where grading activities will take place, the water main shall not be installed until final grade has been achieved in the location of the proposed water main. The City shall not be responsible for required relocating or lowering of installed water lines due to insufficient pre-construction grading activities. See details for utilities in the Standard Drawing Details. Construction of watermain in Right-of-Way shall be approved by the City on a case by case basis.
- J. A tracer wire and indicator tape shall be provided for all water mains and services per details in Standard Drawing Details. Access boxes for tracer wire splices not corresponding to a valve or other structure shall be provided.
- K. At the termination of all water mains or at locations as specified by the City, a dead end assembly with a fire hydrant in accordance with the Construction Specifications shall be provided to allow for future water main extensions.

- L. Fire hydrants shall be provided at locations as required to provide for thorough flushing of all water mains in the project area. Whenever practical, water mains five hundred (500) feet and longer shall be provided with a fire hydrant for flushing.
- M. Thrust blocking of adequate size and retainer glands shall be provided at all tees, elbows and bends to resist all resultant thrusts due to hydrostatic pressure. Horizontal and vertical alignment shall be achieved by appropriate elbows and bends with adequate blocking. Alignment by deflection will not be permitted. All blocking shall conform to the Construction Specifications and Standard Drawing Details.
- N. Ductile iron pipes or PVC shall be used for all water mains constructed in the City. Mains and fittings shall be as described in the City's Standard Water System Specification Section 02510.
- O. Fire hydrants shall conform to AWWA C502, and shall be either Mueller "Centurion" or Clow "Medallion" models. Fire hydrants shall be as described in the City's Standard Water System Specification Section 02510.
- P. Sufficient isolation valves shall be provided on water mains to allow a system to be adequately flushed and so that inconvenience and sanitary hazards to customers will be minimized during repairs. The following requirements shall be met when designing system valves. The weight of the valve shall not be carried by the pipe. Valves shall be provided with proper support, such as crushed stone, concrete pads or a well compacted trench bottom. Where new water mains connect to an existing main, a valve shall be installed on the new line. As a rule of thumb, no more than four valves should require closing to isolate a pipe. At a reducer, a valve should be placed in the smaller pipe within 20 feet of the reducer. Valves shall be located at not more than 300-foot intervals in all areas within the incorporated limits of the City and those areas that directly connect to the City's water distribution system.
- Q. Gate valves shall be of the resilient-seated configuration and shall conform to the applicable requirements of AWWA C515. Gate Valves shall be as described in the City's Standard Water System Specification Section 02510.
- R. Tapping sleeves and valves shall be used where required to connect to existing in-service mains. Tapping Sleeves shall be as described in the City's Standard Water System Specification Section 02510.
- S. Water systems shall be designed to minimize the number of stream crossings. Water crossings shall be designed to cross a stream as nearly perpendicular as possible and shall be free from change in grade. All structures, such as manholes and etc. shall be located so they do not interfere with the free discharge of flood flows of the stream. Water mains entering or crossing streams shall be constructed of restrained joint PVC or ductile iron carrier pipe in either a welded steel or restrained joint PVC encasement pipe 4" greater in diameter than the carrier pipe, they shall be constructed so they will remain watertight and free from changes in alignment or grade. Material used to backfill the trench shall be stone, coarse aggregate, washed gravel, or other materials which will not readily erode, cause siltation, damage pipe during placement, or corrode the pipe. The design engineer shall include in the project specifications the method(s) to be employed in the construction of sewers in or near streams.

Such methods shall provide adequate control of siltation and erosion by limiting unnecessary excavation, disturbing or uprooting trees and vegetation, dumping of soil or debris, or pumping silt-laden water into the stream.

Aerial sewer crossings shall be reviewed by the City and approved on a case by case basis.

1. Below Stream Bed Crossings

- a. Flowing streams and water body crossings five hundred feet or less in length shall have a minimum cover of four feet over the pipe. When crossing water courses greater than 15 feet in width, the following shall be provided.
 - (1). The pipe shall be of special construction, having watertight joints. Restrained joint or fusion welded pipe may be used for open cut crossings, provided it is encased in a welded steel casing below the stream bed. Restrained joint or fusion weld pipe shall be used for bored crossings.
 - Adequate support and anchorage shall be provided on both sides of the stream.
 - Valves shall be provided at both ends of water crossings so that the section can be isolated for testing or repair; the valves shall be easily accessible and should not be subject to flooding.
 - Bank erosion is a major cause of stream crossing failures, and erosion protection measures such as rip rap have limited success. Stream movement and the history of bank erosion must be considered when choosing the length that the crossing pipe or casing shall extend beyond the upper edge of the stream channel. The stream crossing pipe or casing shall extend at least 15 feet beyond the upper edge of the stream channel on each side of the stream.
- T. An approved backflow prevention device shall be installed on each service line to a consumer's water system serving premises where, in the judgment of the City Manager, actual or potential hazards to the public potable water system exist. Use only double check valve assemblies or reduced pressure principle assemblies included on the current Missouri Department of Natural Resources approved assemblies list. Use on commercial or industrial applications. Backflow preventers and their installation shall conform to Missouri Department of Natural Resources Regulations 10 CSR 60-11.010. Backflow prevention devices for fire lines shall be located in an appropriate vault as close to the water main as is reasonably practical. Backflow prevention devices for domestic water services shall be located on the consumer's side of the water meter. In certain cases, the domestic water service may be supplied from the fire line with the approval of the City Manager. The fire line would remain the responsibility of the property owner.
- U. Water services and plumbing shall conform to the applicable local plumbing codes. Plumbing fittings and fixtures not in compliance with standards established in accordance with 42 U.S.C. 300g-6(e) shall not be used. All service materials shall comply with MoDNR Standards and Guidelines for materials and connections.
- V. A service connection shall be provided for each lot between the water main and the meter setter. The service line shall be a minimum $\frac{3}{4}$ -inch diameter, (single setter), and a minimum 2-inch diameter, (double setter), 200 PSI, SDR-9 PE 3408, ASTM-D2737, CTS-OD pipe. For new

systems, each service connection shall be individually metered. For existing systems, each new service connection shall be individually metered.

- W. Single family units, each unit of a townhome, duplex, triplex and four-plex shall normally be provided with separate water meters for each living unit unless otherwise approved by the City. Multi-family apartment units shall be provided with one water meter for the entire facility. Irrigation systems may be provided with separate water meters.
- X. Commercial meters (1" or larger) shall be placed inside the building.
- Y. Water rates shall be per the City Ordinance – Chapter 700 Utilities (Appendix A). All fees shall be determined by the City and paid prior to connection.

SECTION 4 – STORM WATER

Section 4.1 General Requirements

- A. All development shall be provided with an approved system for stormwater control in accordance with this Article and subsequent sections of this Ordinance.
- B. All stormwater system and appurtenances shall be designed and constructed in accordance with the most current regulation of all necessary governing agency's rules, regulations, and Statutes of the State of Missouri.
- C. All stormwater system plans, including all systems within the City, shall be submitted to the City Manager, for approval.
- D. Any review by the City, or approval of construction shall not relieve the developer or the developer's engineer from complying with all rules, regulations, ordinances, laws or statutes that are in effect at the time of design or construction.
- E. In addition to the rules, regulations and state statutes specified in Section 4.1.2, the City will require conformance with the following design guidelines and with the Constructions Specifications.

Section 4.2 Approvals and Permits Required

- A. Developer shall be responsible for all applicable permitting including local, state, and federal jurisdictions. Copies of all approvals shall be provided to the City prior to approval to start construction.

Section 4.3 Coordination with Other Jurisdictions

- A. Where proposed storm drainage facilities are located on property adjoining to other local government jurisdictions, the design of storm drainage facilities shall include provisions to receive or discharge storm water in accordance with the requirements of the adjoining jurisdiction, in addition to meeting City requirements. In these cases, two (2) additional sets of plans shall be submitted and will be forwarded to the adjoining jurisdiction for review and comment.
- B. No grading or construction of storm drainage facilities may commence without prior notification of the Missouri One Call utility warning system at 1-800-DIG-RITE, as required by law.

Section 4.4 Ownership and Maintenance

A. Improvements on Public Road Right-of-Way

1. Storm drainage improvements on public right-of-way shall, upon acceptance, become the property of and shall be maintained by the City.

B. Improvements on Private Property

1. Storm drainage improvements on private property shall be maintained by the owner of the lot upon which the improvements are located or by the homeowners' association for improvements located in common areas. Maintenance of such improvements shall be identified on the final plat, in the subdivision covenants, and in the homeowner association's bylaws, as applicable.
2. All such improvements that serve a drainage area of five (5) acres or more shall be located in drainage easements and the public shall have such rights of access to repair or maintain such facilities.

Section 4.5 Drainage Easements

- A. All areas subject to inundation during a major storm must be included in drainage easements. Drainage easements shall be as described in Section 5.12.2.

Section 4.6 Design Guidelines

- A. For watersheds with a total tributary area less than 100 acres and a one percent annual probability (100-year) fully developed discharge, the design storm runoff may be analyzed using the rational formula.
- B. For watersheds with a total tributary area greater than 100 acres or with a one percent annual probability (100-year) fully developed, the design storm runoff shall be analyzed using an approved hydrograph method.

Section 4.7 Rational Formula

- A. The Rational Method may be used to calculate peak rates of runoff to elements of enclosed and open channel systems, including inlets, when the total upstream area tributary to the point of consideration is less than 100 acres. The Rational Method is as defined as follow:

$Q = KCiA$, where

Q = Peak rate of runoff to system in cfs

C = Runoff coefficient as determined in accordance with Table 4.7.A.2

i – Rainfall intensity in inches per hour in accordance with local rainfall data.

K = Dimensionless coefficient to account for antecedent precipitation as follows, except the product of C x K shall not exceed 1.0.

Table 4.7.A.1

ANTICEDENT PRECIPITATION COEFFICIENTS	
Design Storm	K
10% and more frequent	1.0
4%	1.1
2%	1.2
1%	1.25

Table 4.7.A.2

LAND USE/ZONING	RUNOFF COEFFICIENTS		RATIONAL METHOD "C"
	AVERAGE PERCENT IMPERVIOUS	AVERAGE PERCENT PERVIOUS	
1. Business			
Downtown Area	95	5	0.87
Neighborhood Areas	85	15	0.81
2. Residential			
Single Family Areas	35	65	0.51
Multifamily Areas	60	40	0.66
Churches & Schools	75	25	0.75
3. Industrial			
Light Areas	60	40	0.66
Heavy Areas	80	20	0.78
Parks, Cemeteries	10	90	0.36
Railroad Yard Areas	25	75	0.45
4. Undeveloped Areas	0	100	0.3
5. All Surfaces			
Impervious: Asphalt			
Concrete, Roofs, Etc.	100	0	0.9
Turfed Areas	0	100	0.3
Wet Detention Basins	100	0	0.9

Rational Method "C" for Non-Standard Land Use/Zoning Classifications

The "C" value can be calculated from any type of land use and known percent impervious surface from the following equation: $C = 0.3 + 0.6 * I$, where: I = percent impervious divided by 100

Unzoned But Master Planned Areas

Areas whose future land use is defined by an adopted land use plan shall be assigned runoff coefficients for the land use indicated on such plan.

Agricultural and Unplanned Areas

Proposed Conditions: Undeveloped areas designated as agricultural or those areas for which no specific land use is indicated shall be assigned a minimum of 35% impervious surface for purposes of the design of storm drainage systems (C=0.51).

Time of Concentration

Time of Concentration (T_c) is equal to the overland flow time to the most upstream inlet or other point of entry to the system, Inlet Time (T_I), plus the time for flow in the system to travel to the point under consideration, Travel Time (T_T).

$$T_c = T_I + T_T$$

Inlet Time

T_I shall be calculated by the following formula or determined graphically from Table 4.7.A.2, but shall not be less than 5 minutes nor great than 15 minutes.

$$T_I = 1.8 * \frac{(1.1 - C) D^{0.5}}{S^{0.333}}$$

T_I = Inlet Time in Minutes

C = Rational Method Runoff Coefficient as determined in accordance with this section

D = Overland flow distance parallel to slope in feet (100 feet shall be the maximum distance used for overland flow)

S = Slope of tributary area surface perpendicular to contour in percent

Travel Time

T_T shall be calculated as the length of travel in the channelized system divided by the velocity of flow. Velocity shall be calculated by Manning's equation assuming all system elements are flowing full without surcharge.

Travel Time

When the upstream area is unimproved, use $T_I = 15$ minutes for the first 100' from the most distant ridge line. Then use the following table to calculate T_T to account for future development.

Table 4.7.A.3

<u>SLOPE PERCENT</u>	AVERAGE CHANNEL	<u>VELOCITY IN FT/SEC</u>
<2		7
2 TO 5		10
> 5		15

Section 4.8 Time of Concentration

- A. Time of concentration, shall be determined using the current TR-55 Technical Bulletin.

Section 4.9 Hydrograph Methods

Shall be determined in a case by case basis by the City Manager if planned development within City Limits exceeds 100 acres. Methodology shall be reviewed by City and Developer prior to beginning any calculations or analysis.

Section 4.10 Inlets

- A. Inlet Locations
 - 1. Inlets shall be provided at locations and intervals, and shall have a minimum inflow capacity such that maximum flooding depths set below are not exceeded for the specified storm; at all sump locations where ponding of water is not desired, and where drainage cannot be released at the ground surface. It is recommended that inlets be provided at street intersections upstream of pedestrian cross-walks.

- B. Interception and Bypass Flow
 - 1. It is generally not practical for inlets on slopes to intercept 100% of the flow in gutters. Inlets must intercept sufficient flow to comply with street flooding depth requirements. Bypass flows shall be considered at each downstream inlet, until all flow has entered approved storm sewers or drainage ways.

- C. Allowable Street Depths
 - 1. All streets shall be designed to direct storm water run off toward the gutter line of the street. Water shall not be allowed to flow outside of the gutter line. Inlets shall be placed so that depth of water in gutter line does not exceed the depth of the City’s standard curb and gutter detail.

 - 2. Hydraulics
 - a. The allowable storm capacity of each street section with curb and gutter is calculated using the modified Manning’s formula for both the 5-year and 25-year storm event

$$Q = 0.56(Z/n)S^{1/2}d^{8/3}$$

Where: Q = discharge in cubic feet per second

Z = cross slope of the street in feet per foot

d = depth of flow at the gutter in feet

S = longitudinal slope of the street in feet per foot

n = Manning's roughness coefficient

Section 4.11 Types of Inlets Allowed

A. Public Streets

1. Curb Opening Inlets

- a. Standard curb opening inlets as shown on details in the Standard Drawing Details shall be used for public streets with curb and gutter.

2. Grated Inlets

- a. In general, the use of grated inlets in streets, which require adjustment when streets are repaved, will not be permitted.
- b. Where conditions are such that curb inlets cannot intercept the required rate of flow, necessary to control street flooding depth or to provide diversion of flow to detention, sedimentation or infiltration basins, "trench inlets" with vaned grates may be specified with approval of the City Manager.
- c. Other types of inlets will not be permitted unless approved by the City Manager.

B. Outside of Public Right-of-Way

1. The type of inlets specified outside of public right-of-way is left to the discretion of the designer.

C. General Safety Requirements

1. All inlets openings shall:

- a. Provide for the safety of the public from being swept into the storm drainage system; the maximum allowable opening shall not exceed six (6) inches in height.
- b. Be sufficiently small to prevent entry of debris that would clog the storm drainage system;
- c. Be sized and oriented to provide for safety of pedestrians, bicyclists, etc.

Section 4.12 Storm Sewers

A. Design Criteria

1. Spread in Streets

- a. Local Residential Streets – inlets shall be spaced at such an interval as to provide one clear lane of traffic having a minimum width of 10 feet during the peak flows of a design storm having a 10 year frequency.

- Collector Streets and Local Non-Residential Streets – inlets shall be spaced at such an interval as to provide one clear lane of traffic having a minimum width of 12 feet during the peak flows of a design storm having a 25 year frequency. The clear lane shall be centered on the centerline of the roadway.
- Arterial Streets – inlets shall be spaced to provide one clear lane of traffic in each direction during the peak flows of a design storm having a 25 year frequency. Two lanes of traffic being defined as 20 feet in width, being 10 feet on either side of the crown, for undivided roadways, and as one 12 foot wide lane on each side of the median for divided roadways.
- In addition to the inlet spacing requirements for limiting width of flow, inlets shall be located to limit gutter flow from crossing the street centerline at the time of peak discharge for the design storm to the following limits:

CONDITION CAUSING FLOW TO CROSS STREET CENTERLINE	MAXIMUM DISCHARGE, (CFS)
Transitions to superelevation	1.0
Sump at midblock	Not Allowed
Overflow of non-gutter flow	See 3

- b. Freeboard Requirements – Any opening through which surface water is intended to enter (or may backflow from) the system shall be 0.5 feet or more above the hydraulic grade line in the inlet during the design storm in Table 4.12.A.3 where such calculation must include junction (so-called “minor”) losses.

2. Gutter Flow

a. Gutter Capacity

Gutter capacity may be determined from Izzard’s Formula below

$$Q = \frac{0.56z * S_0^{0.5} * D^{2.666}}{n}$$

Q = The gutter capacity in cubic feet per second

z = The reciprocal of the average cross-slope, including gutter section, in feet per foot

S₀ = the longitudinal street grade in feet per foot

D = The depth of flow at curb face in feet

n = Manning’s “n”

Street Grade on Vertical Curves, S_0

The following formula shall be used to determine the street grade at any point on a vertical curve using plus for grades ascending forward and minus for grades descending forward, in feet per foot.

$$S_0 = S_1 + \frac{x * (S_2 - S_1)}{L}$$

S_0 = The street grade on a vertical curve at point x, in feet per foot

S_1 = The street grade at the PC of a vertical curve, in feet per foot

S_2 = The street grade at the PT of a vertical curve, in feet per foot

X = the distance measured from the PC to point x on a vertical curve, in feet

L = The total length of a vertical curve, in feet

- 3. Protection for Streets
 - a. Street Crossings

Concentrated flow not conveyed in the gutter system, shall be conveyed under streets to prevent vehicles from being swept from the roadway in infrequent storms. These crossings (bridges, culverts or underground systems) must be designed to completely convey flood flows without street overtopping in accordance with the following table:

Table 4.12.A.3

DESIGN STORM CAPACITY FOR STREETS		
<u>STREET CLASSIFICATION</u>	<u>MIN. DESIGN STORM CAPACITY</u>	<u>DESIGN STORM RETURN INTERVAL</u>
Arterial	1%	100 Year
Collector & Local Non-Residential	4%	25 Year
Residential	10%	10 Year

- a. Roadway Overtopping

Concentrated flow in excess of the minimum design storm may only overtop the roadway if the following conditions are met:

- The span of the structure opening is less than 20 feet.

- The peak stormwater runoff from the 1% storm is 250 cfs or less unless a guard rail is installed on the downstream side of the roadway.

Such overflow depths at low points in roadways during the 1% storm will be limited to 7 inches measured at the high point in the roadway cross section; except that it also shall not exceed 14 inches at the deepest point in the roadway cross section. Depths may be limited where necessary by reverse grading the downstream right of way area, by lengthening the vertical curve of the roadway, by reducing roadway crown, or by other similar means. Roadway overtopping depths shall be determined by integrating the broad crested wier formula across the roadway profile. Each incremental flow can be determined by using the formula:

$$q = Clh^{1.5}$$

q = the flow for an increment of profile length (width of flow)

l = the incremental width

C = a flow coefficient that shall not exceed 3.0

H = the average depth of flow at each increment

The total flow Q is the sum of the incremental flows. Depth determinations can be made through an iterative process where successive depths are chosen, Q is calculated for each depth and then compared to the known Q at the overtopping point.

Overflow protection criteria provides additional accessibility criteria at major stream crossings for emergency personnel, and provides the public with protection against injury and property damage.

4. Vertical Alignment

- a. The recommended minimum slope for storm drain piping is 0.5% (five-tenths percent). Pipe grades may not be less than the minimum friction slope required to convey the design flow, unless specifically approved. Maximum recommended grade is 10% (ten percent). Properly designed anchorage may be required for grades above 10% (ten percent) and will be required for grades above 20% (twenty percent).
- b. Pipe size shall never be reduced downstream even though pipe slope and theoretical capacity may increase. A minimum vertical drop of 0.1' (one-tenth feet) shall always be provided across a junction structure, unless otherwise approved.
- c. Under or within two feet (2') of streets or paved areas, the top of the pipe shall be located a minimum of twelve inches (12") below the pavement or curb subgrade, or greater if required to meet minimum cover and strength requirements for the type of pipe specified to withstand an AASHTO HS-20

loading. Outside of paved areas, the top of the pipe shall be located a minimum of twelve inches (12") below finished earth grade. Box culverts or other relatively wide and flat conveyance structures may be required to have additional cover if deemed necessary to support grass or other vegetative cover.

- d. Siphons or inverted siphons are not allowed in the storm sewer system.
5. Horizontal Alignment:
 - a. Storm sewer alignment between manholes shall be straight except when approved by the City Manager. Curved alignments are not allowed.
 - b. Storm sewer crossings shall be perpendicular to the street.
 - c. The permitted locations for storm sewer within a street right-of-way are behind the curb. The outside edge of the pipe shall be located a minimum of 6" behind the back edge of curb. Except for crossings, storm sewers shall not be located under streets.
 - d. Storm sewers located on private property shall be located within drainage easements and shall be aligned parallel with property lines unless otherwise approved. Where storm drains exit the street right-of-way between residential lots, the pipe shall be extended a minimum of forty feet (40') past the front yard setback line, or to the estimated location of the rear of the dwellings, whichever is more. The outside edge of the pipe shall be located a minimum of five feet (5') from the easement line.
6. Bends and Junctions:
 - a. A manhole or junction structure must be provided at each change in direction or grade of the piping. Bends must be provided at junction structures if the angle of entry is less than sixty (60) degrees. Pipes shall be aligned such that the direction of flow of any incoming pipe is not less than perpendicular to the direction of flow of the outflow pipe (i.e. flow "against the grain" shall be avoided).
 - b. Access manholes shall be provided at a maximum of five hundred feet (500') spacing along the pipe.
 - c. Precast circular manholes, square cast-in-place or precast junction boxes, or inlets may be used for junction structures.
7. Clearance from Other Utilities:

Sanitary sewer and water Ten feet (10')

* or greater, if needed to allow proper placement and alignment of flared end sections

Vertical Clearance: A minimum clear distance of eighteen inches (18") from any other utility line shall be maintained above or below the storm drain pipe, unless otherwise approved by the Public Works Director.
8. Pipe Size:
 - a. The minimum allowable pipe size for storm sewers fifteen (15) inches.
9. Storm Sewer Capacity and Velocity
 - a. Storm sewers should be designed to convey the design storm (25-year) of a duration which produces the maximum peak flow rate of stormwater runoff flood peaks without surcharging the storm sewer. The sewer may be surcharged during larger floods and under special conditions when approved by the City.

- b. The capacity and velocity shall be based on the Manning's n-values presented in Table I. The maximum full flow velocity shall be less than fifteen (15) fps. The City may approve higher velocities if the design includes adequate provisions for uplift forces, dynamic impact forces and abrasion. The minimum velocity in a pipe based on full flow shall be 2.5 fps and the minimum slope shall be 0.50% to avoid excessive accumulations of sediment.
- c. The energy grade line (EGL) for the design flow shall be no more than six (6) inches below the final grade at manholes, inlets, or other junctions. To ensure that this objective is achieved, the hydraulic grade line (HGL) and the energy grade line (EGL) shall be calculated by accounting for pipe friction losses and pipe form losses. Total hydraulic losses will include friction, expansion, contraction, bend, manhole, and junction losses. The methods for estimating these losses are presented in the following sections.

10. Storm Sewer Outlets;

- a. All storm sewer outlets into open channels shall be constructed with a headwall and wingwalls or a flared-end-section. Flared end sections and headwalls shall have a toe wall extending a minimum of eighteen inches (18") below grade at their downstream end to prevent undercutting. Approved energy dissipation material shall be provided at all outlets.

11. Hydraulic Evaluation:

- a. Developer shall provide a detailed evaluation of necessary storm sewer design with all accounted pipe losses, structure losses, and surcharging of the system during required storm duration.

B. Easements

1. Drainage easements shall be provided for all public drainage flowing across any proposed development. Generally, private, onsite drainage does not require a drainage easement. In some cases, additional drainage improvements and easements may be required upstream or downstream of a new development to address potential impacts of the development. The required easement widths are as follows, but shall not be less than 15' width. These requirements are assuming that the storm sewer is centered within the easement. Additional width may be required as determined by the City Manager:
 - a. For pipes forty-two (42) inches or less in diameter or width, the required minimum easement width is fifteen (15) feet.
 - b. For pipes and boxes greater than forty-two (42) inches in width, the required minimum easement width is ten (10) feet plus the width of the proposed storm sewer, but shall not be less than 20' width.
 - c. Storm sewers greater than eight (8) feet in depth to the flow line may require additional easement width and shall be assessed by the City Manager.
 - d. All easements required for construction of storm sewers, which are not included on the final plat, shall be recorded and a copy of such recorded easement filed with the City prior to approval of the engineering design plans.

Section 4.13 Design Standards for Culverts

- A. **Horizontal Alignment.** Culverts shall be positioned to match the alignment of the existing watercourse to the greatest degree practical. Relocating existing stream channels to match the culvert alignment shall be avoided unless specifically approved by City and associated governing Environmental Agency.
- B. **Vertical Alignment.** Culverts shall be placed such that the vertical alignment of the invert matches the slope of the existing water course to the greatest extent practical. The recommended minimum slope for culverts is 0.5% (five-tenths percent). Culvert grades may not be less than the minimum friction slope required to convey the design flow, unless specifically approved. Maximum recommended grade is 10% (ten percent).

The top of the culvert pipe shall be located a minimum of twelve inches (12") below the pavement or curb subgrade, or greater if required to meet minimum cover and strength requirements to withstand an AASHTO HS-20 loading for the type of pipe specified. A reduction in minimum clearance may be allowed when necessary in order to minimize rock excavation or to provide clearance from existing utilities, with written approval by the City Manager.

- C. **Bends and Junctions.** Changes in direction, grade, size or material are not allowed within the culvert barrel, unless approved in writing by the City Manager.
- D. **Clearance from Other Utilities.** Clearance from other utilities shall be the same as specified for storm sewers.
- E. **Allowable Sizes.** The minimum allowable inside diameter or least dimension for any culvert is fifteen inches (15"). Culverts in county or state right-of-way shall comply with necessary minimum diameter by agency.
- F. **Construction Materials.** Culverts under public and private roads shall be constructed of any of the materials allowed for storm sewers.
- G. **Design Capacity.** Culverts shall be designed to pass the 25-year storm with one (1) foot of freeboard prior to overtopping the road or driveway.
- H. **Headwater.** The maximum headwater for the major storm design flow shall be 1.5 times the culvert diameter for round culverts or 1.5 times the culvert rise dimension for shapes other than round.
- I. **Inlet and Outlet Requirements.** Culverts are to be designed with protection at the inlet and outlet areas as provided in Part VI of these criteria. A cast-in-place concrete headwall or a pre-fabricated flared end section of the same type of material as the culvert pipe shall be provided at the inlet and outlet ends of all culverts. Headwalls or end sections are to be located a sufficient distance from the edge of the shoulder or the back of walk to allow for a maximum slope of 3H:1V to the back of the structure. Flared end sections and headwalls shall have a toewall extending a minimum of eighteen inches (18") below grade at the downstream end to

prevent undercutting. The designer shall determine if outlet protection is required and means of protection.

- J. Velocity Limitations. The maximum allowable discharge velocity is fifteen (15) feet per second.

Section 4.14 Design Standards for Open Channels

A. General Design Guidelines

1. Natural or Existing Manmade Channels;
 - a. Any modification to a blue-lined stream as identified by the USACE or other US Agency shall not be modified except where unavoidable. A required 404 Permit copy shall be submitted to the City with plans for review.
 - b. Trees and vegetation shall not be removed within twenty-five feet (25') of the stream bank of a blue lined stream. If the stream banks are not defined, then the twenty-five feet (25') shall be taken from the invert of the blue lined stream. Clearing of brush and undergrowth shall be minimal. It is preferred that existing vegetation remain within one hundred feet (100') of the stream bank.
 - c. Any work within a Federally designated floodplain requires a Floodplain Development Permit. A Conditional Letter of Map Revision (CLOMR) must be obtained for any filling within the floodway. Work within the stream channel may require a Department of the Army "404" permit.
 - d. Watercourses in which flow is broad and shallow, and which have no defined channel should not be modified or channelized. Removal of trees and vegetation within the watercourse should be avoided as much as practical.
 - e. For the purpose of preliminary planning and design, the approximate limits of the floodplain can be determined using approximate methods.
2. Grass Lined Channels:
 - a. Grass lined channels are the most desirable of the artificial channels. The channel storage, lower velocities and the greenbelt multiple use benefits obtained create significant advantages over other artificial channels. Unless existing development restricts the availability of right of way, channels lined with grass should be given preference over other artificial types. The minimum slope in a grass-lined channel shall be 1.0% unless a concrete low flow channel is installed. Maximum side slopes shall be 3:1 with 4:1 preferred.
3. Composite Channels
 - a. Many different channel shapes and lining types are possible. Different shapes and lining types can be combined in a composite design. In determining the capacity and depth of flow in composite channels, they shall be analyzed as an irregular section using representative "n" values for each segment of the channel cross-section
4. Concrete Channels
 - a. Concrete lined channels are sometimes required where right of way restrictions within existing development prohibit grass-lined channels. The lining must be designed to withstand the various forces and actions that tend to overtop the bank, deteriorate the lining, erode the soil beneath the lining and erode unlined areas. The minimum slope in a concrete lined channel shall be 0.50%.

B. Hydraulics

1. Hydraulics of open channel flow shall be calculated and provided in detail to the City for review and approval. Design of channel shall show that all storm water remains within the banks of the channel during required storm duration with 1' of freeboard. Grass channels shall not exceed 5 fps, concrete channels shall not exceed 15 fps. Channels shall not exceed 3' depth with 3:1 sloped channel walls.

C. Easements

1. Easements shall be provided for all open channels constructed in the City that are not located within public rights-of-way. The minimum easement width for open channels is the flow width inundated by a 100-year event plus fifteen (15) feet. Additional width may be required as determined by the Director of Public Works.
2. All easements required for construction of open channel drainageways, which are not included on the final plat, shall be recorded and a copy of such recorded easements filed with the City prior to approval of the engineering design plans.

Stormwater Detention

Section 4.15 Purpose

- A. Detention facilities are used to reduce storm water runoff rates by storing excess runoff. The usual function of a detention facility is to provide sufficient storage such that peak runoff rates are not increased when development occurs.

Section 4.16 Policy

- A. The primary goal of the City's storm water management program is the prevention of flood damage and erosion to downstream properties.
- B. The City further recognizes that:
 1. The best means to assure effective performance of a detention basin is to perform reservoir routing calculations using hydrographs, The Simplified Volume Formula shall not be allowed in the City.

Section 4.17 Methods of Analysis

- A. Innovation in design
 1. It is the desire of the City that detention facilities be designed and constructed in a manner to enhance aesthetic and environmental quality of the City as much as possible. The City therefore encourages designs, which utilize and enhance natural settings, and minimize disturbance and destruction of wooded areas, natural channels, and wetlands.

B. Interpretation

1. The City Manager will make interpretations of the detention policy. Appeals of the decisions of the City Manager may be made to the Board of Trustees.

Section 4.18 Design Criteria

A. General

1. The rates (pre-developed and post-developed) of runoff shall be determined for 2-, 25- and 100-year rainfall frequencies. Design shall be based on a 20-minute minimum storm duration.
2. One (1) foot of freeboard shall be provided between the maximum water surface elevation (maximum stage for a 1% annual probability event) and the minimum top of berm or wall elevation.
3. Embankment slopes steeper than three horizontals to one vertical (3H:1V) are not permitted.
4. Concrete walls shall not be substituted for earth berms unless otherwise approved by the City Manager.
5. Dry detention basins shall maintain a minimum bottom slope of one foot per hundred feet (1%).
6. Any detention basin or channel shall not be located closer than twenty (20) feet horizontally from any building and the maximum water surface elevation shall be at least three (3) feet below the lowest sill plate elevation of any building. For this application the horizontal limits of the detention basin shall be defined as the outside face of the crest of the berm.
7. Trickle channels shall have a minimum slope of one foot per hundred feet (1.0%) for unpaved channels and one-half foot per hundred feet (0.5%) for paved channels.
8. Parking lot detention shall not be allowed. Ponding shall not exceed 6" in paved parking lots.

B. Detailed Analysis

1. Detailed analysis shall be performed using hydrograph methodologies and reservoir routing techniques. The most common techniques are those developed by the Corps of Engineers and the Soil Conservation Service. These methods are preferred; however other proven techniques will be accepted.
2. The rates (pre-developed and post-developed) of runoff shall be determined for 2-, 25- and 100-year rainfall frequencies. Design shall be based on a 20-minute minimum storm duration.
3. The runoff model must include the entire drainage basin upstream of the proposed detention pond. The model shall be prepared in sufficient detail to ensure that peak runoff rates are reasonably accurate. The runoff model shall be developed for the following cases:
 - a. Case 1: Existing conditions in the drainage basin prior to development of the applicant's property.
 - b. Case 2: Existing conditions in the drainage basin with developed conditions on the applicant's property.
 - c. Case 3: Fully developed conditions in the entire drainage basin.

- d. Cases 1 & 2 are utilized to determine the required detention volume and the type of outlet structure to be provided, and shall be analyzed for the three storm recurrence frequencies required above.
- e. The detention facility shall be designed such that peak outflow rates from the facility for Case 2 are no greater than the rates determined in Case 1 for each of the three storm recurrence frequencies required.
- f. The storage volume provided shall not be less than the difference in total runoff volume between Case 1 and Case 2.
- g. Case 3 is used determine the size of the overflow spillway. Case 3 need only be analyzed for the 1% annual probability ("100-year"). This shall determine if upstream detention is adequate or additional measures are necessary for retention. The overflow spillway will, in most cases, be combined with the outlet structure.

C. Submittals

1. The following information must be submitted for detention ponds designed by detailed methods:
 - a. Information regarding analytical methods and software to be used, including:
 - Name of software to be used.
 - Type and distribution of precipitation input.
 - Method for determining precipitation losses.
 - Type of synthetic hydrograph.
 - Method for routing hydrographs.
 - Method used for reservoir routing.
 - b. Map(s) showing sub-basin delineation, topography, presumed flow routes, and pertinent points of interest; soil types; existing basin development conditions used in the model; fully developed conditions used in the model.
 - c. Routing diagram for the runoff model.
 - d. A summary of sub-basin characteristics used for program input.
 - e. Stage-area or stage-storage characteristics for the basin in tabular or graphic form.
 - f. Stage-discharge characteristics for the outlet structure and overflow spillway in tabular or graphic form; hydraulic data for weirs, orifices, and other components of the control structure.
 - g. A printout of the input data file.
 - h. A summary printout of program output, including plots of hydrographs (these are intended to be the printer plots generated by the software).
 - i. A computer generated soil survey should be provided from the USDA following(<http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm>). The soils data should be submitted as a Hydrologic Soil Group report. Submitting data from the old USDA soils survey books is not permitted as the soils data is not updated on the website.

D. Easements

1. All detention basins serving more than one (1) lot or property shall be located within a drainage easement. At a minimum, the easement shall include the area of the dam, the area downstream of the dam to a point twenty feet (20') downstream of the end of the outlet structure, including the area provided for erosion control or energy dissipation;

and the area covered by the reservoir including freeboard, plus an additional twenty feet (20') around the perimeter. Detention basins for a development may be located on adjoining property downstream from the development provided that a drainage easement is obtained and adequate means of maintenance access (including ingress/egress easements where necessary) is provided. The easement shall be granted to the developer or to property owners' association. Where the detention basin does not immediately adjoin the development, a drainage easement covering the area inundated by the peak flow from the 1% AEP (100-year) storm shall be provided to connect the development site with the detention basin.

E. Construction Requirements

1. Berms shall be constructed of properly compacted earth fill and shall be keyed a minimum of two feet, (2') into existing ground.
2. Minimum embankment width at top of dam shall be five feet, (5')
3. Concrete retaining walls used at outlet structures or spillways and that exceed 3'-6" in height shall be provided with four foot, (4') high chain link or solid fence.
4. Spillways and outlet structures shall be provided with toewalls extending eighteen inches, (18") below finish grade at upstream and downstream ends to prevent undercutting.
5. Where wet ponds are specified; the pond lining must be designed to retain water. Site soil conditions shall be evaluated by a soils engineer and an appropriate lining to be provided.
6. Low flow orifice minimum size at openings shall be 3".

SWPPP (Stormwater Pollution & Prevention)

Section 4.19 Goals and Objectives

- A. The goal of the regulation is to effectively minimize erosion and discharge of sediment by application of relatively simple and cost effective Best Management Practices. This goal can be attained by meeting the following objectives:
1. Minimize the area disturbed by construction at any given time.
 2. Stabilize disturbed areas as soon as possible by re-establishing sod, other forms of landscaping, and completing proposed structures, pavements and storm drainage systems.
 3. Provide for containment of sediment until areas are stabilized.
 4. Provide permanent erosion controls.
 5. Require construction to be sequenced whereby all erosion control best management practices, (BMP's), are installed prior to any land disturbance.

Section 4.20 General Design Guidelines

The following items shall be considered in preparing a sediment and erosion control plan:

A. Temporary vs. Permanent Controls

1. The greatest potential for soil erosion occurs during construction. Temporary controls are those that are provided for the purpose of controlling erosion and containing sediment until construction is complete.
2. Temporary controls include straw or hay bale dikes, silt fences, erosion control blankets etc., which are not needed after the area is stabilized.
3. Permanent controls consist of concrete trickle channels, detention basins, etc., which will remain in place through the life of the development.
4. It is possible for the same facility to serve both a temporary and permanent purpose. The difference between temporary and permanent erosion control should be clearly recognized in preparing a sediment and erosion control plan.

B. Sheet Flow vs. Concentrated Flow

1. In areas where runoff occurs primarily as sheet flow, containment of sediment is relatively simple. In these areas straw or hay bales, silt fences and vegetative filter areas can be very effective.
2. Where concentrations of flow occur, containment of sediment becomes more difficult as the rate and volume of flow increase. In these areas more sophisticated controls such as sedimentation basins must be provided.

C. Slope

1. Control of erosion becomes progressively more difficult as the slope of the ground increases. Areas with steeply sloping topography, and cut and fill slopes must be given special consideration.

D. Soils and Geologic Setting

1. Area soils and the geologic setting must be considered in preparing the plan and any special considerations deemed necessary for a particular site provided.

E. Environmentally Sensitive Areas

1. Where construction occurs within the vicinity of permanent streams, springs, sinkholes, lakes or wetlands, special attention must be given to preventing discharge of sediment.

Section 4.21 Permits

A. NPDES Storm Water Permit

1. Construction sites where the area to be disturbed is one (1) acre or more must apply for a storm water discharge permit from MoDNR.
2. Permit requirements are set forth in 10 CSR 20-6.200 of the Missouri Clean Water Laws.

B. "404" Permit

1. Grading activities in streams or wetlands may require a Department of the Army Permit under Section 404 of the Clean Water Act.

Section 4.22 Design Standards & Criteria

A. Grading

1. Maximum Grades
 - a. Cut or fill slopes shall not exceed 3:1.
 - b. 4:1 slopes are preferred where possible.
2. Minimum Slope
 - a. Slope in grassed areas shall not be less than 1%.
3. Construction Specifications
 - a. Construction for streets must comply with specifications set forth in Article II.
 - b. For all other areas, construction specifications stating requirements for stripping, materials, subgrade compaction, placement of fills, moisture and density control, preparation and maintenance of subgrade must be included or referenced on the plans, or accompanying specifications submitted.
4. Spoil Areas
 - a. Broken concrete, asphalt and other spoil materials may not be buried in fills within proposed building or pavement areas.
 - b. Outside of proposed building and pavement areas, broken concrete or stone may be buried in fills, provided it is covered by a minimum of two (2) feet of earth.
 - c. Burying of other materials in fills is prohibited.
5. Stockpile Areas
 - a. Location of proposed stockpile areas shall be outlined on the plans and specifications for proper drainage included.
6. Borrow Areas
 - a. The proposed limits of temporary borrow areas shall be outlined in the plans and a proposed operating plan described on the grading plan. Borrow areas shall not be located closer than 50 feet from a stream bank.
 - b. Temporary slopes in borrow areas may exceed the maximums set forth above. At the time that borrow operations are completed, the area shall be graded in accordance with the criteria set forth above, and reseeded.

B. Sediment Containment

1. Existing vegetative filter areas may be used where:
 - a. Un-concentrated sheet flow occurs,
 - b. An area of existing vegetation a minimum of twenty-five (25) feet in width can be maintained between the area to be graded and a property line, watercourse, sinkhole, spring, wetland or classified lake,
 - c. Existing ground slope is no greater than 5:1 (20%),
 - d. The existing vegetative growth is of sufficient density and in sufficiently good condition to provide for filtration of sediment.
 - e. Vegetative filter areas are a temporary and permanent practice.
2. Hay/Straw Bale Dike or Silt Fence
 - a. Containment areas constructed of hay or straw bales, or silt fence may be provided in areas where:
 - Un-concentrated sheet flow occurs,

- An area of existing vegetation a minimum of twenty-five (25) feet in width cannot be maintained between the area to be graded and a property line, watercourse, sinkhole, spring, wetland or classified lake,
 - Existing ground slope is no greater than 5:1 (20%),
 - Concentrated flow from an area no greater than one (1) acre occurs and a minimum volume of 1000 cubic feet per acre is contained behind the dike.
- b. Either cereal grain straw or hay may be used for bale dikes. Straw/hay bale dikes shall be constructed as shown in details in the Standard Drawing Details
 - c. Silt fence may be used in lieu of hay or straw bales. Silt fence shall be constructed as shown in details in the Standard Drawing Details.
 - d. Straw bale dikes and silt fences are temporary practices.
3. Temporary Containment Berms
 - a. Temporary containment berms may be provided for areas where concentrated flow from areas greater than one (1) acre and less than five (5) acres occurs. Temporary containment berms must contain a volume of 1000 cubic feet per acre of drainage area. Containment berms and swales must be installed level, "along the contour". Accumulated sediment must be removed when it reaches one-third (1/3) of the berm height.
 - b. Temporary containment berms shall have an outlet with a sediment filter or a perforated pipe outlet.
 - c. Temporary containment berms and accumulated sediment may be completely removed after the tributary area is stabilized, and must be removed prior to final acceptance.
 4. Inlet Protection
 - a. This practice consists of protecting the inlet perimeter or opening with straw bales, silt fence or sandbags. The purpose of this practice is to keep sediment from collecting in storm drains. This practice is also useful when site conditions prevent locating a sediment basin downstream of the storm sewer outfall. Inlet protection described in this paragraph cannot be used where blockage of the inlet opening would result in flooding of residential dwellings, buildings, streets or roads, or off-site property.
 - b. Curb Inlets
 - Curb inlets can be protected from sediment entry by placing sand bags over the inlet opening. Sand bags must be replaced when deteriorated and removed when the area has been stabilized.
 - Accumulated sediment must be removed from the street after each rainfall.
 - c. Area Inlets
 - In paved areas, area inlets can be protected by placing gravel filled sandbags up to two (2) courses high around the perimeter of the inlet.
 - Outside of paved areas or before pavement is placed, area inlets can be protected by installing a silt fence of straw bale dike around the inlet perimeter. Open side drop inlets can be protected by placing sandbags over the openings.
 - Accumulated sediment must be removed prior to final approval.
 - d. Diversion

- Where flow must be diverted into sediment basins or other sediment retaining facilities, diversion berms or swales or other approved means of diverting runoff may be specified.
 - Where sediment enters a street which is up-grade from an existing street, means must be provided to divert runoff to a sediment basin before discharge from the site. The method of diversion will vary depending upon the phase of construction. After initial grading, an earth berm can be used. This is no longer possible after the street subgrade is completed and curbs are installed. After the street pavement is completed, sand bags can be used to divert the runoff into inlets for discharge into the sediment basin.
5. Gravel Filter Dam
- a. Where concentrated flow occurs and less than two (2) acres of tributary drainage area are graded (i.e. a sediment basin is not required) or where construction of a sediment basin is not feasible, a gravel filter dam shall be provided prior to discharge of runoff from the property.
 - b. Gravel filter dams consist of a layer of filter fabric and crushed rock covering the upstream side of a riprap dike. Riprap shall be six and twelve inches (6" and 12") in size. Filter fabric may be woven or non-woven, Mirafi 500X, Mirafi 150NL, or equal. The purpose of the filter fabric is to remove sediment particles as water flows through it. The layer of crushed rock provides additional filtration protects the filter fabric, and holds it in place.
 - c. Where gravel filter dams are used as sediment basin outlets, one (1) square foot of filter fabric area shall be provided for each one thousand (1,000) cubic feet of storage. The minimum area provided shall be four (4) square feet.
 - d. Where gravel filter dams are used as ditch checks in channels, the gravel filter area shall extend throughout the width of the dam.
 - e. Stilling basins shall be provided downstream of the filter dam where discharge is to a grass channel.
6. Sediment Basin
- a. Sediment basins shall be provided for all areas where concentrated flow occurs from an area of five (5) or more acres. Sediment basins shall be designed to detain the runoff from one (1) inch of rainfall, for a period of at least 24 hours. Runoff shall be calculated using the methods contained in Chapter 2 of TR-55 (Reference 11), using the recommended curve number for newly graded areas from Table 2-2a.
 - b. Note: For construction sites in the City an average value of runoff volume from one (1) inch of rainfall is approximately 1000 cubic feet per acre, using a Curve Number of 90, as indicative of a mixture of type B & C soils. This value may be used in sizing sediment basins or the runoff volume determined using the values from Figure 2-1 of TR-55 (Reference 11).
 - c. Sediment basins shall be provided with an outflow structure consisting of:
 - A flow restriction device which provides for the required detention time,
 - An outfall pipe sized to carry the maximum estimated outflow rate,
 - Protective structures at the pipe outlet to prevent crushing or damage of the end of the pipe,

- Protective structures to prevent blockage of the pipe with debris,
 - Erosion protection at the pipe outlet.
- d. Provide an overflow spillway capable of discharging the peak flow rate for the 4% annual probability (25-year) storm while maintaining a minimum freeboard of one (1) foot
- Overflow spillways may be sodded where the depth of flow at the crest is limited to no greater than six (6) inches and outlet channel velocities do not exceed five (5) feet per second for the minor (5-year) storm.
 - Overflow spillways not meeting these restrictions must be constructed of concrete or other approved, non-erodable material.
- e. Detention basins can be used for temporary sediment basins provided it can be demonstrated that flood control requirements can also be met until the sedimentation controls are removed.
- f. Accumulated sediment must be removed prior to final acceptance of construction.

C. Erosion Protection

1. Seeding

a. Permanent Seeding

- Permanent seeding fertilizer and mulch shall be applied at the rates set forth in the Constructions Specifications.
- Permanent seeding seasons are as designated in the Constructions Specifications.

b. Maintenance

- Seeded areas must be maintained for one year following permanent seeding.

2. Cut and Fill Slopes

- a. Cut and fill slopes shall be protected from erosion by construction of straw bale dikes, silt fences, diversion berms, or swales along the top of the slope.
- b. Where drainage must be carried down the slopes, pipe drains, concrete flumes, chutes, or other impervious areas must be provided. Suitable erosion control measures such as stilling basins or other approved methods must be provided at the bottom of the slope.
- c. Diversions shall be maintained until permanent growth is firmly established on the slopes.

3. Channels and Swales

- a. Permanent channels and swales shall be provided with a stabilized invert consisting of one of the following materials:

- Sod

(1). Where the average velocity of flow is five (5) feet per second or less and there is no base flow, the channel shall be lined with sod.

(2). For channels with a bottom width less than fifteen (15) feet, sod shall extend up the side slope to a minimum height of six (6) inches above the toe.

(3). Channels with a bottom width of fifteen (15) feet or greater, shall be provided with a low flow area, fifteen (15) feet in width lined with sod.

(a). The remainder of the channel slopes shall be seeded and mulched as provided above.

- Erosion Control Blanket
(1). Commercial erosion control blankets may be used in lieu of sod provided that samples are submitted and approved by the Public Works Director. The guaranteed maintenance period shall be one year.
- Non-Erosive Lining
(1). A non-erosive lining of large diameter riprap, or approved alternative, shall be used in all channels with an average velocity of (5) five feet per second or greater.

4. Storm Sewer and Culvert Outlets

- a. Erosion protection shall be provided at storm sewer and culvert outlets. Minimum erosion protection shall consist of a concrete toe wall and non-erosive lining.
- b. Flared end sections or headwalls are required. The required length of non-erosive lining will not be decreased where flared end sections or headwalls are provided unless calculations and data to support the decrease in length are submitted and approved.

5. Curb Openings

- a. Where drainage flows from paved areas to grass areas through curb openings erosion protection shall be provided.

6. Ditch Checks and Drop Structures

- a. In grass channels grades and velocities may be controlled by use of ditch checks and drop structures.
- b. Ditch checks may be required in natural channels where average velocity for the peak flow rate from the 5-year storm exceeds five (5) feet per second for post-development conditions.

7. Spillways

- a. Erosion protection must be provided at spillways and outlet structures for detention ponds. Erosion protection shall extend to the point where flow has stabilized and average velocity in the outlet channel is five (5) feet per second or less.

D. Temporary Construction Entrance

1. The temporary construction entrances shall be installed prior to any land disturbance. A minimum of one (1) temporary construction entrance is required at each site, but shall be located at every point where construction traffic enters or leaves a construction site. Additional temporary entrances may be provided if approved. The location of each construction entrance shall be shown on the plan.

E. Cleaning Streets

1. Streets, both interior and adjacent to the site, shall be cleaned of sediment as needed, after each rainfall and at the end of construction and prior to release of security deposit.

F. Dust Control

1. The contractor will be required to use water trucks to wet haul roads and construction areas to minimize dust leaving the site when conditions warrant.

G. Timing of Construction Activities

1. BMP's shall be established prior to disturbing any soils.
2. Detention and water quality facilities shall be constructed prior to disturbing the site.
3. Weekly inspection reports shall be prepared as required by the MoDNR permit.
4. BMP's shall be maintained throughout the construction project.
5. BMP'S shall be removed when all disturbed surfaces have been established with vegetation or permanent surfaces.
6. Notice of Termination(s) shall be filed with MoDNR.
7. The City closes the land disturbance permit.

SECTION 5 – STREETS

Section 5.1 General Design Guidelines

A. Overview

1. This chapter establishes design guidelines for the construction of roads, streets, and parking areas within the jurisdictional boundaries of the Village of Kingdom City. It also establishes the guidelines for reconstruction, improvement, and maintenance of existing streets within the city. Design standards are based upon the AASHTO Policy on the Geometric Design of Highways and Streets and the Supplement for Design of Very Low Volume Local Roads, < 400 Average Daily Traffic (ADT).

B. Classification of Roads and Streets

1. Arterial Streets subdivided into three classifications:
 - a. Arterials over 50,000 Average Daily Traffic Count (ADT): Major through routes for high volume, moderate speed traffic, with limited access.
 - b. Arterials with between 10,000 and 50,000 ADT: Major through route for high volume, restricted speed traffic, with restricted access.
 - c. Arterials with between 5,000 and 10,000 ADT: Major connecting through routes.

The design criterion shall be as indicated in Table I - Design Criterion.

2. Collector Streets. Collector are those that streets that intersect with arterial streets and/or local streets and serve primarily local traffic from neighborhoods to through routes. Dependent upon traffic count and local conditions the access will be restricted. Collector Streets are subdivided into two classifications:
 - a. Collector Street with over 3,000 ADT
 - b. Collector Street with 1,000 to 3,000 ADT

The design criterion shall be as indicated in Table I - Design Criterion.

3. Local Streets. Local streets are relatively low traffic neighborhood streets that provide access to residences or business locations and connect to collector streets. Local Streets are subdivided into four classifications:
 - a. Local Street with over 1,500 ADT: Relatively busy neighborhood streets that serve several residences and/or condo units and connect to collectors and lesser local streets.
 - b. Local Street with less than 1,500 ADT: Neighborhood streets serving more than 10 residences or condo units, and connecting to lesser local streets. May be dead end streets.

The design criterion shall be as indicated in Table I - Design Criterion.

C. Dead End Street

1. Cul-de-sacs shall be constructed on all dead-end streets and shall meet the following criterion:
 - a. The minimum diameter shall be 96-feet (edge of pavement to edge of pavement).
 - b. The minimum easement or right of way shall be 110-foot diameter, or back of cut or fill slope as determined by the City Manager.
 - c. In cases where terrain and other constraints prohibit the construction of a cul-de-sac a “turn-around tee” may be constructed with the approval of the City Manager. The use of a cul-de-sac is preferred.
 - d. Cul-de-sacs shall not exceed 900’ feet in length as measured from the nearest intersection street to the furthest point of the turnaround. All cul-de-sacs shall terminate in circular right-of-way with a minimum diameter of 100 feet.

D. Residential Parking and Commercial Parking Areas

1. Residential Parking
 - a. Each residential property owner shall provide sufficient off-street parking for his or her individual needs. Parking on the city street will not be permitted.
2. Public Parking Areas
 - a. All public and commercial facilities (except those in areas zoned as industrial) shall provide adequate parking to serve the public and employees. In addition, all commercial and public parking shall meet the following requirements:
 - All commercial, industrial, and/or public parking areas shall be asphalt or concrete paved.
 - The minimum structural section for asphalt paved parking areas shall be 3-inches of asphalt pavement on a minimum of 8-inches of Type V Base.
 - The minimum structural section for concrete paved parking areas shall be 6-inches of non-reinforced concrete pavement on 46-inches of Type V Base.
 - ADA handicapped access ramps shall be provided as necessary.
 - The parking area shall be drained to suitably designed storm drainage systems. Refer to the Storm Drainage Guidelines.
 - Minimum cross-slopes for drainage shall be 0.5% for one axis and 1.0% for the transverse axis.
 - The minimum radius for edge of pavement at entrance and exit shall be 20-feet.
 - The minimum width of entranceway for one-way entrances shall be 20 feet, and for two-way entrances shall be 24-feet.
 - The maximum allowable entry width for commercial parking areas shall be 40-feet, edge of pavement to edge of pavement.

STREET AND ROADWAY DESIGN CRITERION						
DESIGN CRITERION	ARTERIAL	COLLECTOR		LOCAL STREET		ONE WAY
	5,000 to 10,000 ADT	Over 3,000 ADT	1,500 to 3,000 ADT	Over 1,500 ADT	Less Than 1,500 ADT	Less Than 400 ADT
Design Speed (mph)	35	25	25	25	15	10
Street Width (ft)	15	14	14	13	13	20
Mimimum Curve Radius (ft)	420	205	165	165	100	45*
				* Minimum width of pavement is 23 ft. curb to curb		
Maximum Grade	10%	10%	10%	10%	10%***	10%***
				***Steeper grades with approval of City Engineer		
Max. K Value	**Shall Meet Design Criteria in MUTCD Code					
Minimum Sight Distance	250 **	155	155	155	100	80
Structural Cross Section						
Asphaltic Concrete						
Pavement	7"	5"	5"	4"	4"	4"
Aggregate Base	12"	12"	12"	10"	10"	10"
Portland-Cement Concrete						
Pavement	8.5"	6.5"	6.5"	6"	6"	6"
Aggregate Base	4"	4"	4"	4"	4"	4"
Curb & Gutter	Required	Required	Required	Required	Required	Required
Sidewalk	Both Sides	Both Sides	Both Sides	One Side	One Side	One Side
A Traffic Report shall be prepared for Roadways over 10,000 ADT.						

Section 5.2 Construction of Sidewalks, Gutters, Curbs & Roadway Entries in Public Right-Of-Way

- A. All sidewalks, gutters and curbs, and roadway entries hereafter constructed within the City right-of-way shall be of uniform construction and shall be inspected by the City.
 1. The owner of any property having a roadway entry connecting to any public right-of-way shall maintain and repair any defective portion that is located within the public right-of-way in conformance with the standards as required by the City.
 - a. That portion of the roadway entry within the public right-of-way between the street and sidewalk shall be the responsibility of the adjoining property owner.
 - b. Where no sidewalk exists, that portion of the roadway entry within the right-of-way shall be the responsibility of the adjoining property owner.
 2. All work located within the City right-of-way shall not begin until applicable permits are obtained from the City.

Section 5.3 Design & Inspection of Sidewalks, Gutters, Curbs & Roadway Entries in Public Right-Of-Way

- A. Sidewalks shall be four (4) inches thick, [six (6) inches thick at residential roadway entries], shall not be less than four (4) feet in width, constructed of Portland cement concrete, and broom finished.
- B. Sidewalk design and as-built geometry shall conform to the U.S. Department of Transportation ADA Standards for Transportation Facilities.
- C. Sidewalks along City streets shall extend to the next public roadway for connection. The purpose is to connect all sidewalks of the public streets together to aid in pedestrian travel safety.
- D. Roadway entries shall be constructed in accordance with the applicable standards as set forth in the American Association of State Highway Transportation Officials. The edition in effect when the roadway entry is constructed shall control.
- E. Roadway entries shall be constructed of concrete or asphalt over a compacted aggregate base.
- F. Concrete or asphalt used in the construction of sidewalks, gutters and curbs, and roadway entries shall not be installed until the City Manager has inspected the forms and/or subgrade.

Section 5.4 Street Lighting

- A. Streetlights shall be provided in all subdivisions. All streetlights shall have underground wiring and meet minimum specifications of the electric utility company serving the area of the proposed subdivision. Streetlights shall be placed at all intersections and in all culs-de-sac. A maximum of three hundred (300) feet separation shall be required, or in special cases a longer separation may be approved by the City Manager and/or his/her designee. Streetlights shall be installed and functional prior to occupancy of structures within the subdivision.

- B. In Ameren Missouri's territory, streetlights shall be installed by the developer in a manner that meets the specifications and rates for "Service Classification No. 6 (M) Street and Outdoor Area Lighting — Customer Owned" for unmetered service, seventy-one (71) watt minimum (LED-Light Emitting Diode) — standard at the energy and maintenance rate (if applicable, otherwise energy only). After inspection and acceptance by the City, the lighting facilities will be maintained and operated by the City. With the developer incurring the full cost of the light installations and connections, streetlight billing in new subdivisions shall be turned over to the City for payment once lights are turned on. Connection fees will be paid to the City by the developer with the City being responsible for payment of the connection fee to the utility company when the lights are ready to be turned on. The City will provide written direction to the electric company to add new lights to the City's bill. During the period when an escrow for streetlighting is in place, escrowed funds may be used for any maintenance expenses incurred or to be incurred by the City.
- C. All proposed streetlights shall have bulbs that are light-emitting diode (LED) technology, assuming the electric district has the current technology available. Any existing bulb shall be replaced with an LED counterpart when the existing bulb is no longer functional. Light Standard shall be as described in Ameren Spec 13 and Developer shall follow Ameren Construction Standard 15 75 05.
- D. This Section pertains to lights on City streets only which are designed to be dedicated to the City for public use. Lighting on private streets and other areas will not be paid for by the City and, therefore, this Section is not applicable to those installations."

Section 5.5 Exceptions to Requirements

- A. Any exceptions must be authorized by the City Manager and approved by the Board of Trustees.

Section 5.6 Construction Cleanup on Public Property

- A. Any person, firm or corporation to whom a building, demolition or right-of-way permit has been issued or who is performing construction of any type in the City, shall remove at least once each working day any mud, dirt, sticky substance, litter or foreign matter of any kind carried into or deposited upon any public street, public sidewalk or other public way or place of the City by any vehicle, or by the wheels of any vehicle, entering or leaving the site of the project for which the building, demolition or right-of-way permit was issued. The removal shall be performed once prior to the end of the working day.
- B. Any landowner involved in building construction, demolition or grading shall remove any mud, dirt, sticky substance, litter, or foreign matter of any kind carried into or deposited upon any public street, public sidewalk, or other public way, or place of the City, by any vehicle, or by the wheels of any vehicle, entering or leaving the site of the project of building construction, demolition, or grading, at least once each working day. The removal shall be performed once prior to the end of the working day.
- C. Any violation of this Section shall be declared an ordinance violation and any person who receives a citation for a said violation shall be guilty of an ordinance violation and shall be fined not less than fifty dollars (\$50.00) and not more than five hundred dollars (\$500.00) per day for each offense.

Section 5.7 Permit Required

- A. No person, firm, or corporation shall make or cause to be made or help, aid, or assist with, therein, any work or excavation on any public street, highway, alley, sidewalk, gutter or other public place, or any public easement or right-of-way, without a right-of-way permit.
- B. No adjoining property owner shall construct, maintain, or permit in or on the portion of the public right-of-way to which such land is adjacent, any fixed structure, material or object without a right-of-way permit.
- C. Except as otherwise provided herein, no person, firm or corporation shall obstruct, or otherwise impact in any manner whatsoever, the normal flow of vehicular or pedestrian traffic in the right-of-way without a right-of-way permit.
- D. The application for a right-of-way permit shall be submitted to the City Manager either by the property owner, or an authorized agent of the property owner, firm, or corporation who will perform the work and/or excavation in the right-of-way.

Section 5.8 Permit Conditions

- A. The City Manager may impose reasonable conditions upon the issuance of a right-of-way permit and the performance of the permittee in order to protect the structural integrity of the right-of-way, to protect the property and safety of other users of the right-of-way, and to protect the health, safety and welfare, and minimize the disruption and inconvenience of the general public. Such permits shall be deemed to be subject to, and anyone obtaining such a permit shall be deemed to have consented to, the following conditions:
 - Compliance with Missouri One Call Statutes, regulations, and policies;
 - 1. Compliance with the City's Code of Ordinances, including its right-of-way ordinances, zoning ordinances, utility ordinances, all applicable laws and regulations, and any restrictions contained in any documents relating to the acquisition nor limit of use of the area the permit is being obtained for;
 - 2. Agreement to pay just compensation charged in an attachment agreement or to pay just compensation should the City charge for the use of its rights-of-way in the future;
 - 3. Agreement to indemnify and hold the City harmless from the permittee's use of the right-of-way which shall include defense and payment of money for attorneys' fees and all costs, provided such condition provides that it is not to be deemed a waiver of sovereign or other immunities or defenses available to the City, its officials, employees and agents;
 - 4. Compliance with all design standards of the City and on file with the City Manager
 - 5. At all times, any structure or facility used to support any permittee's equipment shall be structurally sound and not subject to failure for defects in design, maintenance, wear and tear, or weather conditions as identified by the City Manager.
- B. The permittee shall perform all work or excavation in full accord with any and all applicable engineering codes and design standards adopted or approved by the City and in accordance with applicable Statutes of the State of Missouri, and the rules and regulations of the commission or any other local, State or Federal agency having jurisdiction over the parties. The permittee shall perform all work or excavation in conformance with all applicable codes and established rules and regulations and shall be responsible for all work or excavation done in the right-of-way pursuant to its right-of-way permit, regardless of by whom the work or excavation is done.

- C. A permittee shall not disrupt a right-of-way such that the natural free and clear passage of water through the gutters or other waterways is interfered with. No person may park private vehicles within or next to the work or excavation area, except for such areas which may be designated and marked as safe areas for vehicle parking in accordance with an approved right-of-way permit.
- D. If work or excavation is performed for the permittee by another person, firm, or corporation, the permittee shall be responsible for ensuring that the work or excavation is performed consistent with their right-of-way permit and applicable law and shall be responsible for promptly correcting acts or omissions by said person, firm or corporation.
- E. The City Manager may establish limitations in the right-of-way permit pertaining to the amount of concurrent work or excavation that may occur and the amount and duration of right-of-way which may be obstructed during construction.
- F. The permittee shall, in the performance of any work or excavation required for the installation, repair, maintenance, relocation and/or removal of any of its facilities, limit all work or excavation to that necessary for efficient operation.
- G. The permittee shall not have work or excavation remain open longer than is necessary to complete the repair or installation, and in no event may work or excavation remain open beyond the expiration of the right-of-way permit or any approved extension.
- H. The permittee shall perform work or excavation in the right-of-way at such times that will allow the least interference with the peace and quiet of the neighborhood, and shall not work between the hours of 8:00 P.M. and 7:00 A.M.
- I. Street plates shall be placed in accordance with the City's specifications and shall not be in place for more than ten (10) calendar days without written approval of the City Manager.
- J. The City Manager may allow street cuts on an individual review basis based on the criteria set out in this Chapter and the City's design standards.
- K. All street cuts shall be restored in their entirety within ten (10) days of the street cut unless approved, in writing, by the City Manager. Failure to complete within the ten (10) days shall constitute cause for the City to restore the cut and the permit holder shall reimburse the City its costs.
- L. Any action or inaction by the permittee that results in the City restoring or repairing of the right-of-way due to failure to comply with these or other conditions shall constitute cause for not issuing future permits and for the permittee to be financially responsible to reimburse the City all of its costs whether from any bond held by the City or other means at the option of the City.

Section 5.9 Completed Work

- A. The permittee shall notify the office of the City Manager upon completion of the work, excavation or temporary traffic control authorized in the right-of-way permit.

- B. Before final approval, the City reserves the right to perform any additional inspections as it deems necessary and apply any additional requirements meeting the codes and standards customarily applicable to the type of permitted work in the right-of-way.

Section 5.10 Emergency Work

- A. A right-of-way permit is required for emergency situations that are not the result of a declared emergency or disaster by the State, Federal or local agencies empowered to enter such declarations. If, however, due to such emergency that is not the result of a declaration of disaster or emergency, and it is necessary to perform work in the right-of-way and it is impractical for the person, firm or corporation to first get a right-of-way permit, the work or excavation may be performed, and the required permit shall be obtained as soon as possible, but not later than twenty-four (24) hours after the start of work or excavation. The person, firm or corporation shall notify the City's Public Works Department when emergency work or excavation is necessary.

Section 5.11 Inspection

- A. The City Manager may choose to inspect the ongoing permitted work in the right-of-way at any time to ensure that all requirements of the approved right-of-way permit are being met by the permittee.
- B. At the time of any inspection, the City Manager may order the immediate cessation, through a stop work order, of work in the right-of-way that poses a serious threat to the life, health, safety, or wellbeing of the public.

Section 5.12 Traffic Control

- A. All temporary traffic control devices shall be properly installed and maintained at the permittee's expense. All traffic control materials and methods shall be in conformance with the latest edition of the Manual on Uniform Traffic Control Devices.
- B. The City requires ten (10) days advanced notice prior to closure, or partial closure, of any public street, alley, traveled way or sidewalk.
- C. All traffic control devices must be implemented according to the approved traffic control plan, if required by the right-of-way permit.
- D. Any authorized representative of the City may close any public street, alley, highway or any part thereof when necessary for the proper control of traffic or upon which public work or improvement, repair or reconstruction is in progress or presently contemplated or where in his/her opinion such is required for the safety and protection of traffic and for such period of time as he/she may deem necessary for the benefit of such work and safety, and for such purpose to cause the street, alley, highway or part thereof, to be barred to traffic by the public and placarded as closed. It shall be unlawful for any person willfully to drive or cause to be driven any animal or vehicle on, along or across any public street, alley, highway or any part thereof so barred, or willfully to throw down, remove or otherwise disturb any barrier or placard placed under the direction of an authorized representative of the City. Any person who receives a citation for a

violation of this Section shall be fined not less than fifty dollars (\$50.00) and not more than five hundred dollars (\$500.00) for each offense.

Section 5.13 Unauthorized Work or Excavation Prohibited

- A. Any person who is found working or excavating in the public right-of-way without a right-of-way permit will be directed to stop the work or excavation until a right-of-way permit is acquired and available at the work site or excavation.
- B. Any person who is found obstructing in any manner whatsoever or otherwise impacting the normal flow of vehicular or pedestrian traffic in the right-of-way without a right-of-way permit will be directed to stop work causing such issue(s) and restore normal traffic conditions until a right-of-way permit is acquired and available at the work site or excavation.
- C. No permittee may commence work or excavation before the right-of-way permit start date or, except as provided herein, may continue work or excavation after the end date. If a permittee does not complete the work or excavation by the right-of-way permit end date the permittee must apply for and receive either a new right-of-way permit or a time extension of an existing right-of-way permit before work or excavation may resume.
- D. No permittee shall obstruct in any manner whatsoever or otherwise impact the normal flow of vehicular or pedestrian traffic in the right-of-way before the right-of-way permit start date or, except as provided herein, after the right-of-way permit end date.

Section 5.14 Restoration

- A. Following completion of permitted work or excavation within the right-of-way, the permittee shall restore all portions of the right-of-way in which the permittee performed work or excavation, in accordance with the conditions provided in this Article.
- B. If work or excavation cannot be backfilled immediately and is left unattended, the permittee shall securely and adequately cover and mark the unfilled excavation or work. The permittee has sole responsibility for maintaining proper temporary traffic control, barriers, safety fencing, signage, street-plating, and/or lights as required, from the time of the opening of the work or excavation until the work or excavation is surfaced and opened for travel.
- C. All earth, materials, sidewalks, paving, crossing, utilities, striping, public improvement or improvements of any kind damaged or removed by the permittee shall be fully repaired or replaced promptly by the permittee at its sole expense and to the reasonable satisfaction of the City Manager. However, a permittee shall not make or attempt to make repairs, relocation or replacement of damaged or disturbed facilities without the approval of the owner of the facilities.
- D. All work and excavation shall also be subject to the following:
 - 1. All sidewalks, gutters and curbs, ADA ramps and roadway entries that are removed during construction must be reconstructed according to City Standards and shall be completed within ten (10) days following removal of the existing feature and as approved by the City Manager within the right-of-way permit;
 - 2. Open excavation within the City right-of-way shall be backfilled, covered, or fenced daily;

3. Open excavations shall be permanently backfilled to City standards within ten (10) calendar days of excavation unless otherwise approved, in writing, by the City Manager;
4. Restoration of areas disturbed by construction shall be completed within ten (10) calendar days of the completion of work unless an extension of time is granted in writing by the City Manager;
5. Where natural vegetation is removed during work, vegetation shall be reestablished according to City Standard Specification Section 02920 Finish Grading and Seeding;
6. Exotic grasses, native plantings, flower beds, and other decorative landscaping placed in the right-of-way by abutting property owners and others are not required to be replaced or restored, are deemed at the risk of the abutting property owners and others, and may be replaced with City approved grass varieties; unless otherwise directed by the City Manager;
7. Erosion control BMPs shall be used when weather is prohibitive to establish vegetative growth such as in the winter or excessively dry conditions, as approved by the City Manager;
8. Types O and A soil as indicated in the USGS Soil Horizon Chart shall be placed in the top six (6) inches of all excavations outside of paved areas, including areas that will receive sod. Types O and A soil are dark nutrient-rich topsoil, free of rocks, clods, and debris that are capable of establishing and sustaining grass. Clay is not acceptable.

Section 5.15 Liability Insurance, Performance and Maintenance Bond Requirement

- A. Except as provided in this Section, each contractor or utility owning, controlling, leasing, maintaining, using or installing facilities within the right-of-way shall provide, at its sole expense, and maintain during the term of an agreement, commercial general liability insurance with a reputable, qualified, and financially sound company licensed to do business in the State of Missouri that shall protect the permittee, the City, and the City's officials, officers, and employees from claims which may arise from operations under an agreement, whether such operations are by the permittee, its officers, directors, employees and agents, or any subcontractors of the permittee. This liability insurance, shall include, but shall not be limited to, protection against claims arising from bodily and personal injury and damage to property, resulting from all permittee operations, products, services or use of automobiles, or construction equipment. The amount of insurance for single limit coverage applying to bodily and personal injury and property damage shall be in no event less than the individual and combined sovereign immunity limits, for political subdivisions; provided that nothing herein shall be deemed to waive the City's sovereign immunity. An endorsement shall be provided which states that the City is listed as an additional insured with full and equivalent coverage as the uncured under the insured's policy and duty of defense by insurer to the City, and stating that the policy shall not be cancelled or materially modified so as to be out of compliance with the requirements of this Section, or not renewed without thirty (30) days' advance written notice of such event being given to the City Clerk. A copy of the policy shall be provided to the City upon request. If the person is self-insured, it shall provide the City proof of compliance regarding its ability to self-insure and proof of its ability to provide coverage in the above amounts. Any self-insurance or deductible above fifty thousand dollars (\$50,000.00) must be declared to and pre-approved by the City. The insurance requirements in this Section or otherwise shall not apply to a permittee to the extent and for such period during an agreement as permittee is exempted from such requirements and has on file

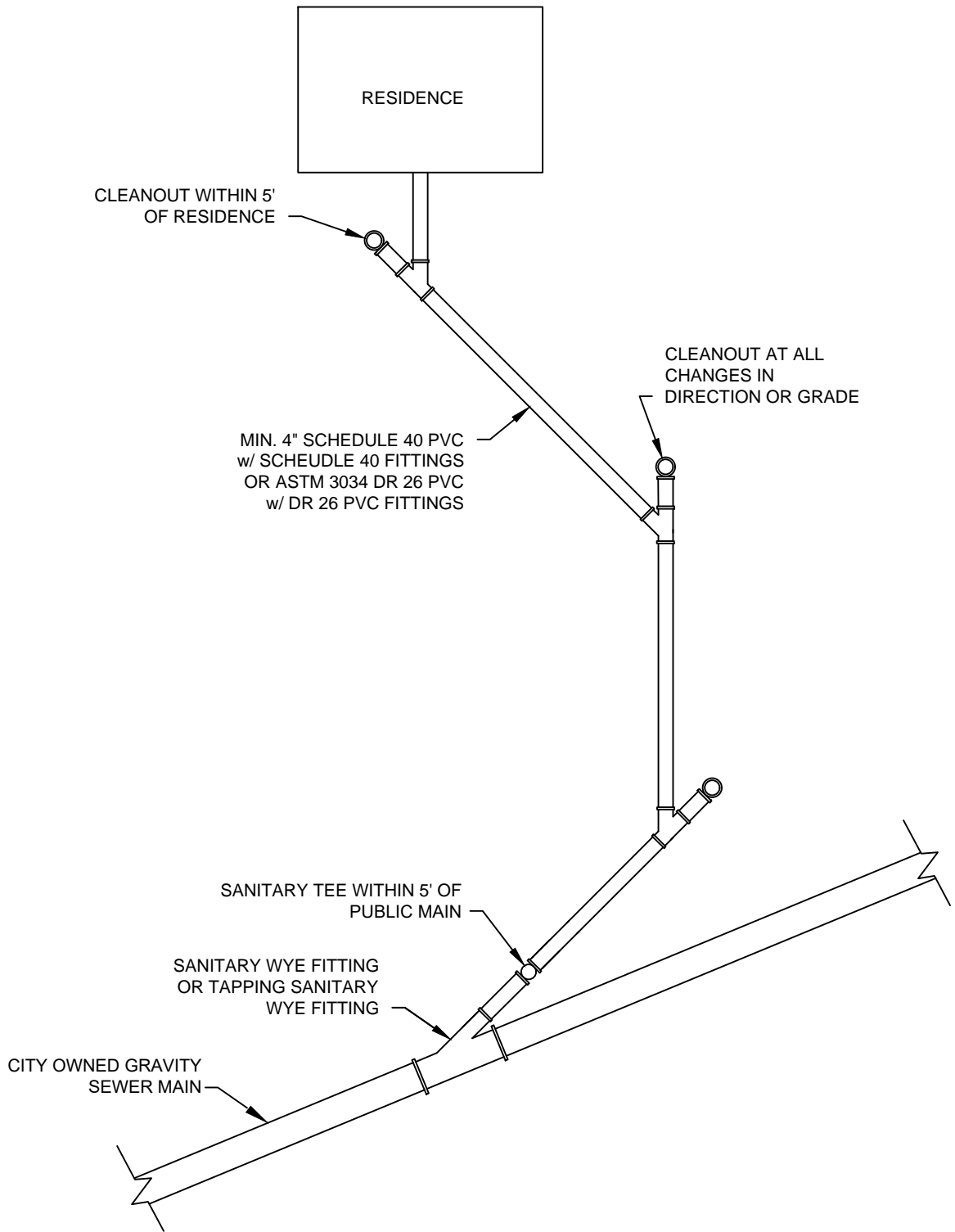
with the City Clerk an affidavit certifying that permittee has twenty-five million dollars (\$25,000,000.00) in net assets and is otherwise, therefore, so exempted unless otherwise provided by agreement. The City reserves the right to waive any and all requirements under this Section when deemed to be in the public interest.

- B. Except as otherwise may be required by law for permittees who have on file with the City Clerk an affidavit certifying that the permittee has twenty-five million dollars (\$25,000,000.00) in net assets and is otherwise, therefore, exempted, contractors and utilities owning, controlling, leasing, maintaining, using or installing facilities within the right-of-way shall deposit with the City an irrevocable letter of credit, escrow funds or a surety bond in a form approved by the City Attorney. The amount of the irrevocable letter of credit, escrow funds or bond will be five thousand dollars (\$5,000.00) or the value of the restoration, as determined by the City Manager, whichever is greater, for a term consistent with the term of the rights-of-way permit plus one (1) additional year, conditioned upon the person's faithful performance of the provisions, terms, and conditions conferred by this Article. Unless otherwise established by the right-of-way permit, an annual bond in an amount of fifty thousand dollars (\$50,000.00) automatically renewed yearly during this period shall satisfy the requirement of this Section. In the event the City shall exercise its right to revoke the right-of-way permit as granted herein, then the City shall be entitled to recover under the terms of said bond the full amount of any loss occasioned. Any such letter of credit, escrow funds or surety bond shall provide that the Village of Kingdom City has the right to draw against any such letter of credit, escrow funds or surety bond in the event the applicant fails to complete the work in the timeframe(s) established herein.
- C. A copy of the liability insurance certificate and performance and maintenance bond must be on file with the City Clerk.

Section 5.16 Standard Details

- A. The City's Standard Details are attached.

STANDARD DETAILS



VILLAGE OF KINGDOM CITY
TYPICAL DETAIL
RESIDENTIAL SERVICE CONNECTION

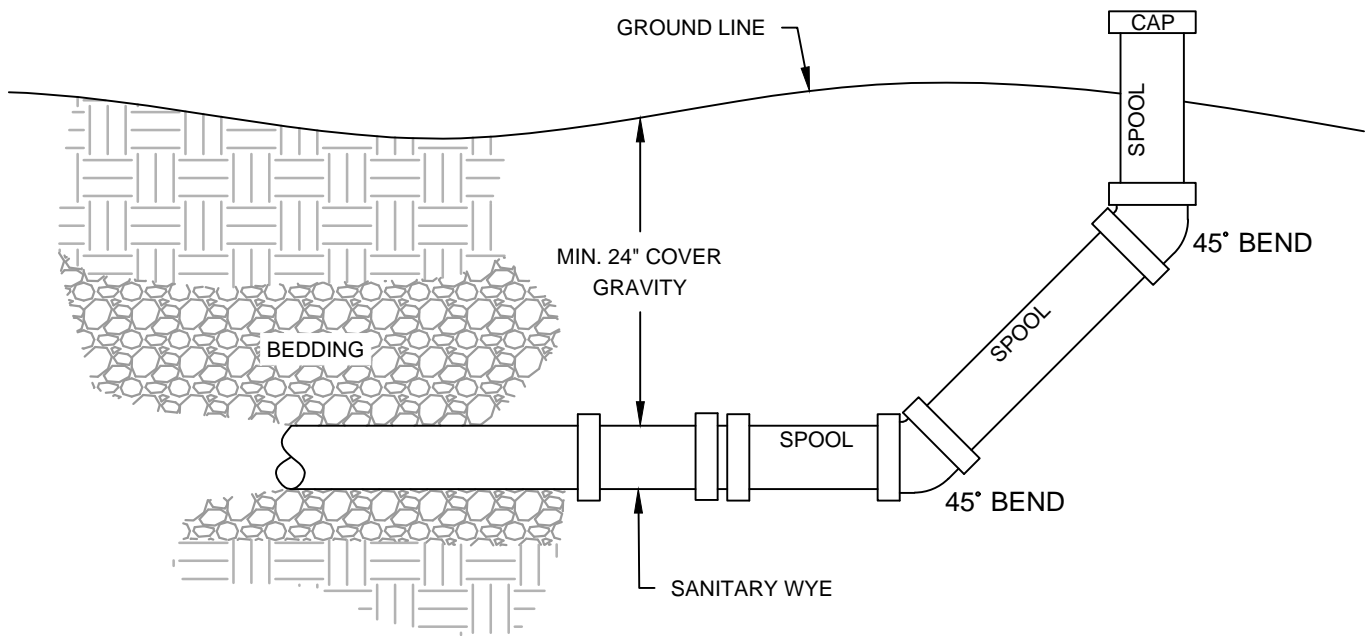
Design Guideline:

SECTION 2

SANITARY SEWER

Drawing No.:

1



VILLAGE OF KINGDOM CITY
 TYPICAL DETAIL
 SANITARY SEWER CLEANOUT DETAIL

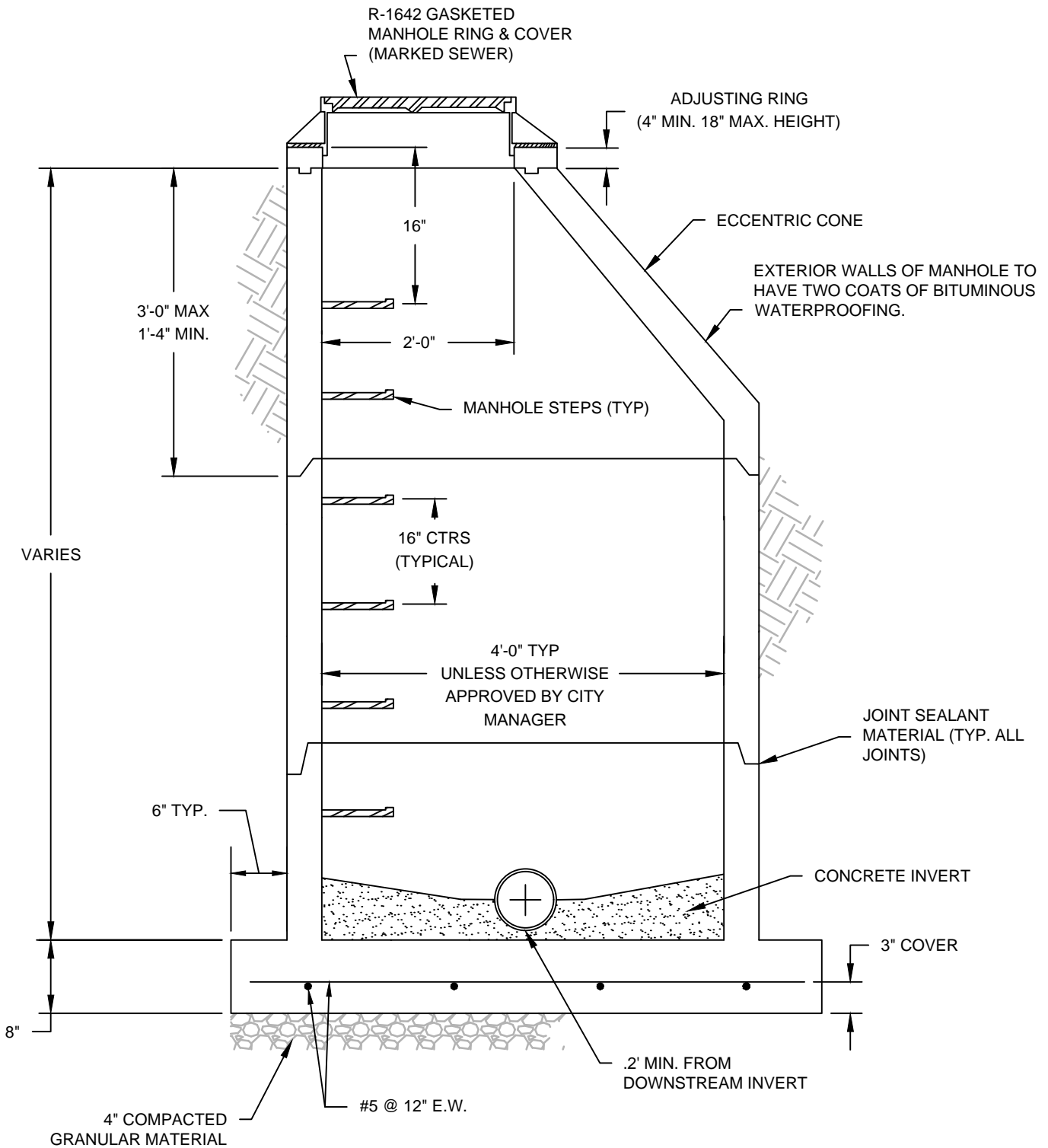
Design Guideline:

SECTION 2

SANITARY SEWER

Drawing No.:

2



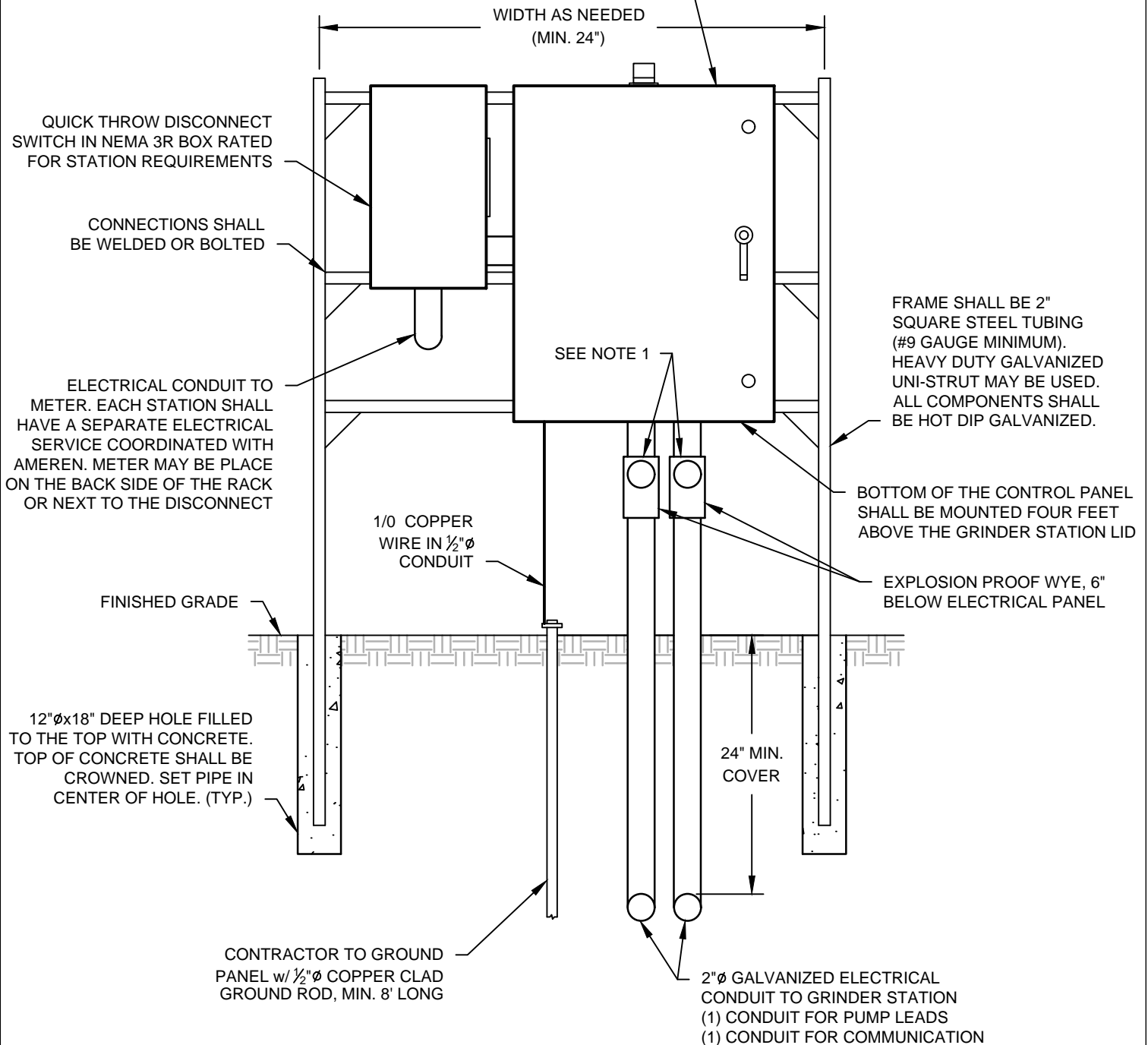
VILLAGE OF KINGDOM CITY
TYPICAL DETAIL
STANDARD PRECAST MANHOLE

Design Guideline: SECTION 2
SANITARY SEWER
Drawing No.: 3

ALL ELECTRIC WORK SHALL BE DONE IN ACCORDANCE WITH THE NATION ELECTRIC CODE AND ALL MATERIAL SHALL BE UL APPROVED.

NOTE: REQUIRED SERVICE ENTRANCE RATED DISCONNECT, METERS, AND OTHER NECESSARY ELECTRICAL ENCLOSURES AND EQUIPMENT SHALL MEET UTILITY PROVIDERS STANDARDS AND SPECIFICATIONS

PANEL SHALL BE MOUNTED APPROXIMATELY 5' ABOVE FINISHED GRADE. EACH CONTROL PANEL SHALL HAVE A WIRING DIAGRAM OR SCHEMATIC ATTACHED TO THE INSIDE OF THE OUTER DOOR OR THE CONTROL PANEL BOX. PANEL SHALL BE PROVIDED BY CITY APPROVED SUPPLIER. OWNER/DEVELOPER SHALL COORDINATE WITH CITY MANAGER.



NOTE:
1. CONDUIT ENTRANCE AT TOP OF BOX TO BE SEALED AIRTIGHT TO PREVENT WET WELL GASES FROM ENTERING CONTROL PANEL

ALL GALVANIZED CONDUIT INSTALLED BELOW FINISHED GRADE SHALL HAVE WATERPROOF COATING OR WRAP.

VILLAGE OF KINGDOM CITY
TYPICAL DETAIL
LIFT STATION RACK

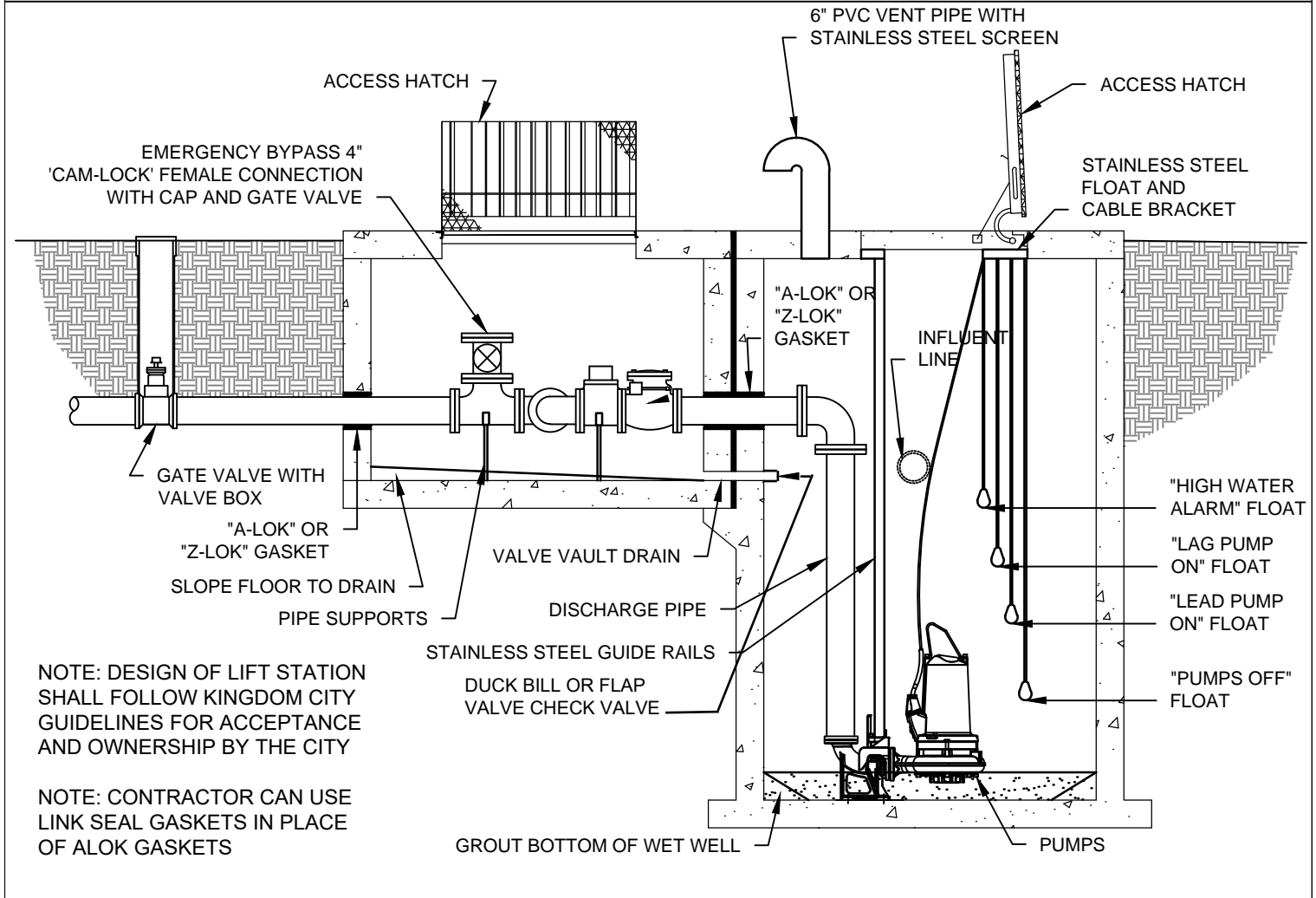
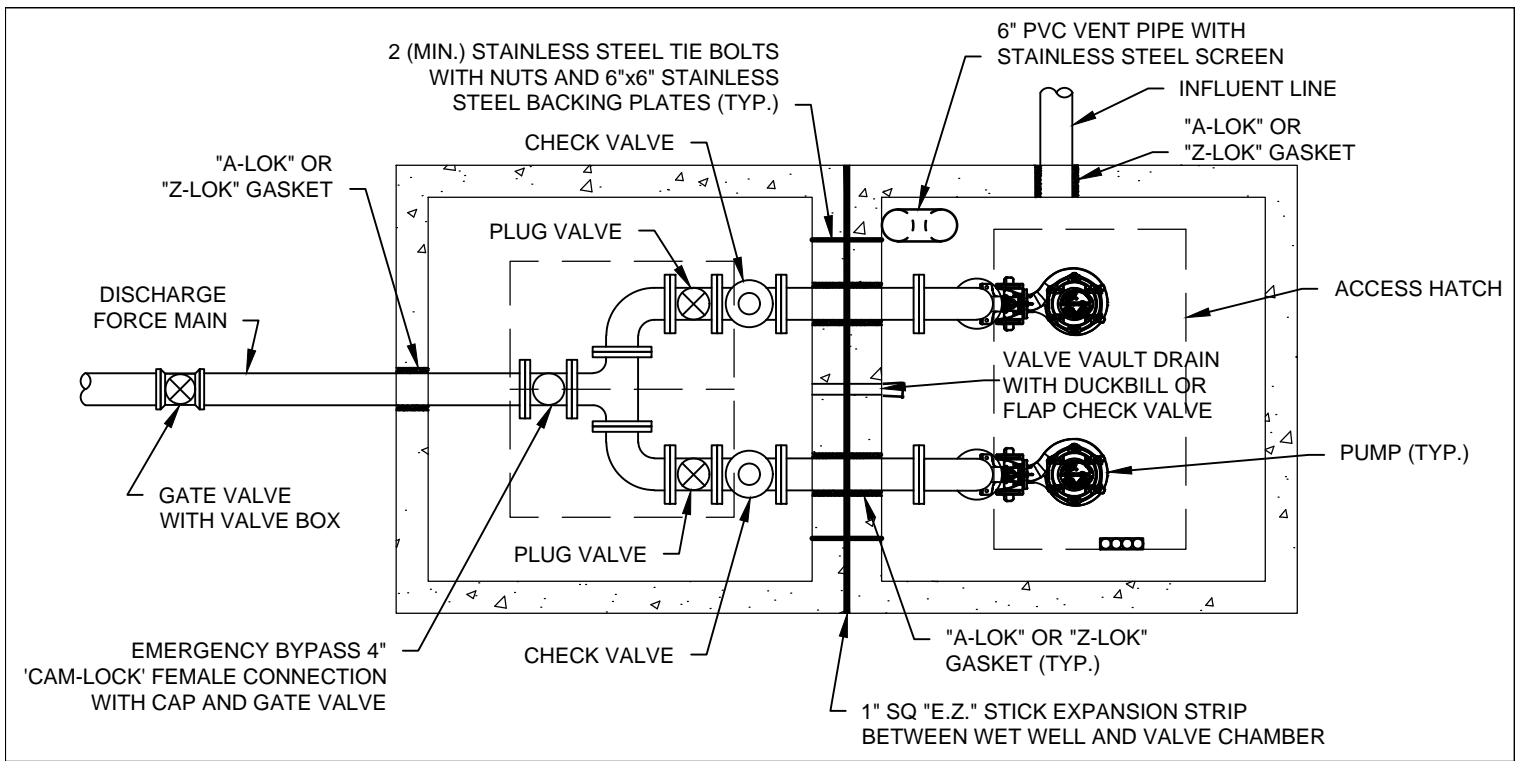
Design Guideline:

SECTION 2

SANITARY SEWER

Drawing No.:

4

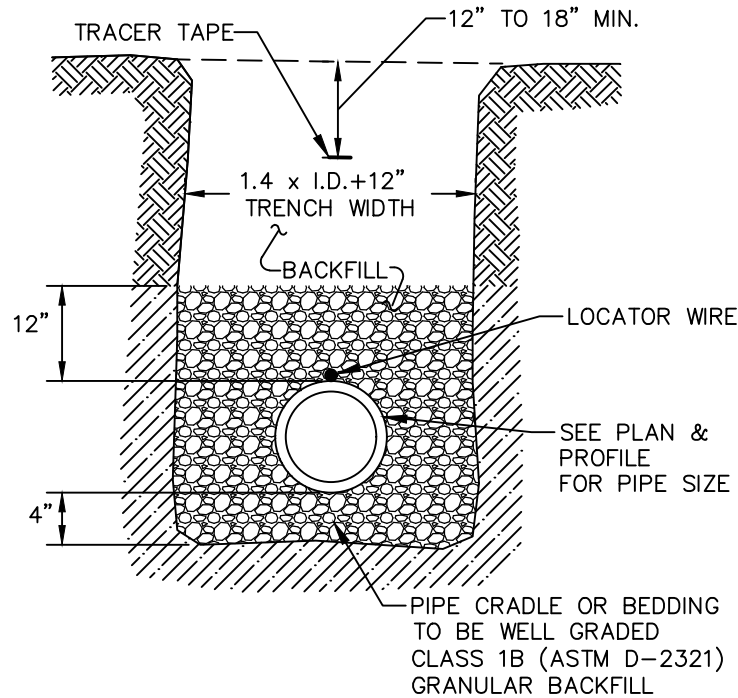


VILLAGE OF KINGDOM CITY
TYPICAL DETAIL
LIFT STATION

Design Guideline:
SECTION 2

SANITARY SEWER

Drawing No.:
5



1. ALL TRENCHES SHALL HAVE A BEDDING OF WELL GRADED, CLASS 1B(ASTM D-2321) GRANULAR MATERIAL FROM 4" BELOW THE BOTTOM OF THE PIPE TO 12" ABOVE THE PIPE COMPACTED TO 95% STANDARD PROCTOR DENSITY (ASTM D-698).
2. IN AREAS TO BE PAVED OVER, ENTIRE TRENCH TO BE BACKFILLED WITH WELL GRADED GRANULAR MATERIAL & COMPACTED TO 95% OF THE STANDARD PROCTOR DENSITY (ASTM D-698).
3. IN AREAS OF CLEAN DIRT CUTS OUTSIDE OF PAVED AREAS, TRENCH MAY BE BACKFILLED WITH SAME MATERIAL AND COMPACTED TO 95% OF THE STANDARD PROCTOR DENSITY (ASTM D-698).
4. IN AREAS OF ROCK CUT, THE TRENCH SHALL BE BACKFILLED WITH WELL GRADED GRANULAR MATERIAL TO 6" ABOVE TOP OF PIPE.
5. CONTRACTOR SHALL BE RESPONSIBLE FOR TRENCH SETTLEMENT.
6. IN AREAS WHERE BACKFILL MATERIAL CONTAINS ROCK, CONTRACTOR TO PLACE CLASS 1B(ASTM D-2321) GRANULAR MATERIAL A MINIMUM OF 6" ABOVE PIPES.

Date Revised:
MAY 2025

By:
GLF

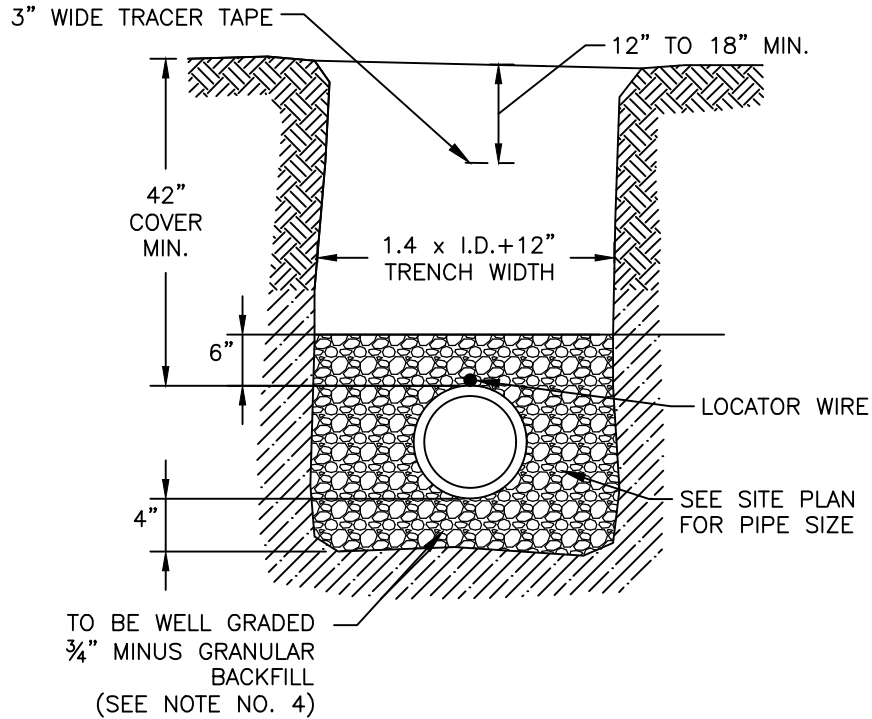
Checked By:
WRJ

**VILLAGE OF KINGDOM CITY
TYPICAL DETAIL
SANITARY GRAVITY MAIN TRENCHING**

Design Guideline:
SECTION 2

SANITARY SEWER

Drawing No:
6



1. BACKFILL MATERIAL FOR FORCE MAIN SHALL BE SUITABLE EARTH, FREE FROM LARGE ROCKS OR STONES.
2. ALL TRENCHES FOR FORCE MAIN SHALL HAVE A BEDDING OF WELL-GRADED, 3/4" MINUS, GRANULAR BACKFILL FROM 4" BELOW THE BOTTOM OF THE PIPE TO ONE-HALF THE DIAMETER OF THE PIPE COMPACTED TO 95% OF THE STANDARD PROCTOR DENSITY.
3. IN AREAS OF CLEAN DIRT CUTS OUTSIDE OF PAVED AREAS, TRENCH MAY BE BACKFILLED WITH SAME MATERIAL AND COMPACTED TO 95% OF THE STANDARD PROCTOR DENSITY. PIPE BEDDING SHALL STILL BE REQUIRED IN AREAS OF CLEAN DIRT CUTS.
4. IN AREAS OF ROCK CUT, THE TRENCH SHALL BE BACKFILLED WITH WELL-GRADED GRANULAR MATERIAL TO SIX INCHES ABOVE TOP OF PIPE.
5. CONTRACTOR SHALL BE RESPONSIBLE FOR TRENCH SETTLEMENT.
6. TRACER TAPE SHALL BE 3" WIDE, BONDED LAYER PLASTIC WITH MAGNETIC FOIL CORE, TERRA TAPE DETECTABLE, MANUFACTURED BY GRIFFOLYN CO. OF HOUSTON, TEXAS, AND SHALL HAVE THE WORDS "CAUTION: SANITARY SEWER BURIED BELOW".
7. WELL-GRADED 3/4" MINUS GRANULAR BACKFILL FULL DEPTH TO BE USED IN ALL AREAS TO BE PAVED.
8. LOCATOR WIRE SHALL BE #12 COPPER WIRE, SOLID INSULATED FOR 600 V. WITH SPLICE POINTS NEAR VALVE BOXES.

Date Revised:
MAY 2025

By:
GLF

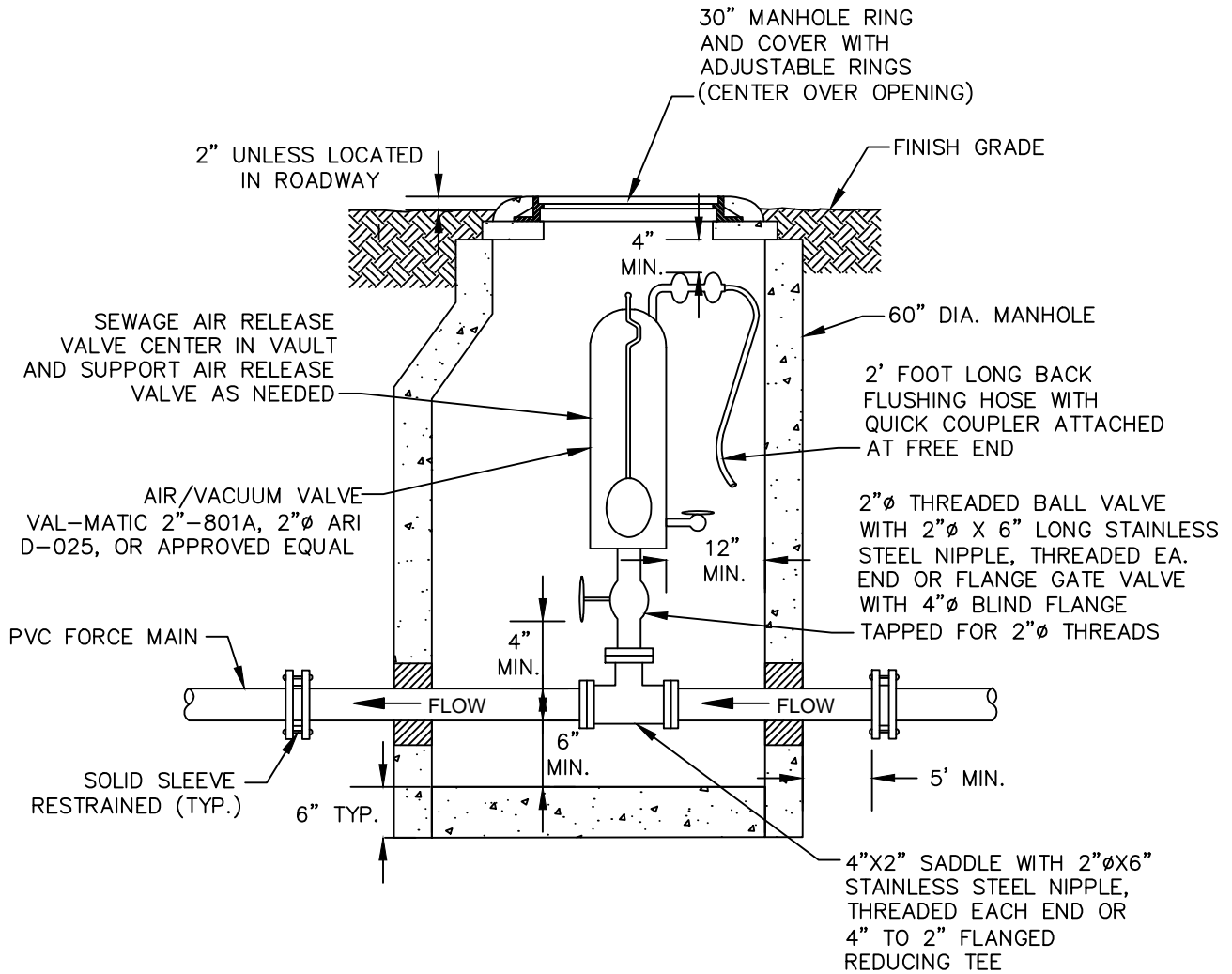
Checked By:
WRJ

VILLAGE OF KINGDOM CITY
TYPICAL DETAIL
SANITARY FORCE MAIN TRENCHING

Design Guideline:
SECTION 2

SANITARY SEWER

Drawing No:
7

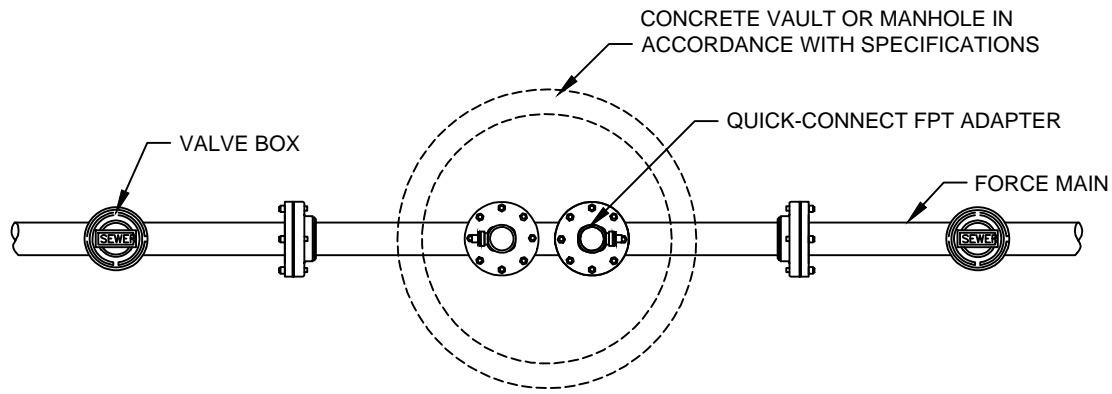


NOTE:
 ALL PIPING, EXCEPT AS NOTED, TO BE DUCTILE IRON WITH FLANGE JOINTS AND STAINLESS STEEL BOLTS.

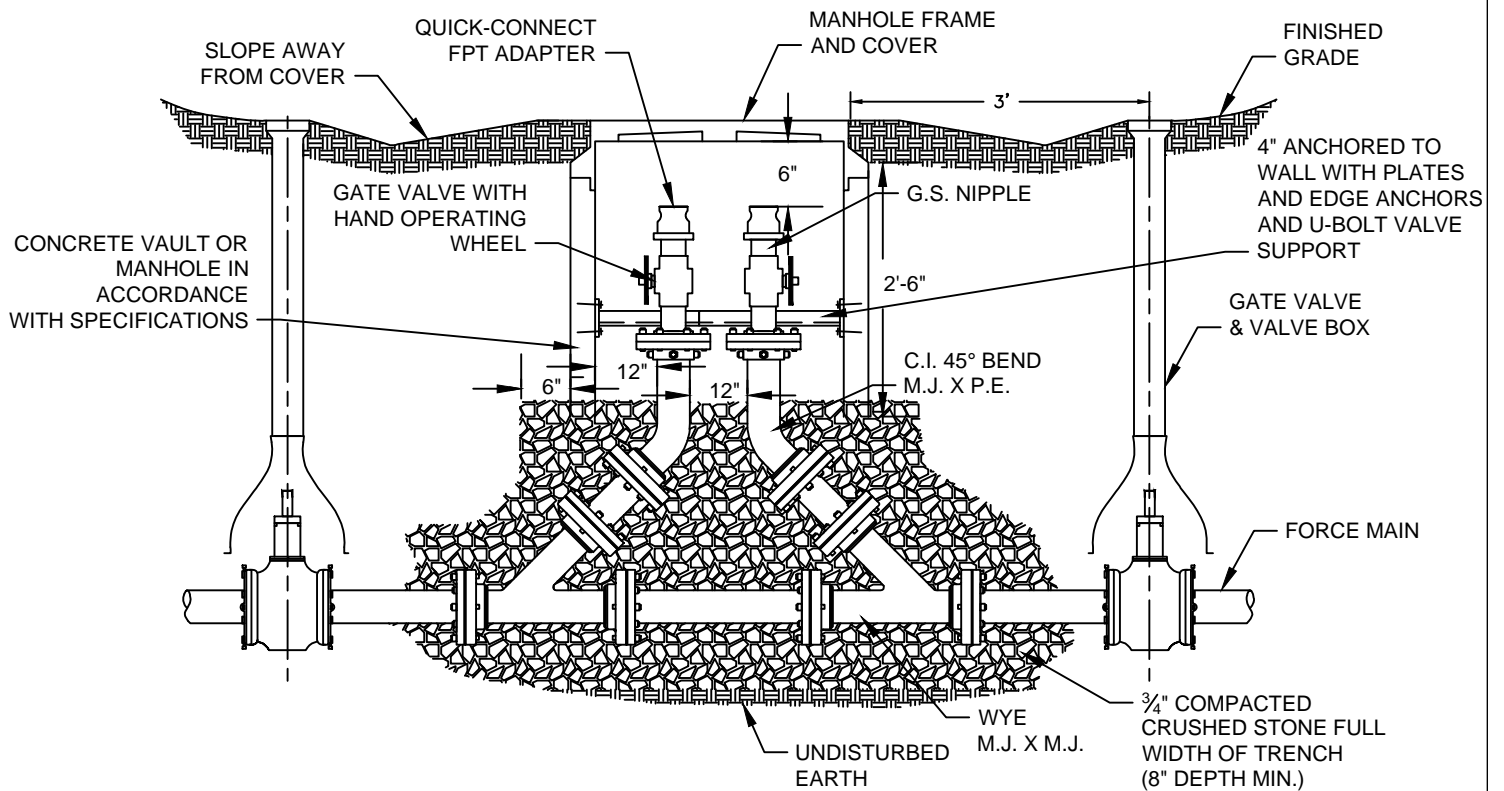
Date Revised: MAY 2025
By: GLF
Checked By: WRJ

**VILLAGE OF KINGDOM CITY
 TYPICAL DETAIL
 SEWER AIR RELEASE VALVE**

Design Guideline: SECTION 2
SANITARY SEWER
Drawing No: 8



PLAN VIEW



PROFILE

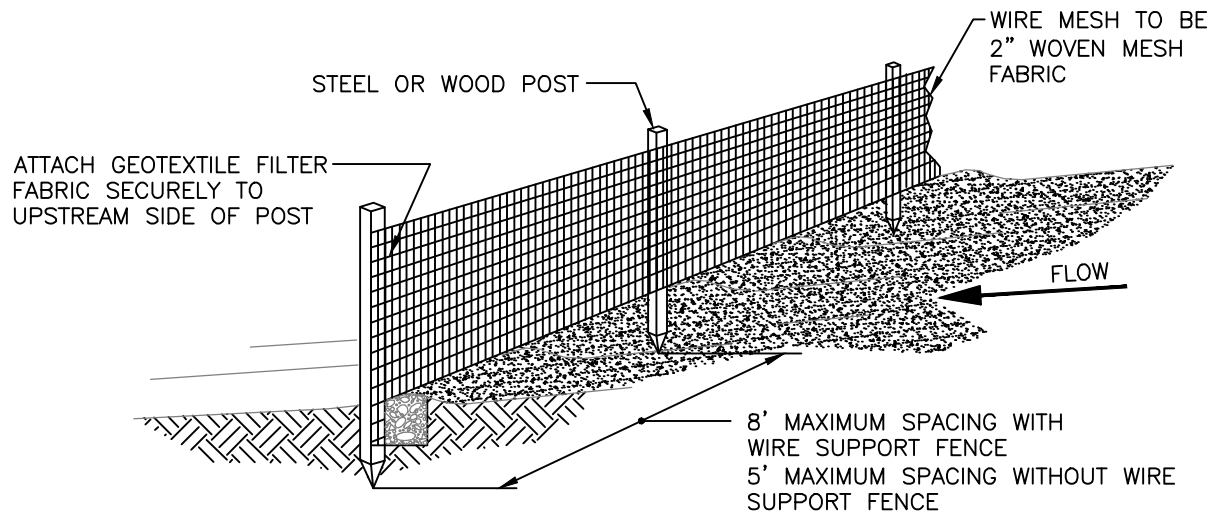
NOTES:

1. RISER PIPES SHALL BE SAME DIAMETER AS FORCE MAIN
2. FOR RISERS SMALLER THAN 2", GATE VALVES MAY BE REPLACED WITH BALL VALVES

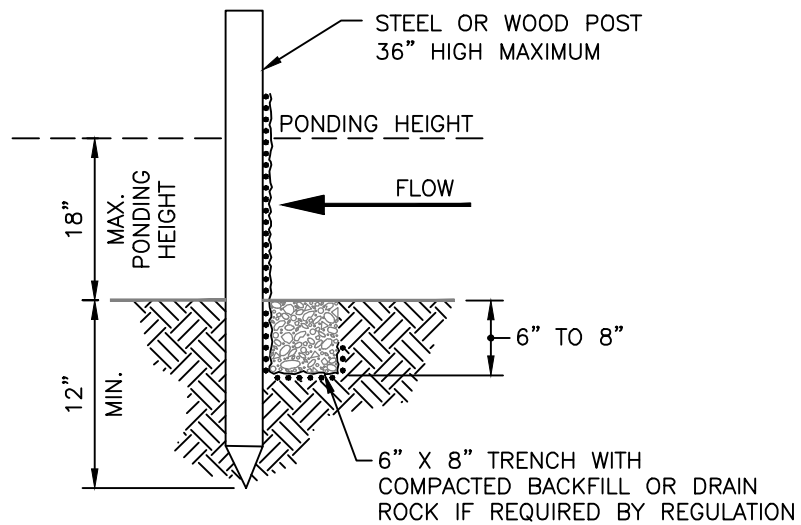
Date Revised: MAY 2025
By: GLF
Checked By: WRJ

**VILLAGE OF KINGDOM CITY
TYPICAL DETAIL
FORCE MAIN
DUAL CLEAN OUT MANHOLE**

Design Guideline: SECTION 2
SANITARY SEWER
Drawing No: 9



SILT FENCE MUST BE INSPECTED AND MAINTAINED DAILY



TRENCH DETAIL

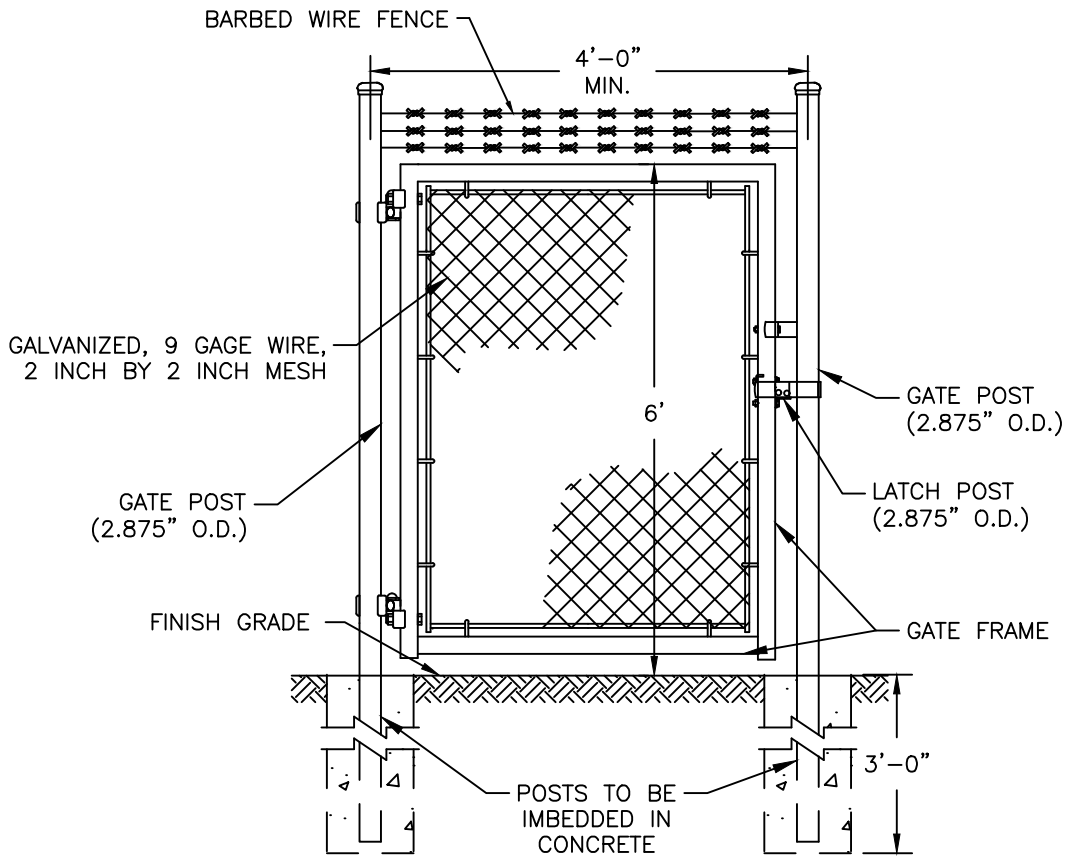
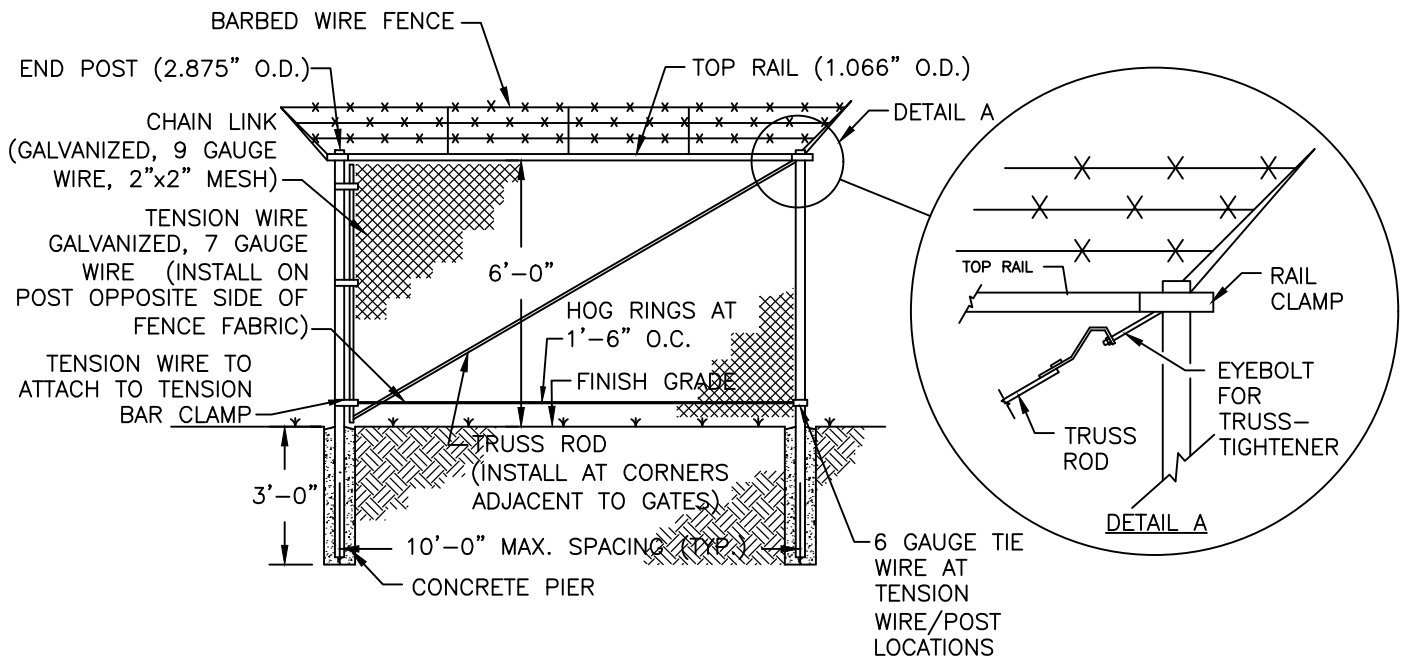
NOTES.

1. BOTTOM OF FILTER FABRIC FENCE MUST BE INSTALLED A MINIMUM OF 6" BELOW GRADE. BOTH ENDS OF EACH FENCE SECTION MUST EXTEND AT LEAST 8 FEET UPSLOPE AT 45 DEGREES TO THE MAIN FENCE ALIGNMENT.
2. ACCUMULATED SEDIMENT MUST BE INSPECTED AND REMOVED DAILY.
3. ANY FENCE SECTION, WHICH HAS BEEN UNDERMINED OR TOPPED, MUST BE IMMEDIATELY REPLACED.
4. WHERE ENDS OF FILTER FABRIC COME TOGETHER, THEY MUST BE OVERLAPPED, FOLDED AND STAPLED TO PREVENT SEDIMENT BYPASS. THE TOE ANCHOR MUST BE BACKFILLED AND COMPACTED TO A DENSITY EQUAL TO THE SURROUNDING SOILS.

Date Revised: MAY 2025
By: GLF
Checked By: WRJ

**VILLAGE OF KINGDOM CITY
TYPICAL DETAIL
SEDIMENTATION / SILT FENCE**

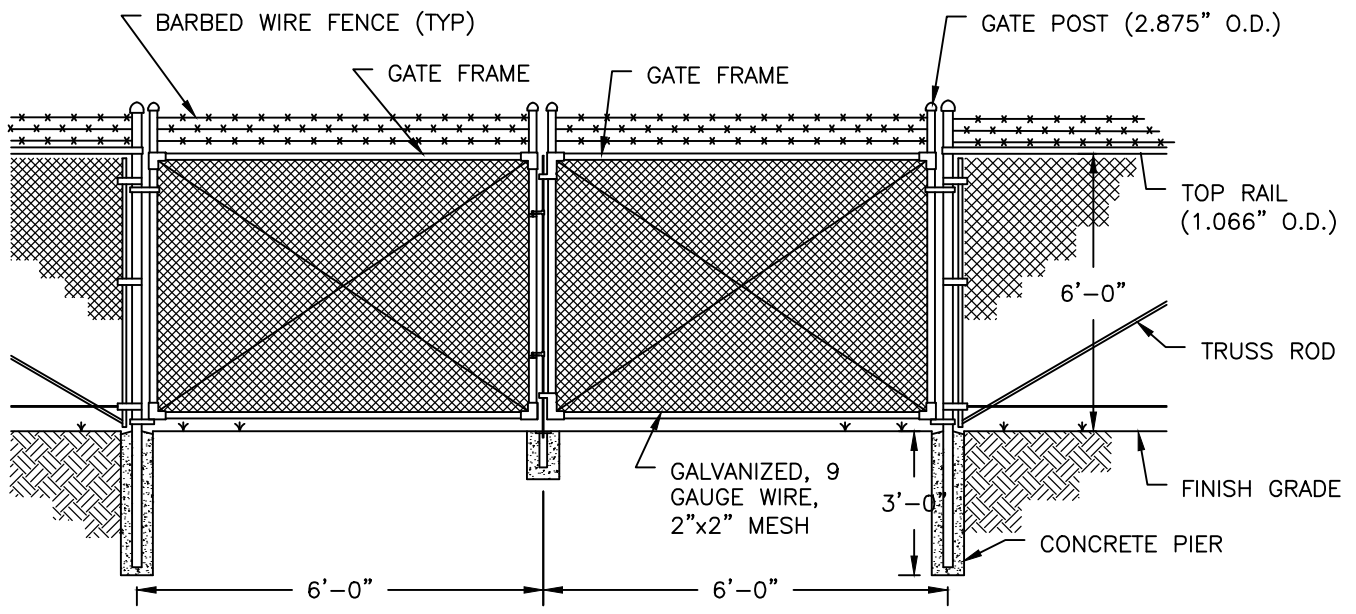
Design Guideline: SECTION 2
SANITARY SEWER
Drawing No: 10



Date Revised: MAY 2025
By: GLF
Checked By: WRJ

VILLAGE OF KINGDOM CITY
TYPICAL DETAIL
CHAIN-LINK FENCING &
FENCE MAIN GATE

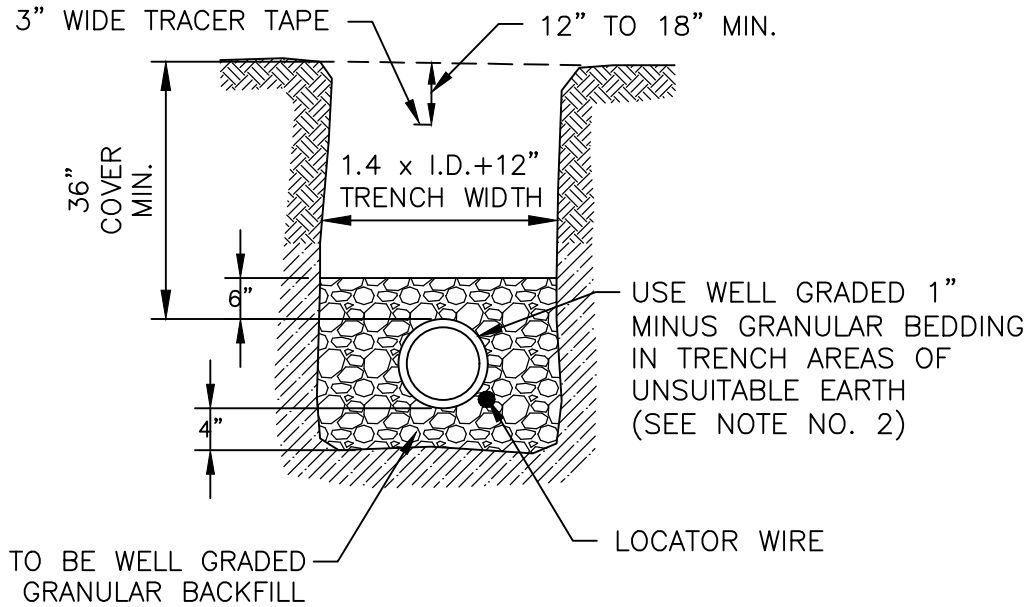
Design Guideline: SECTION 2
SANITARY SEWER
Drawing No: 11



Date Revised: MAY 2025
By: GLF
Checked By: WRJ

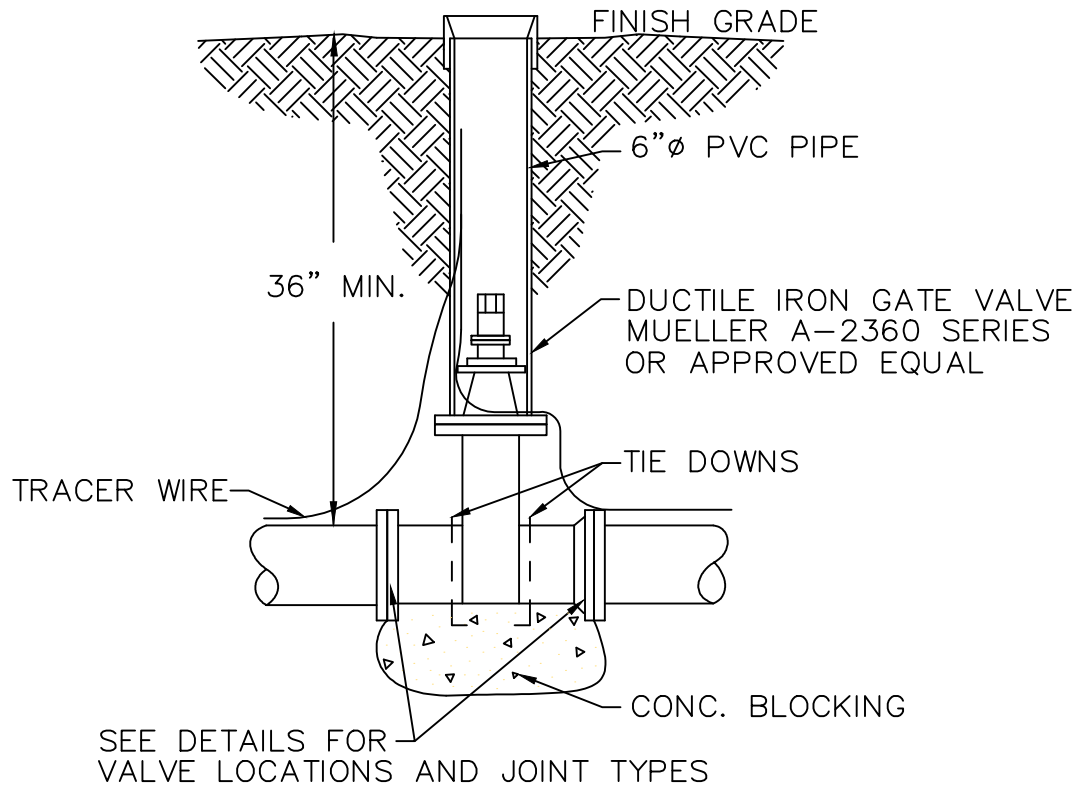
VILLAGE OF KINGDOM CITY
TYPICAL DETAIL
FENCE ENTRY GATE

Design Guideline: SECTION 2
SANITARY SEWER
Drawing No: 12



1. Backfill material for water main shall be suitable earth, free from large rocks or stones.
2. All trenches in areas for water main shall have a bedding of well-graded, granular backfill from 4" below the bottom of the pipe to 6" above the top of the pipe compacted to 95% of the Standard Proctor Density. (ASTM D-698)
3. In areas of clean dirt cuts outside of paved areas, trench may be backfilled with same material and compacted to 95% of the Standard Proctor Density. (ASTM D-698)
4. Contractor shall be responsible for trench settlement.
5. Well-graded granular compacted backfill to be used in all areas to be paved.
6. Locator wire shall be #12 solid copper wire, insulated for 600 v. with splice points at valve boxes.
7. Tracer tape shall be 3" wide, bonded layer plastic with magnetic foil core, Terra Tape Detectable, manufactured by Griffolyn Co. of Houston, Texas, and shall have the words "Caution: WATER MAIN BURIED BELOW"

Date Revised: MAY 2025	VILLAGE OF KINGDOM CITY TYPICAL DETAIL WATER MAIN TRENCHING AND BEDDING DETAIL	Design Guideline: SECTION 3
By: GLF		WATER SYSTEM
Checked By: WRJ		Drawing No: 1



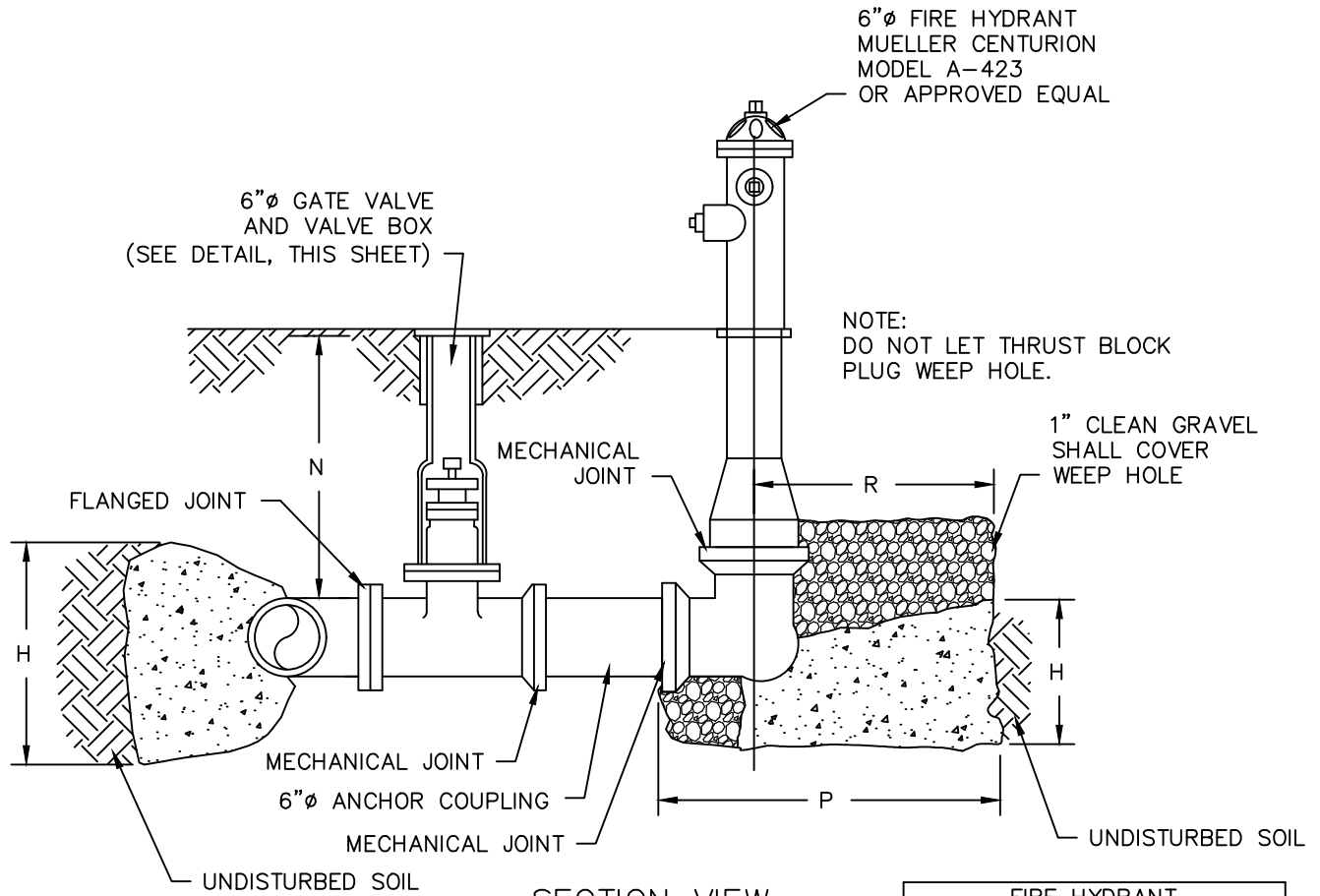
NOTE:

ALL BURIED VALVES SHALL HAVE CAST IRON VALVE BOX AND LID,
REGARDLESS OF LOCATION OF PLACEMENT

Date Revised: MAY 2025
By: GLF
Checked By: WRJ

**VILLAGE OF KINGDOM CITY
TYPICAL DETAIL
GATE VALVE & VALVE BOX**

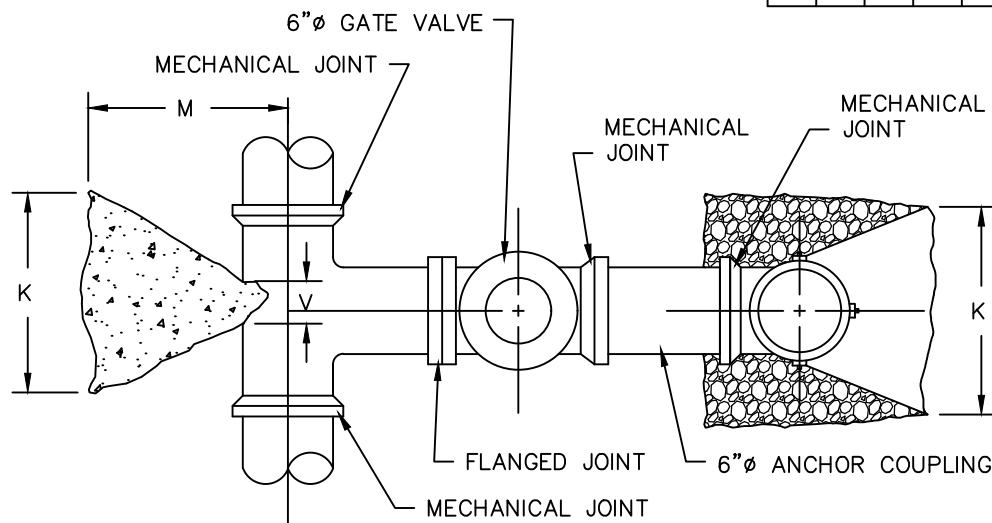
Design Guideline: SECTION 3
WATER SYSTEM
Drawing No: 2



NOTE:
DO NOT LET THRUST BLOCK
PLUG WEEP HOLE.

SECTION VIEW

FIRE HYDRANT THRUST BLOCK DIMENSIONS							
D	K	V	M	H	N	P	R
6"	28"	6"	24"	24"	36"	36"	30"



PLAN VIEW

Date Revised: MAY 2025
By: GLF
Checked By: WRJ

VILLAGE OF KINGDOM CITY
TYPICAL DETAIL
FIRE HYDRANT

Design Guideline: SECTION 3
WATER SYSTEM
Drawing No: 3

C/L ROADWAY

C/L WATER MAIN

EDGE OF PAVEMENT

R/W

R/W

RIGHT-OF-WAY LINE

R/W

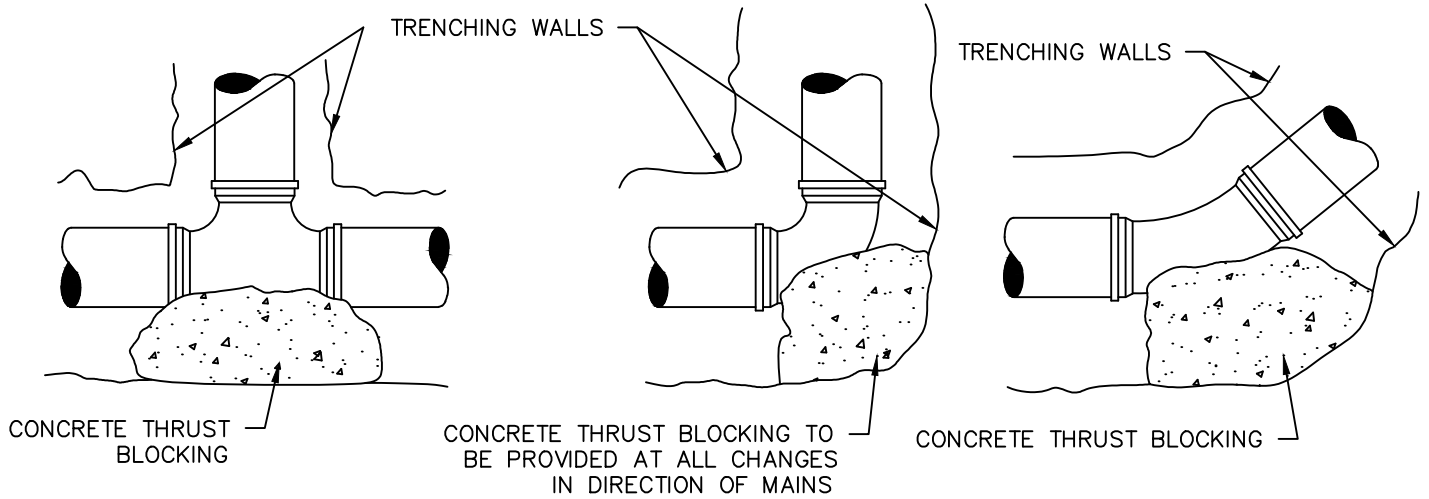
5' MINIMUM

FIRE HYDRANT ASSEMBLY

NOTE:
FIRE HYDRANT SHALL BE LOCATED
5' FROM EOP OR WITHIN THE
CITY'S RIGHT-OF-WAY

VILLAGE OF KINGDOM CITY
TYPICAL DETAIL
FIRE HYDRANT LOCATION

Design Guideline:
SECTION 3
WATER SYSTEM
Drawing No:
4



SQ. FT. OF THRUST BLOCK AREA REC'D				
PIPE SIZE	DEAD END TEE OR IN-LINE VLV.	90° ELBOW	45° ELBOW	22-1/2" ELBOW
4"	MIN.	MIN.	MIN.	MIN.
6"	MIN.	MIN.	MIN.	MIN.
8"	2'3" x 2'3"	2'8" x 2'8"	MIN.	MIN.
10"	2'10" x 2'10"	3'6" x 3'6"	2'6" x 2'6"	1'6" x 2'0"
12"	3'0" x 7'3"	3'0" x 10'3"	2'0" x 3'6"	1'6" x 2'6"

MIN. THRUST BLOCK BEARING TO BE 2 SQ. FT

Date Revised:
MAY 2025

By:
GLF

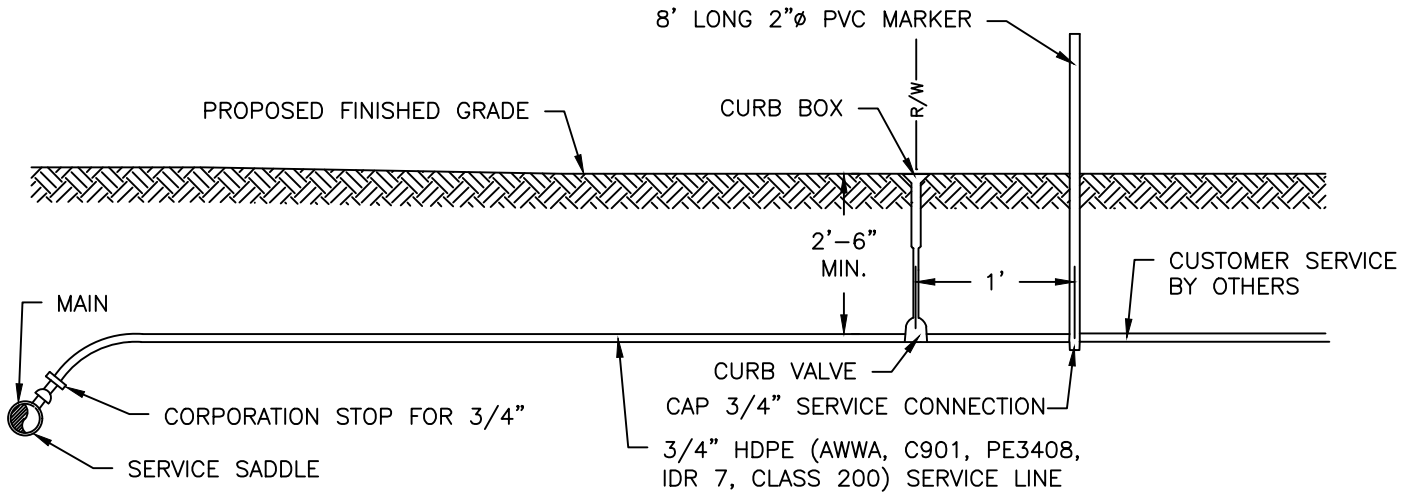
Checked By:
WRJ

**VILLAGE OF KINGDOM CITY
TYPICAL DETAIL
THRUST BLOCKING**

Design Guideline:
SECTION 3

WATER SYSTEM

Drawing No:
5

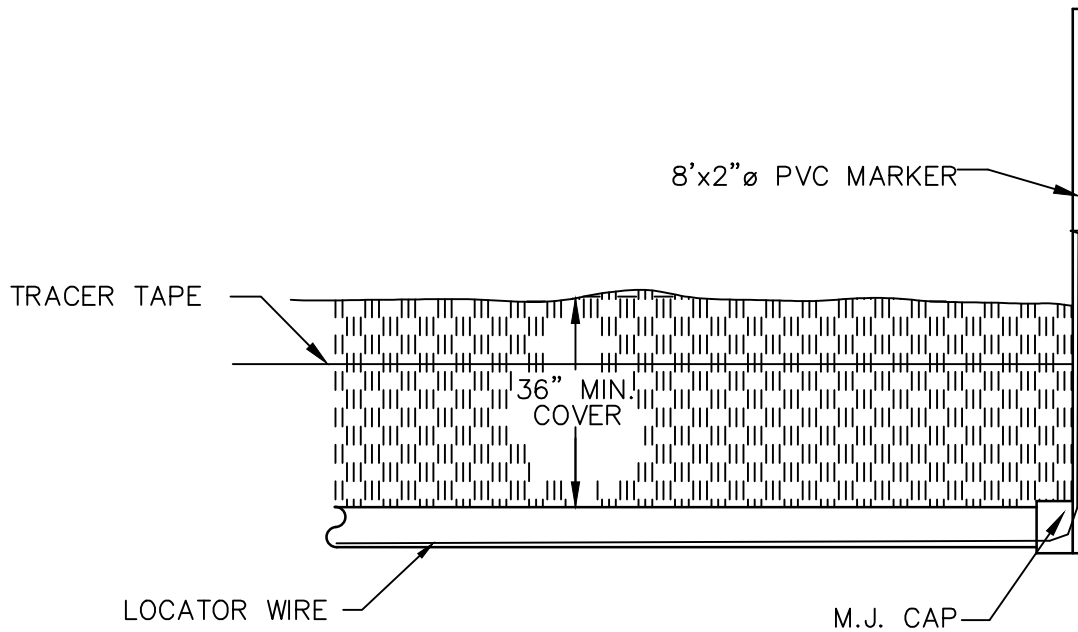


- 1) CURB BOX TO BE A MUELLER MODEL H-10316 OR APPROVED EQUAL
- 2) CURB VALVE TO BE MUELLER H-15219 OR APPROVED EQUAL
- 3) SERVICE SADDLE TO BE A MUELLER MODEL H-13441 6" W.M., H-13442 8" W.M., OR APPROVED EQUAL
- 4) CORPORATION STOP TO BE A MUELLER MODEL B-25008 OR APPROVED EQUAL

Date Revised: MAY 2025
By: GLF
Checked By: WRJ

**VILLAGE OF KINGDOM CITY
TYPICAL DETAIL
WATER SERVICE CONNECTION**

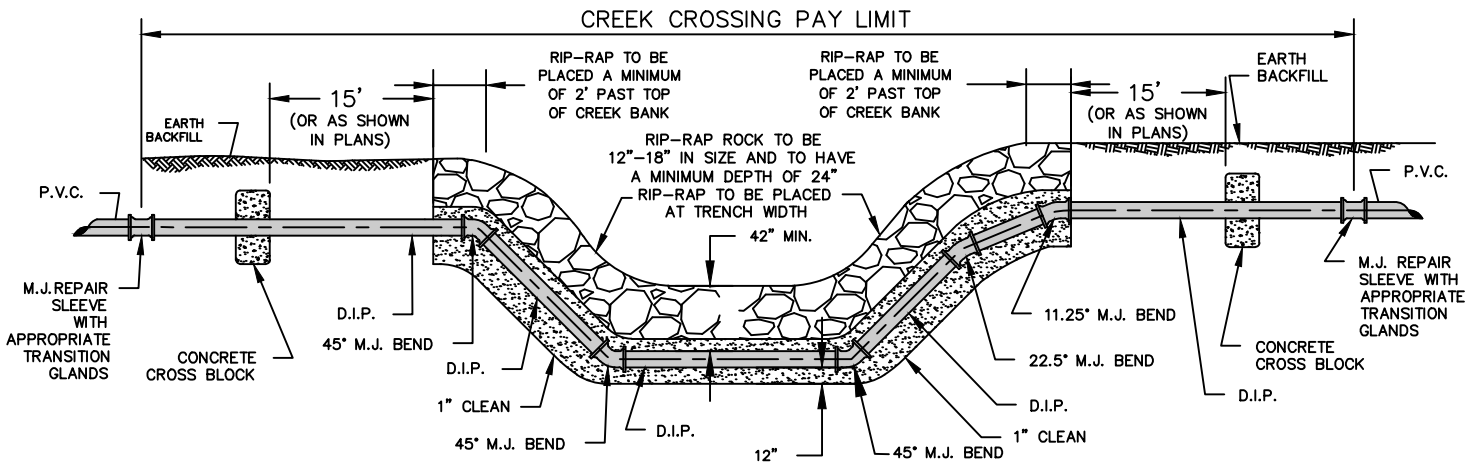
Design Guideline: SECTION 3
WATER SYSTEM
Drawing No: 6



Date Revised: MAY 2025
By: GLF
Checked By: WRJ

VILLAGE OF KINGDOM CITY
TYPICAL DETAIL
WATER MAIN CAP AND MARK

Design Guideline: SECTION 3
WATER SYSTEM
Drawing No: 7



NOTES

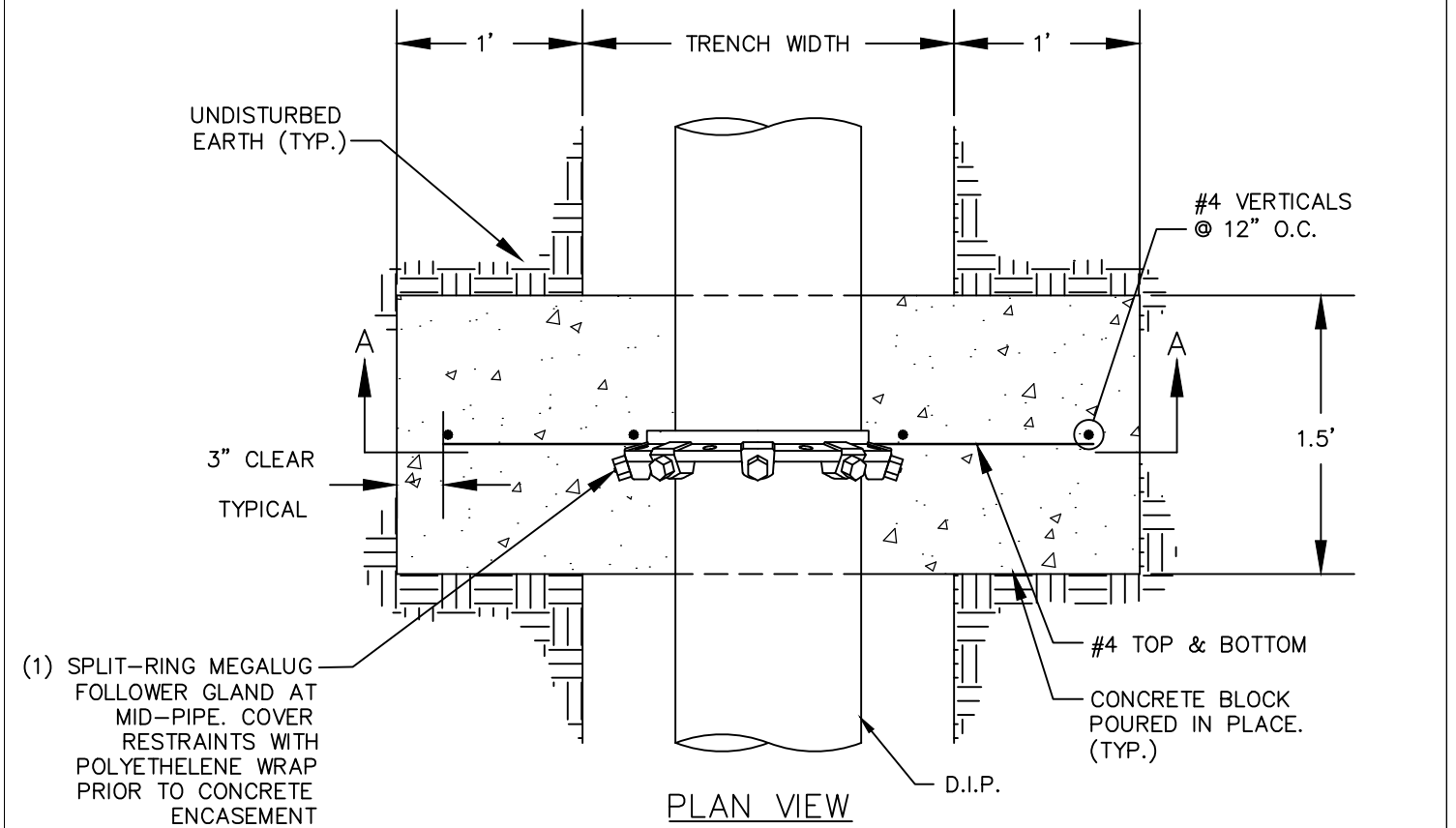
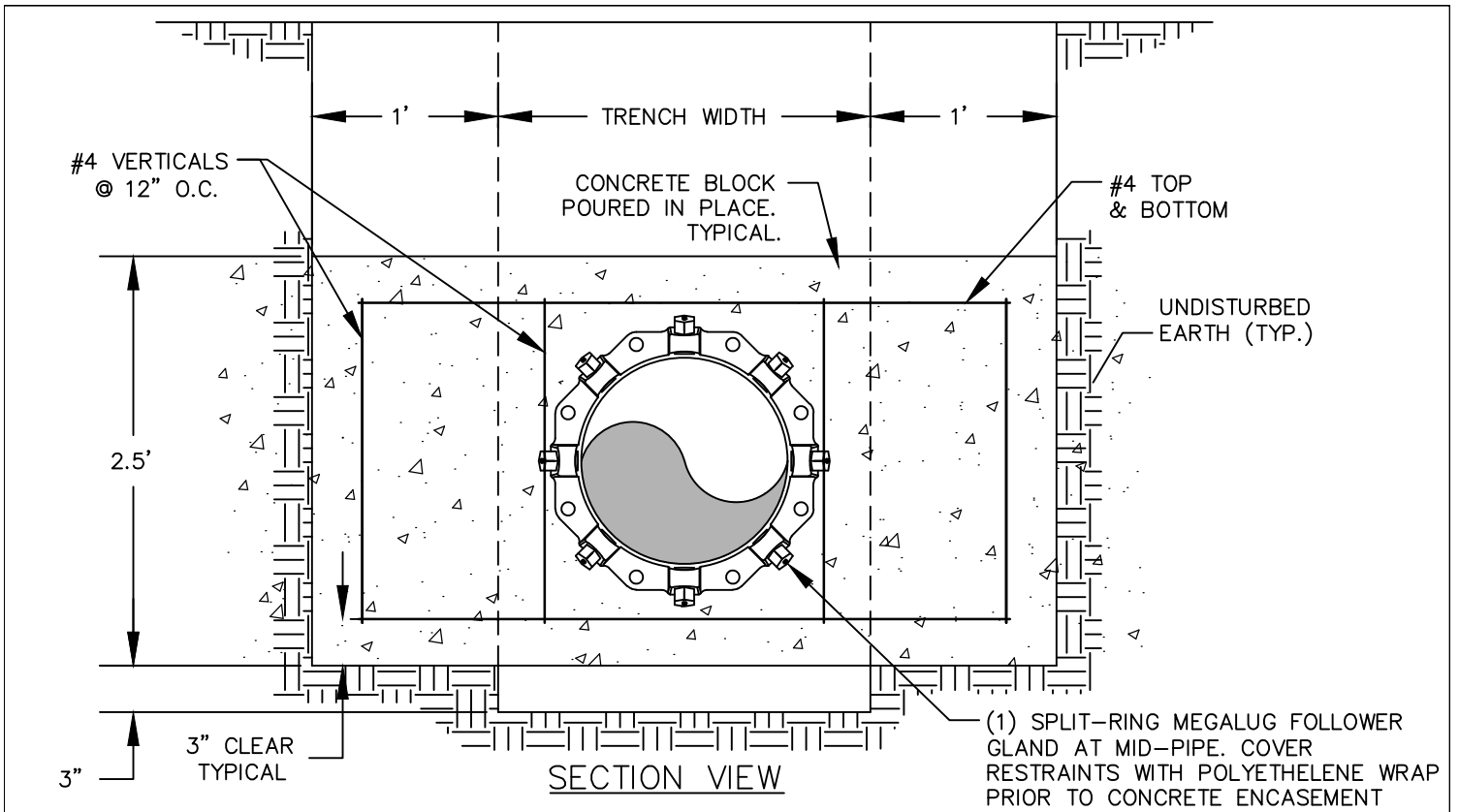
- A. INSTALL CROSS BLOCKS OUTSIDE LIMITS OF CREEK CROSSING (SEE TYPICAL CROSS BLOCK DETAIL BELOW)
- B. NO JOINTS TO BE CONCRETE ENCASED.
- C. PROVIDE "MEGALUG" RETAINER GLANDS FOR ALL BENDS
- D. ALL D.I.P. JOINTS TO USE FIELD LOK GASKETS

NOTE:
BENDS SHOWN ON THIS DETAIL ARE FOR REFERENCE ONLY. SEE PLAN SHEETS FOR ACTUAL BEND LOCATIONS AND TYPE.

Date Revised: MAY 2025
By: GLF
Checked By: WRJ

VILLAGE OF KINGDOM CITY
TYPICAL DETAIL
CREEK CROSSING

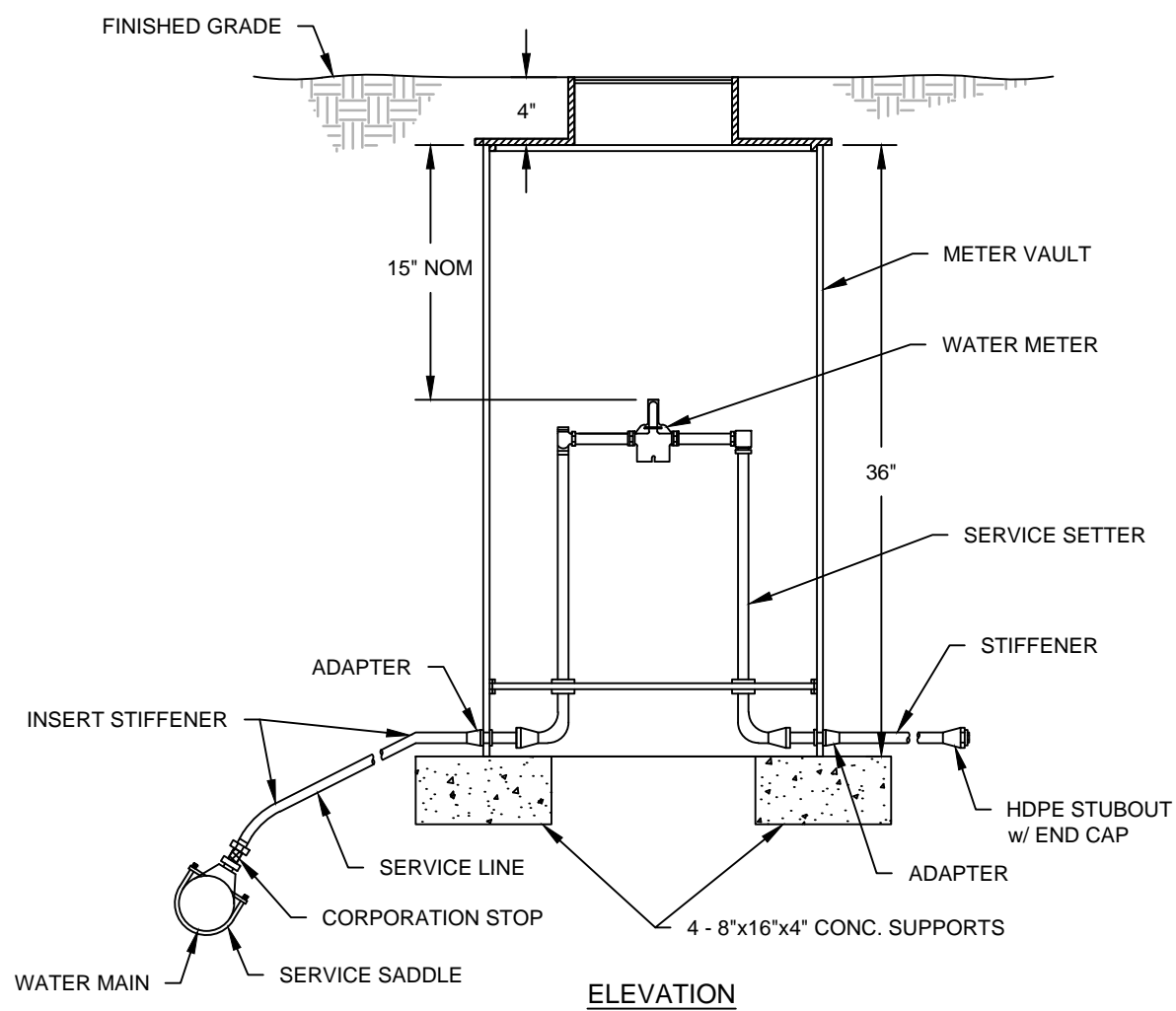
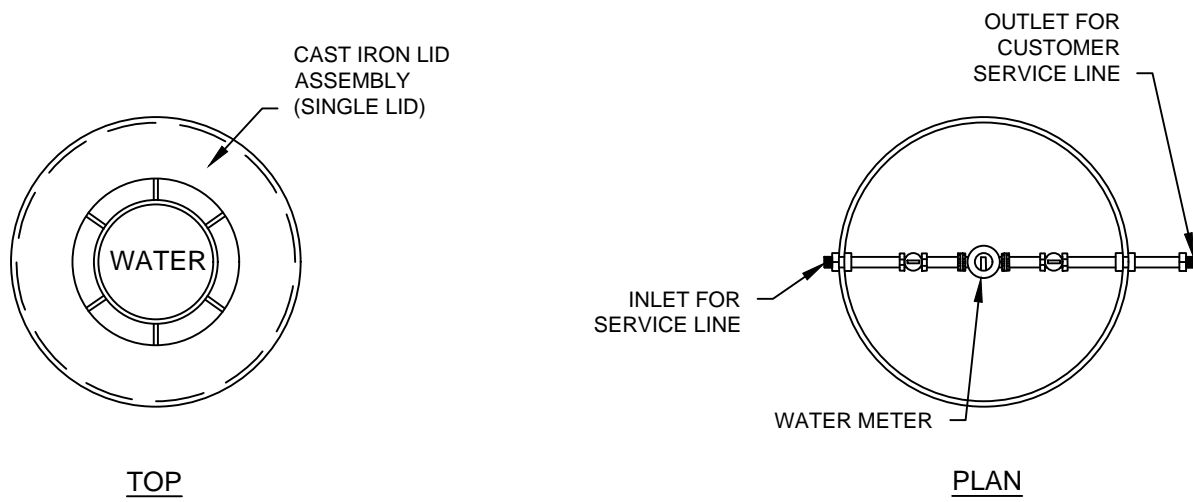
Design Guideline: SECTION 3
WATER SYSTEM
Drawing No: 8



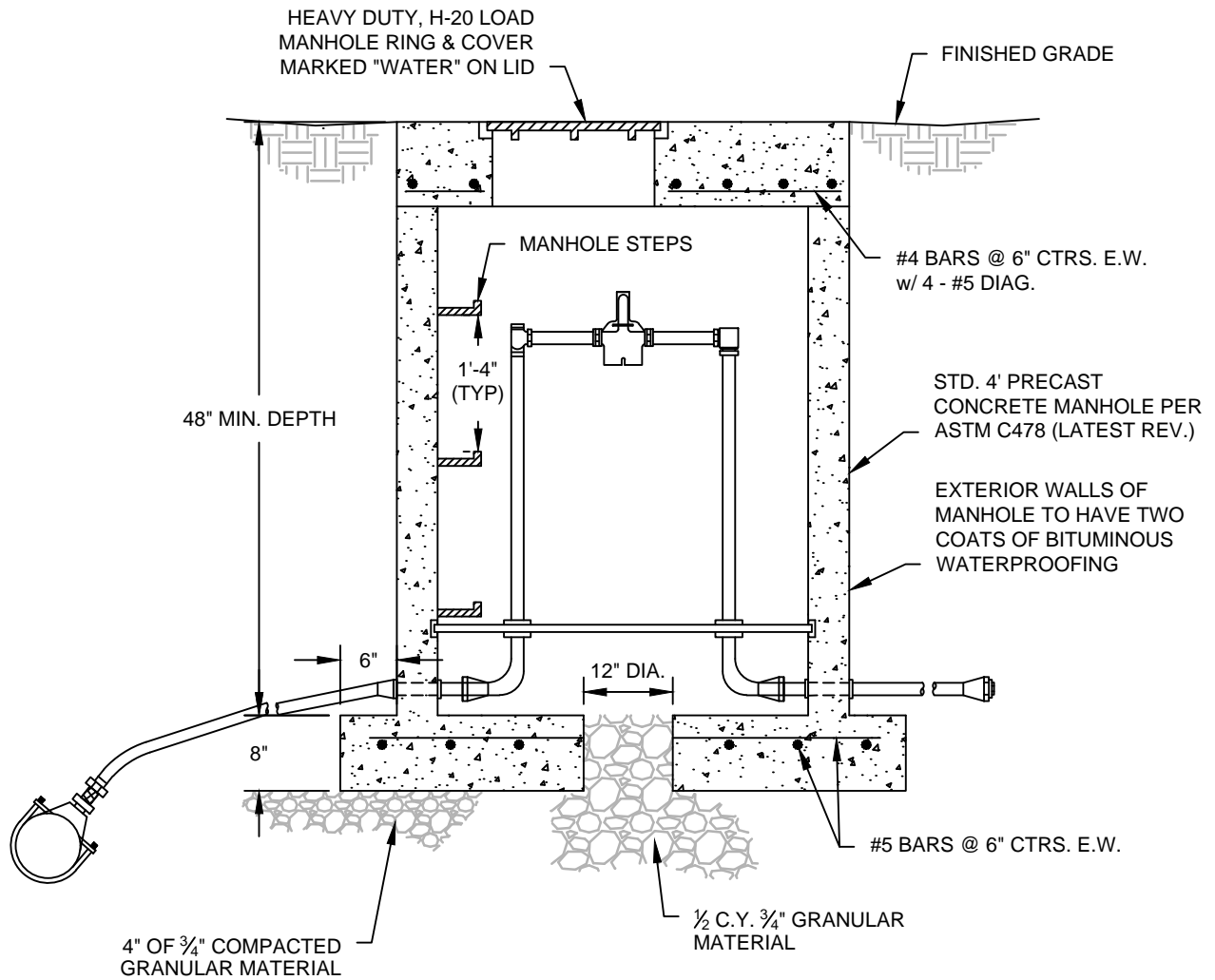
Date Revised: MAY 2025
By: GLF
Checked By: WRJ

**VILLAGE OF KINGDOM CITY
TYPICAL DETAIL
CONCRETE CROSS BLOCK**

Design Guideline: SECTION 3
WATER SYSTEM
Drawing No: 9



Date Revised: MAY 2025	VILLAGE OF KINGDOM CITY TYPICAL DETAIL METER SETTING SIDEWALK OR LAWN $\frac{5}{8}$ "x $\frac{3}{4}$ ", OR 1" METERS	Design Guideline: SECTION 3
By: GLF		WATER SYSTEM
Checked By: WRJ		Drawing No: 11



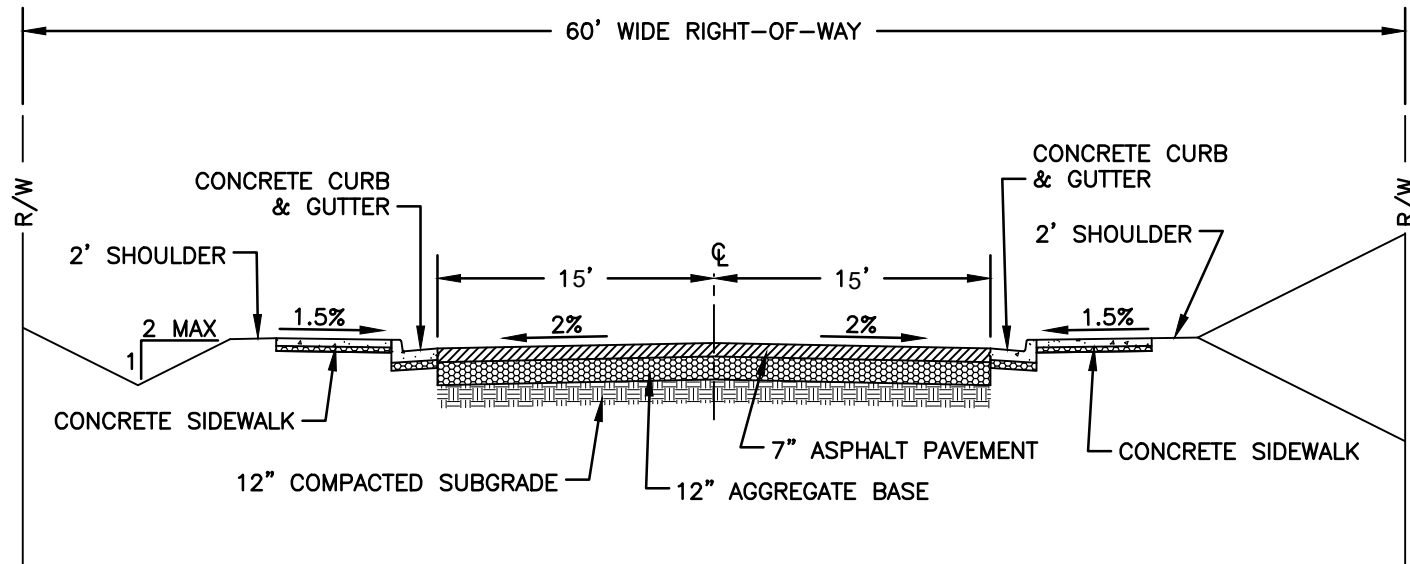
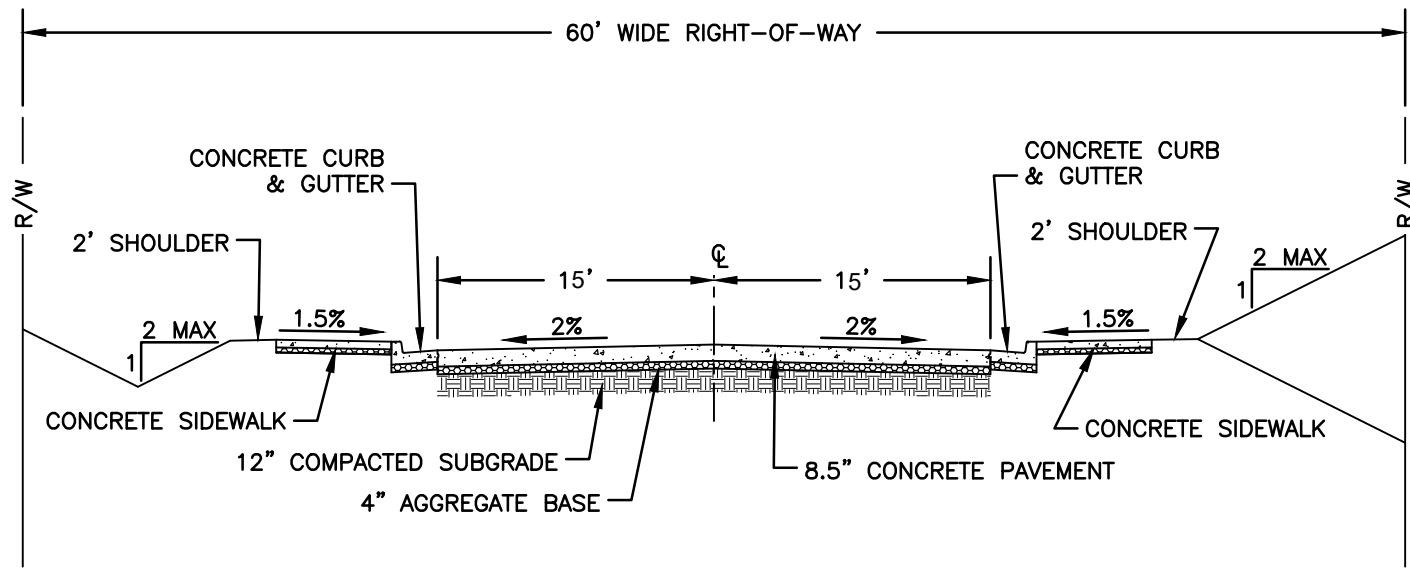
NOTE: WATER METERS IN HARD SPACES SHALL ONLY BE APPROVED ON A CASE BY CASE BASIS AND REQUIRE APPROVAL BY THE CITY MANAGER.

VILLAGE OF KINGDOM CITY
TYPICAL DETAIL
METER VAULT DRIVEWAY OR
PARKING AREA

Design Guideline:
SECTION 3

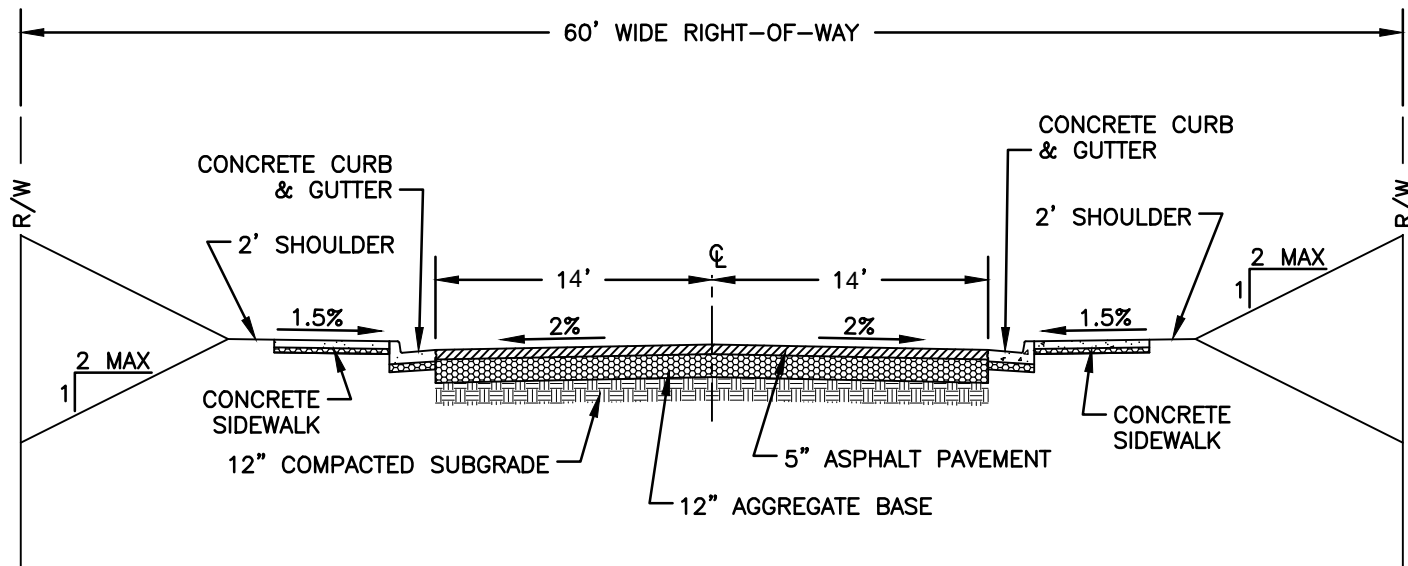
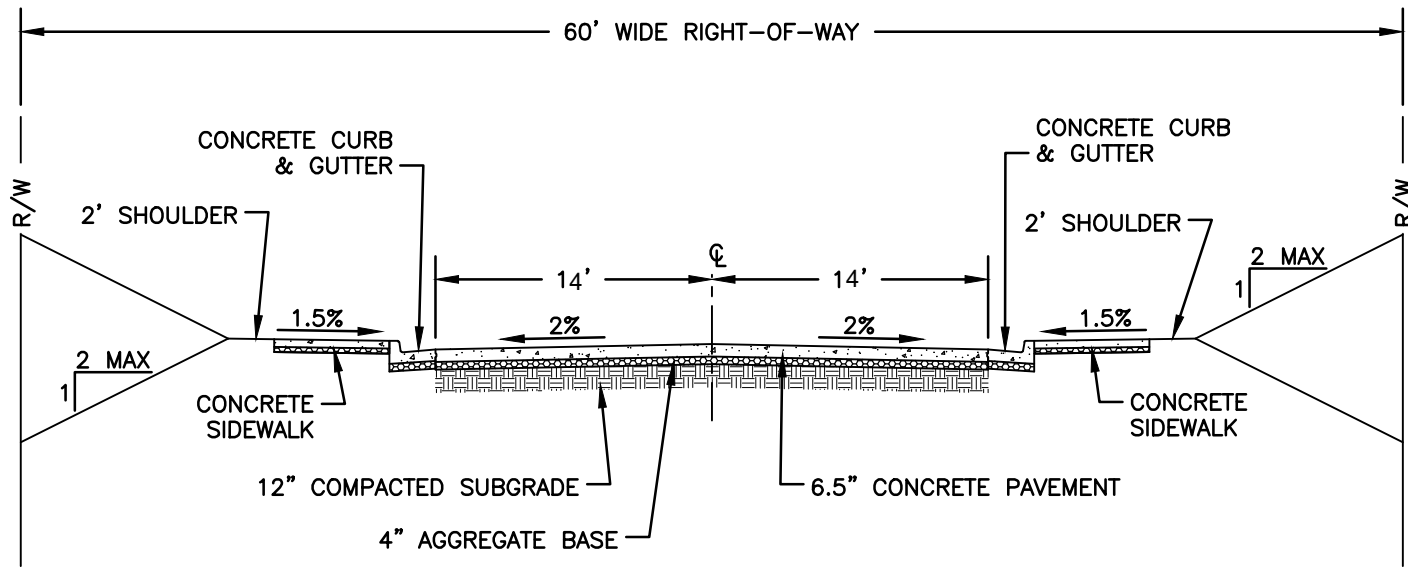
WATER SYSTEM

Drawing No:
12



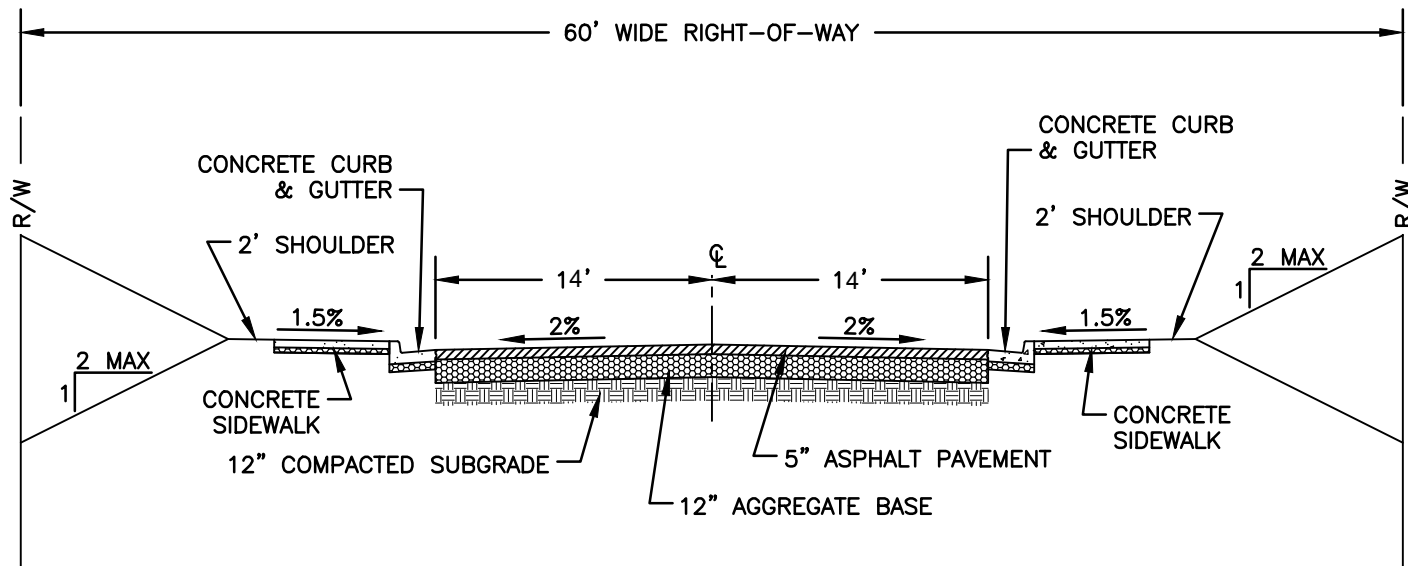
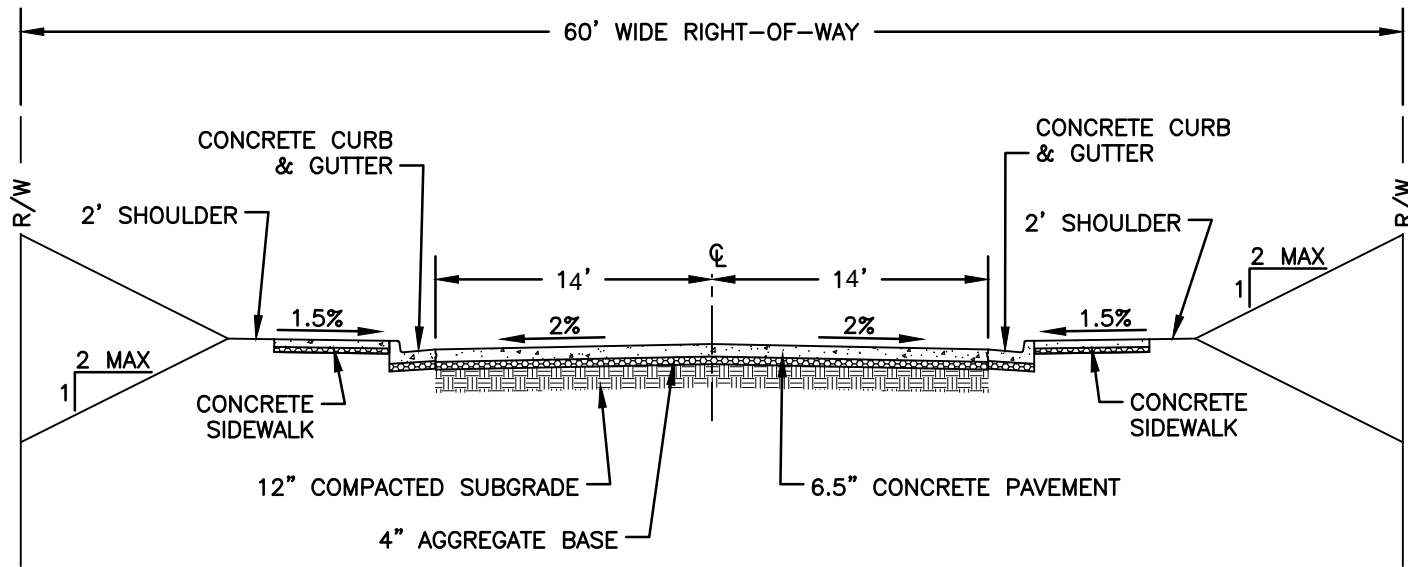
VILLAGE OF KINGDOM CITY
 TYPICAL DETAIL
 ARTERIAL STREET 5,000 TO 10,000 ADT

Design Guideline:
 SECTION 5
 ROADS, STREETS AND
 PARKING AREAS
 Drawing No:
 11



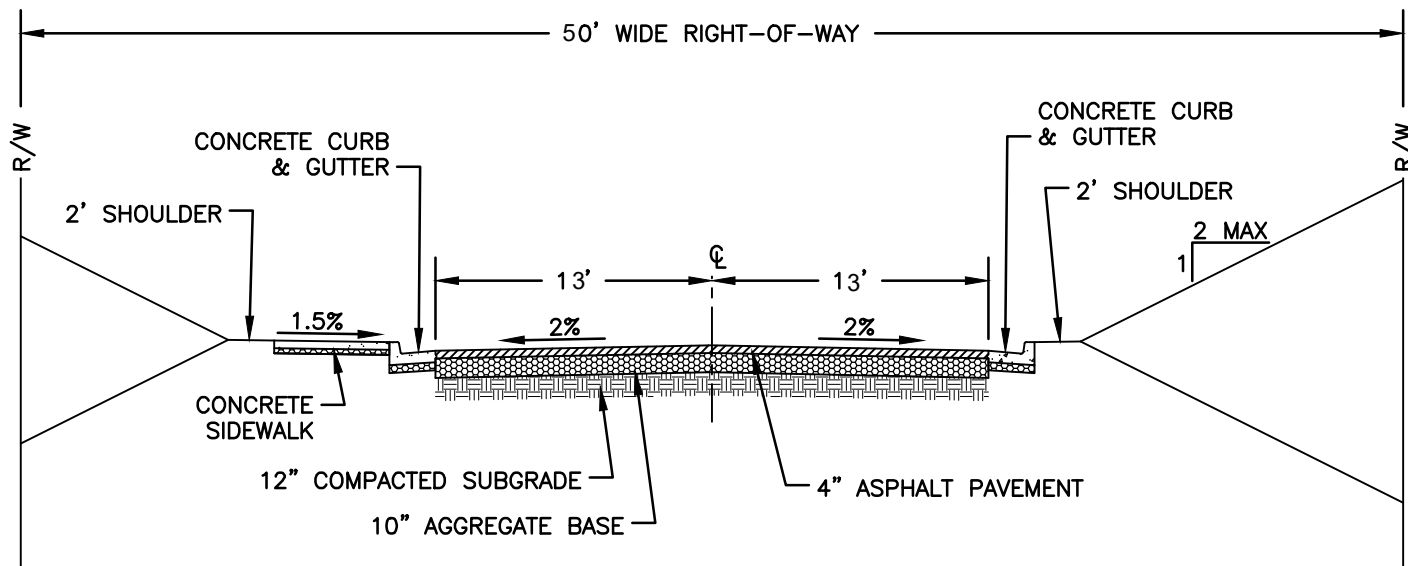
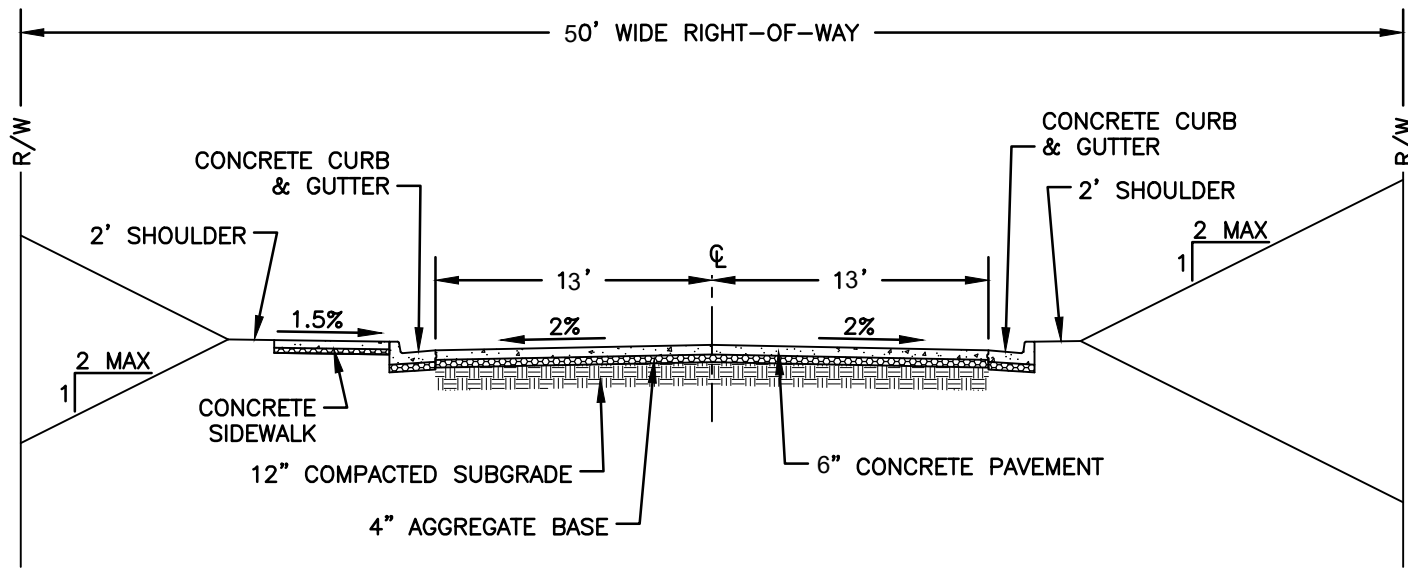
VILLAGE OF KINGDOM CITY
 TYPICAL DETAIL
 COLLECTOR STREET
 1,500 - 3,000

Design Guideline:
 SECTION 5
 ROADS, STREETS AND
 PARKING AREAS
 Drawing No:
 22



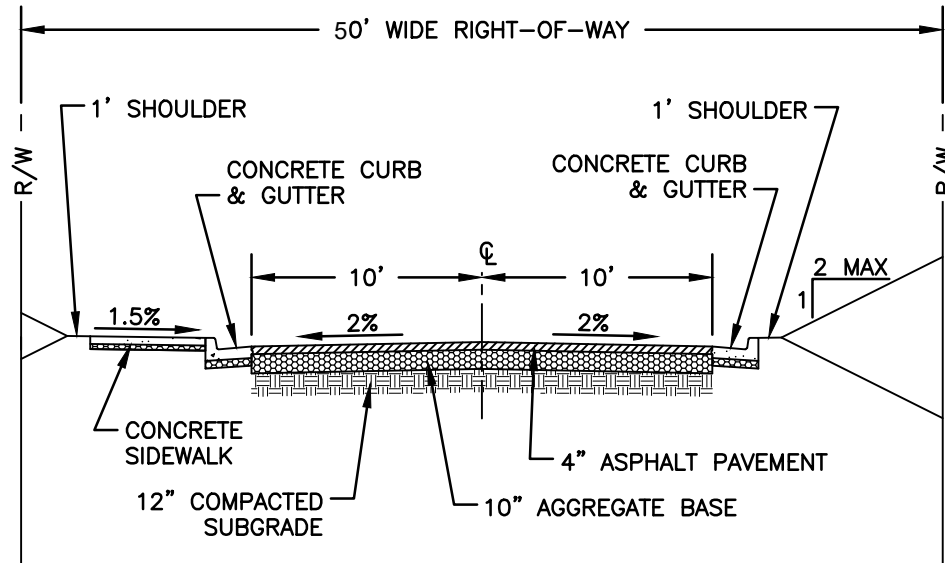
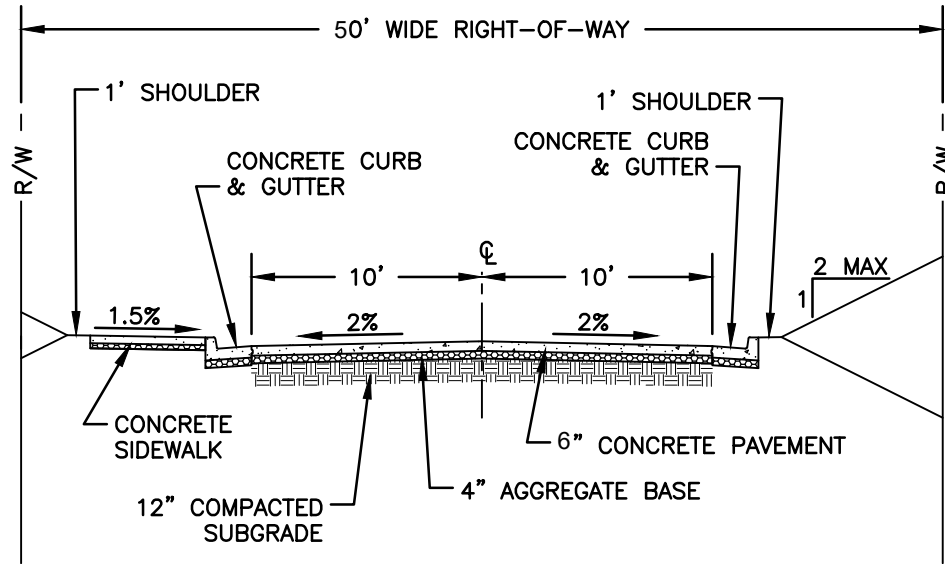
VILLAGE OF KINGDOM CITY
 TYPICAL DETAIL
 COLLECTOR STREET
 3,000 - 5,000

Design Guideline:
 SECTION 5
 ROADS, STREETS AND
 PARKING AREAS
 Drawing No:
 3



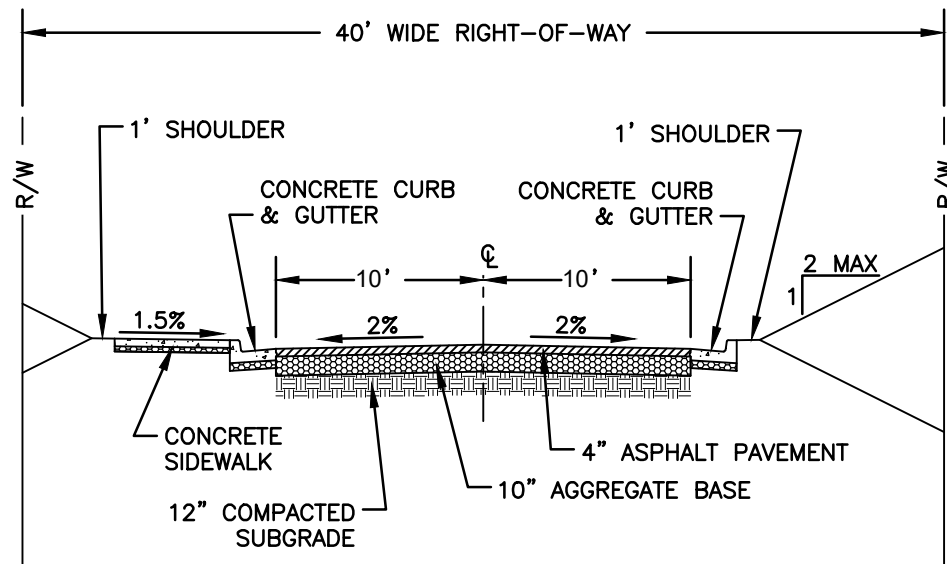
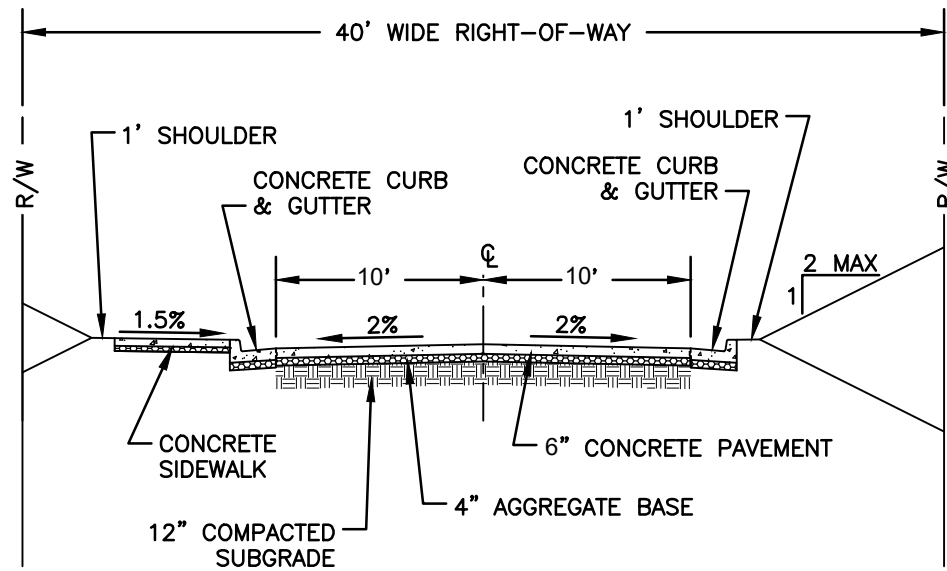
VILLAGE OF KINGDOM CITY
 TYPICAL DETAIL
 LOCAL STREET OVER 1,500 ADT

Design Guideline:
 SECTION 5
 ROADS, STREETS AND
 PARKING AREAS
 Drawing No:
 4



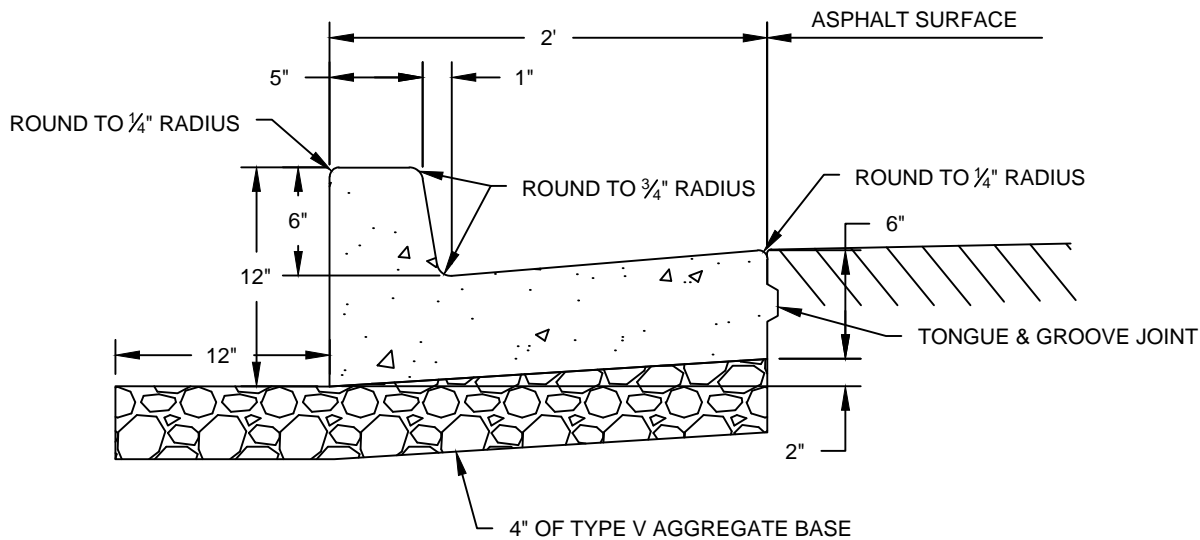
VILLAGE OF KINGDOM CITY
 TYPICAL DETAIL
 LOCAL STREET 400 TO 1,500 ADT

Design Guideline:
 SECTION 5
 ROADS, STREETS AND
 PARKING AREAS
 Drawing No:
 5

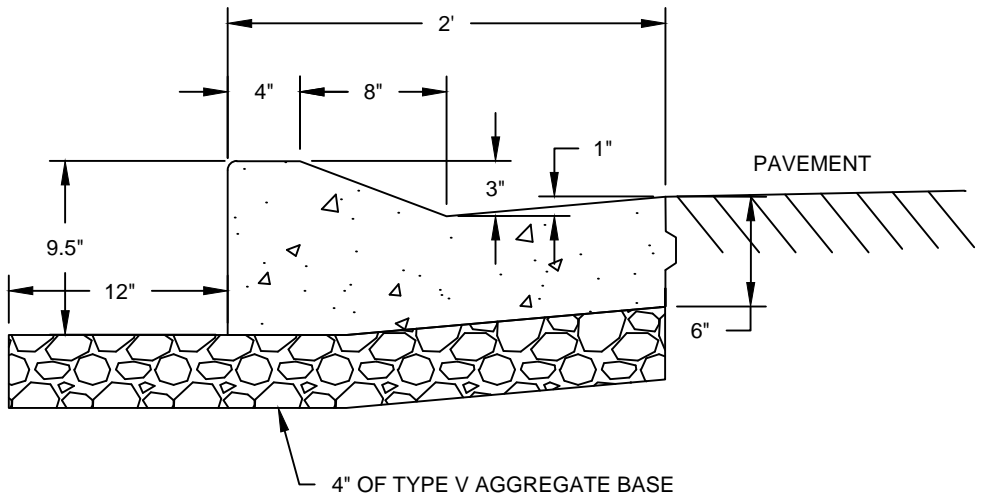


VILLAGE OF KINGDOM CITY
 TYPICAL DETAIL
 LOCAL STREET ONE WAY
 LESS THAN 400

Design Guideline:
 SECTION 5
 ROADS, STREETS AND
 PARKING AREAS
 Drawing No:
 6



BARRIER CURB



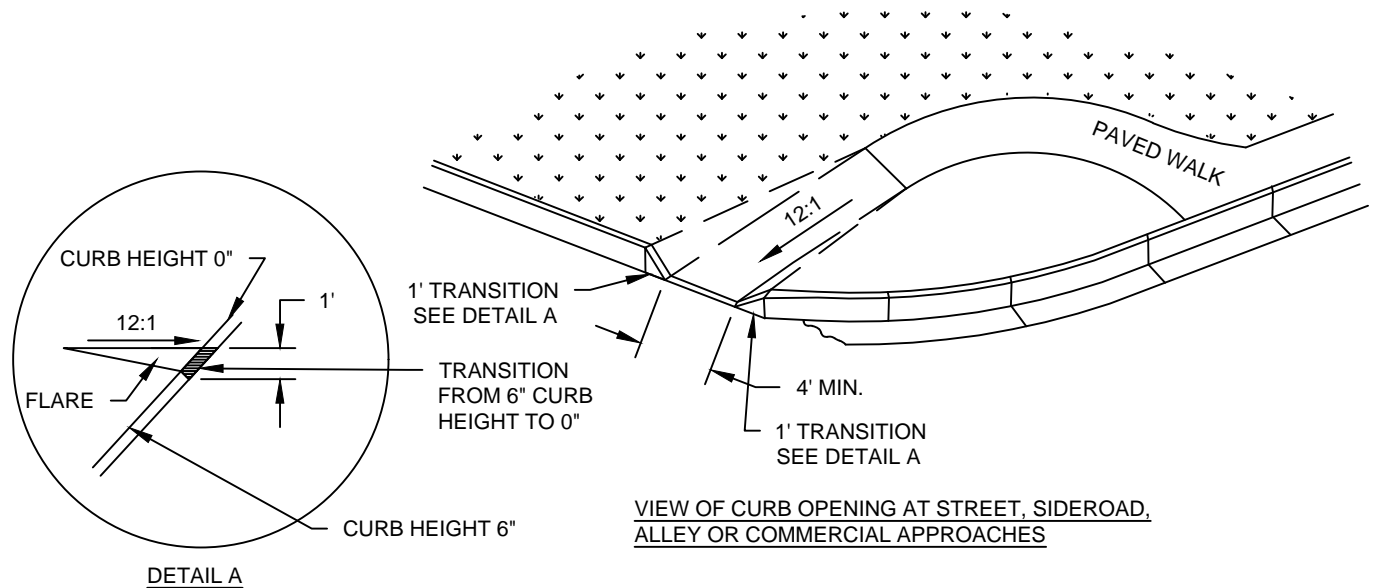
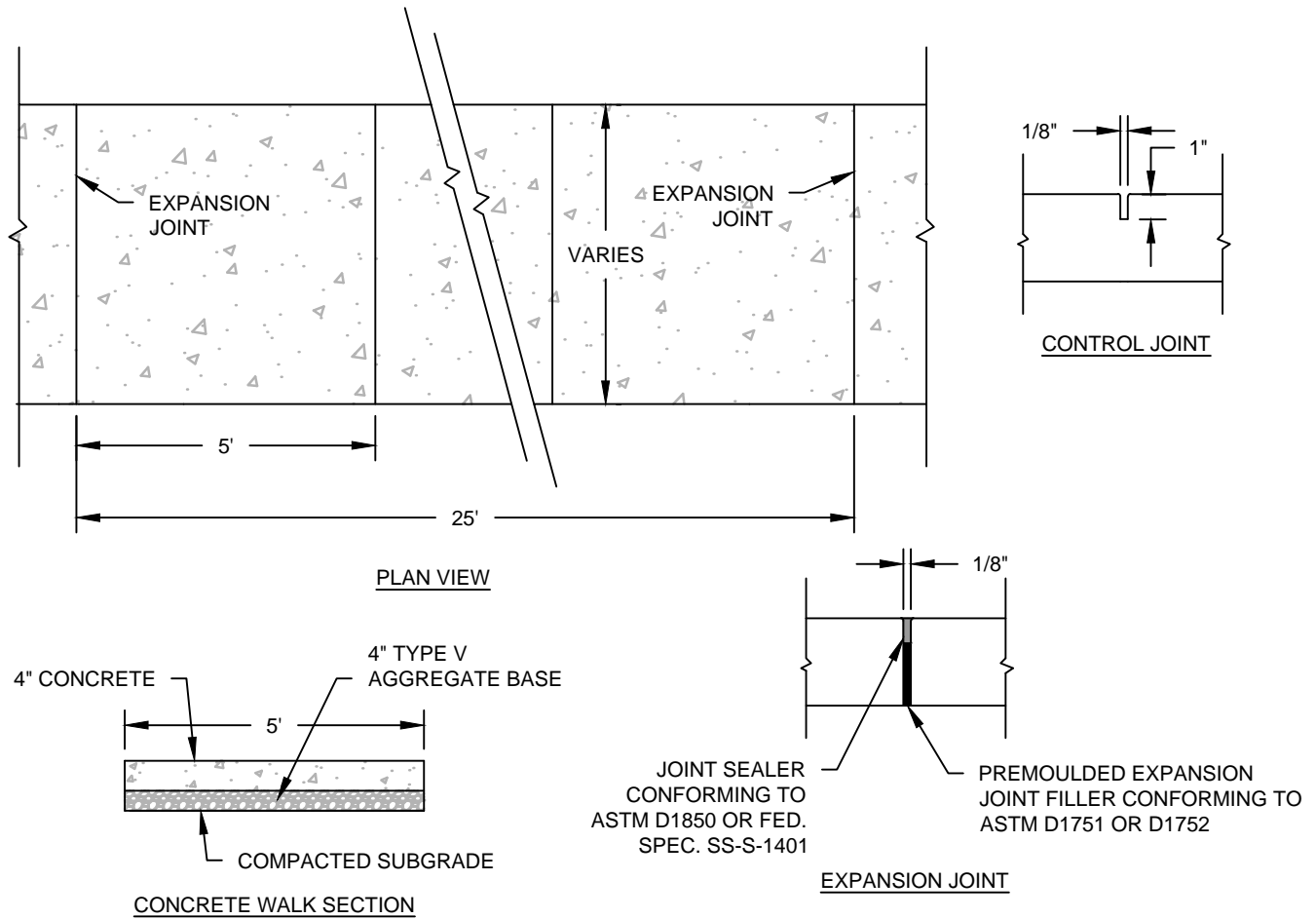
ROLL-BACK CURB

CURB & GUTTER NOTES

1. 3/4" EXPANSION JOINTS TO BE PLACED AT RADIUS POINT JUNCTURES AND AT 250' INTERVALS.
2. 1-1/2" DEEP CONTROL JOINTS SHALL BE INSTALLED AT APPROXIMATELY 15' INTERVALS. JOINTS SHALL PASS THROUGH THE ENTIRE CURB SECTION.
3. A MINIMUM OF 4" AGGREGATE BASE SHALL BE PLACED BENEATH ALL CURB AND GUTTER SECTIONS.

**VILLAGE OF KINGDOM CITY
TYPICAL DETAIL CURB AND
GUTTER**

Design Guideline:
SECTION 5
ROADWAY, STREETS,
AND PARKING
Drawing No.:
7

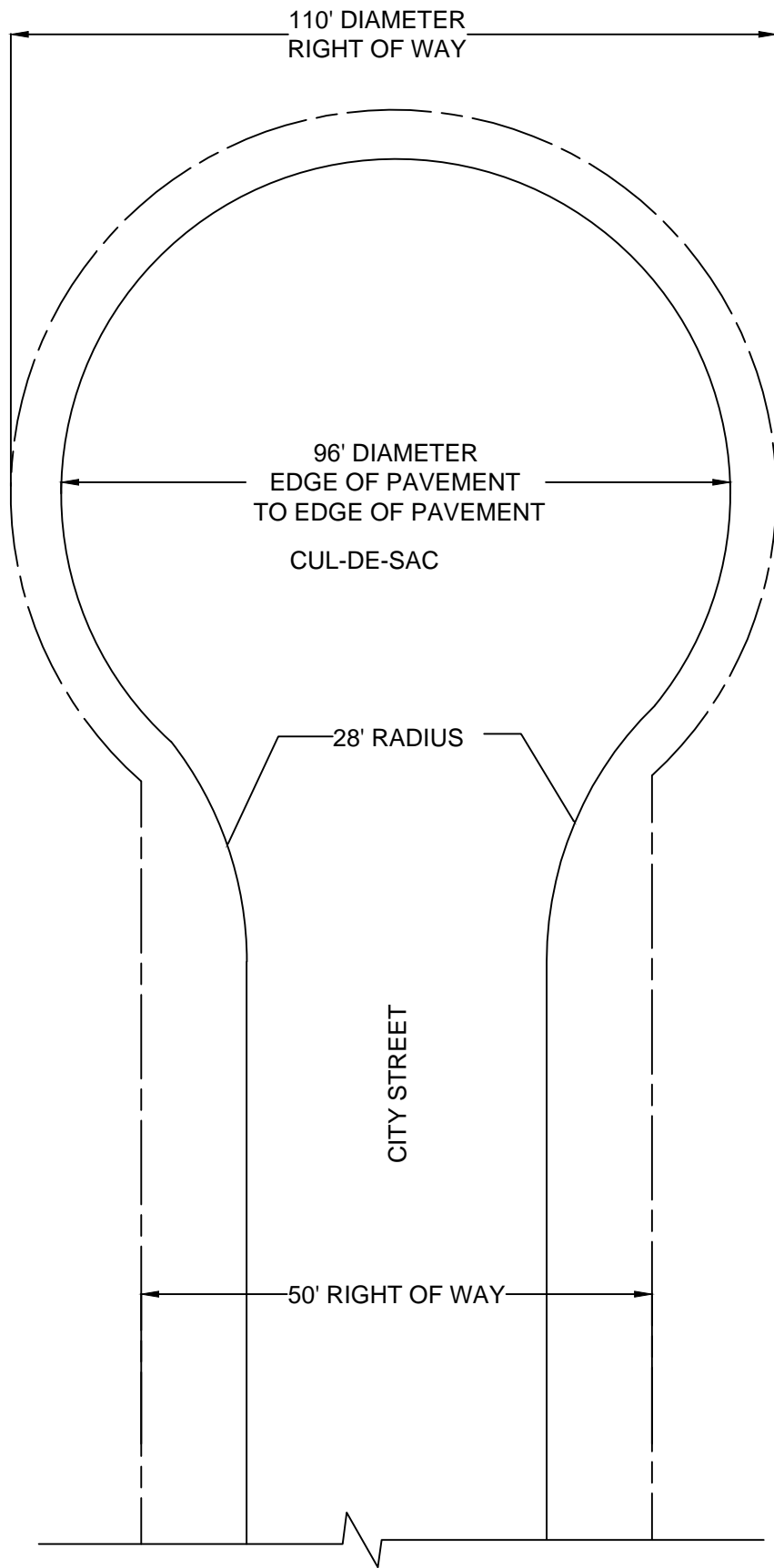


VILLAGE OF KINGDOM CITY
TYPICAL DETAIL
SIDEWALK

Design Guideline:
SECTION 5
ROADWAY, STREETS,
AND PARKING

Drawing No.:

8



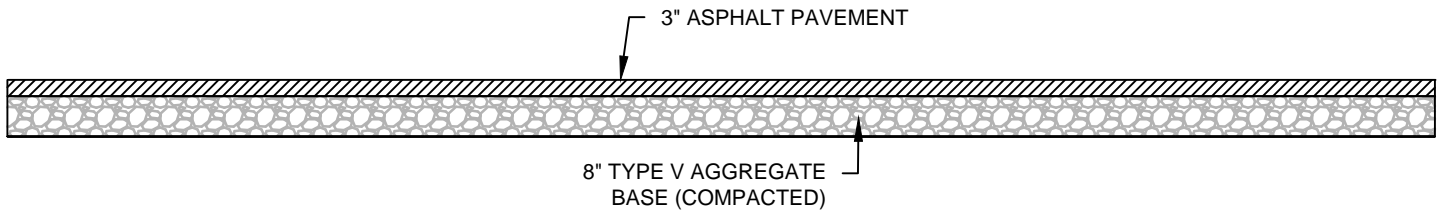
VILLAGE OF KINGDOM CITY
TYPICAL DETAIL
CUL-DE-SAC

Design Guideline:
SECTION 5
ROADWAY, STREETS,
AND PARKING

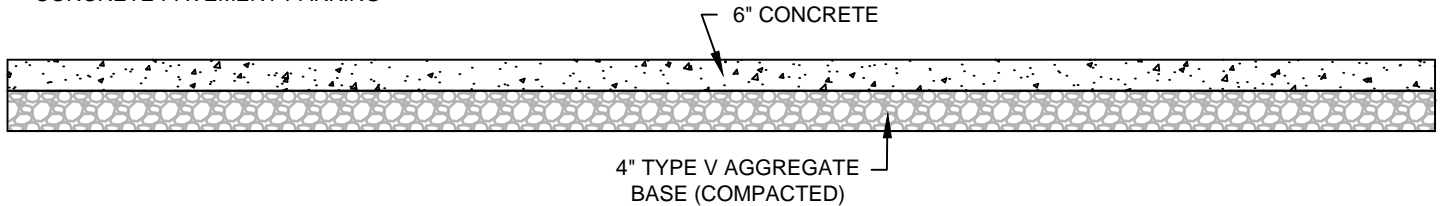
Drawing No.:

9

ASPHALT PAVEMENT PARKING

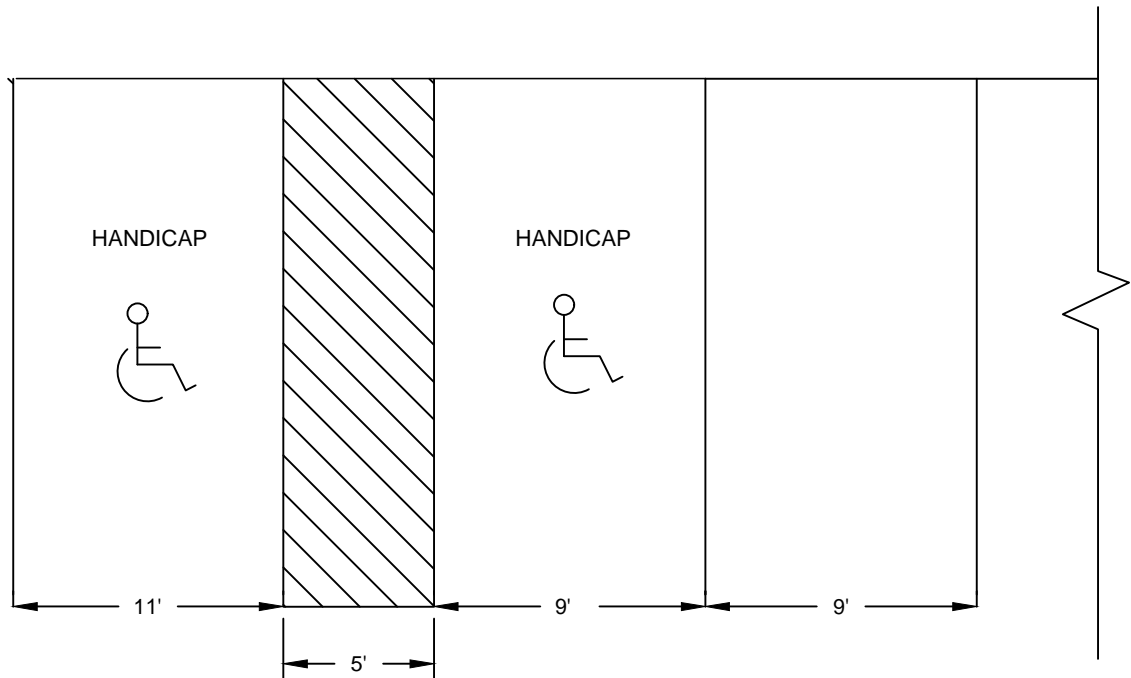


CONCRETE PAVEMENT PARKING



MINIMUM CROSS-SLOPES FOR DRAINAGE IS 0.5% ONE AXIS AND 1.0% TRANSVERSE AXIS.

TYPICAL STRUCTURAL SECTION PAVED PARKING
NOT TO SCALE

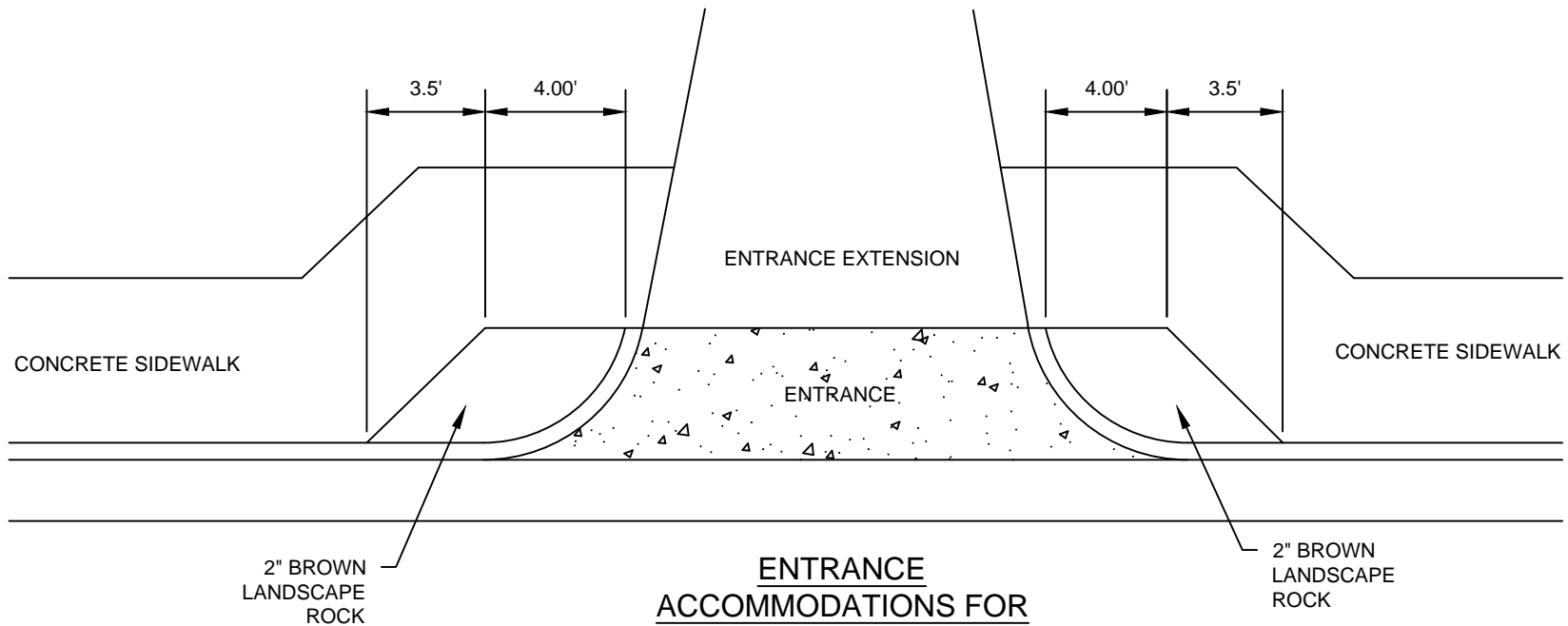


NOTE:
ALL PARKING LINES ARE 4"x 17-1/2"
HANDICAP EMBLEMS ARE AT LEAST 34" WIDE
BY 39" HEIGHT
ALL PAINT AND PAINT APPLICATIONS SHALL
CONFORM TO MoDOT SPECIFICATIONS

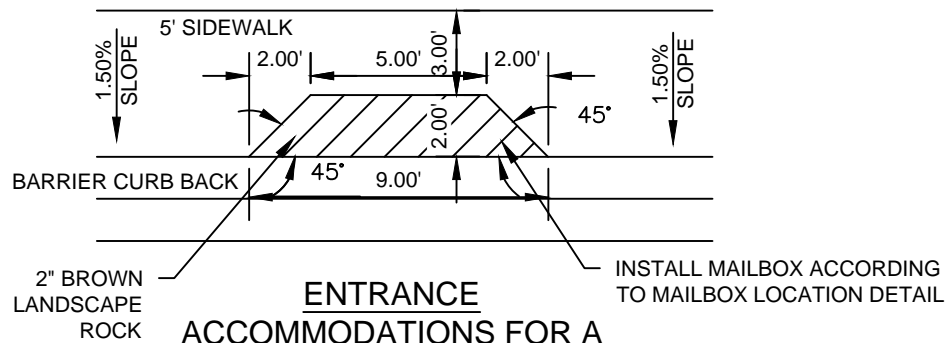
TYPICAL MARKED PARKING AREA WITH HANDICAP PARKING
NOT TO SCALE

VILLAGE OF KINGDOM CITY
TYPICAL DETAIL
PARKING AREA

Design Guideline:
SECTION 5
ROADWAY, STREETS,
AND PARKING
Drawing No.:
10



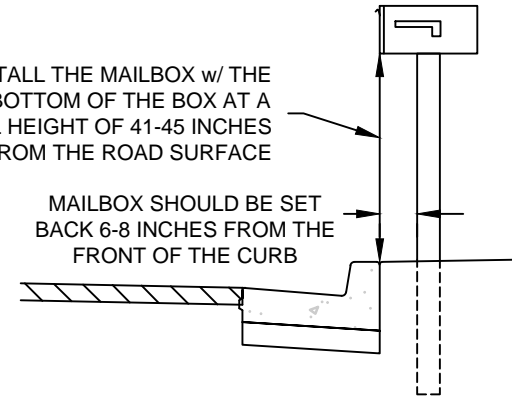
**ENTRANCE
ACCOMMODATIONS FOR
A MAILBOX ALONG SIDEWALK**
NOT TO SCALE



**ENTRANCE
ACCOMMODATIONS FOR A
MAILBOX ALONG SIDEWALK**
NOT TO SCALE

INSTALL THE MAILBOX w/ THE
BOTTOM OF THE BOX AT A
VERTICAL HEIGHT OF 41-45 INCHES
FROM THE ROAD SURFACE

MAILBOX SHOULD BE SET
BACK 6-8 INCHES FROM THE
FRONT OF THE CURB



MAILBOX LOCATION
NOT TO SCALE

**VILLAGE OF KINGDOM CITY
TYPICAL DETAIL
MAILBOX ACCOMMODATIONS**

Design Guideline:
SECTION 5
ROADS, STREETS AND
PARKING AREAS
Drawing No:
11

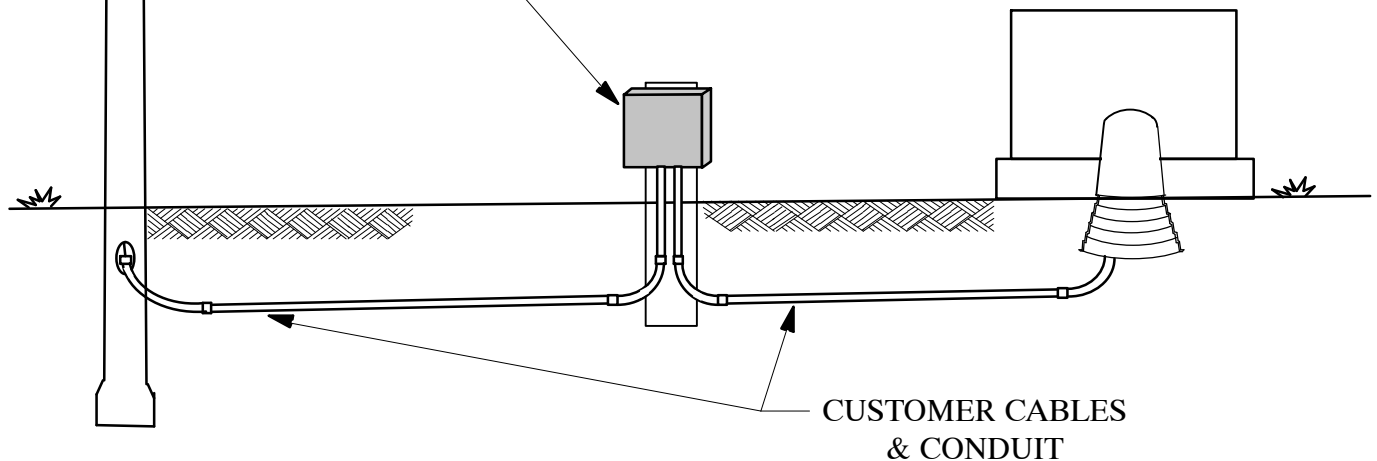
FOR MISSOURI ONLY
CUSTOMER OWNED LIGHTING (6M)
UNMETERED INSTALLATION

Figure 700-12

CUSTOMER OWNED
LIGHT STANDARD

1. CUSTOMER OWNED NEMA WEATHERTIGHT ENCLOSURE.
2. DISCONNECTING MEANS BREAKER OR FUSED DISCONNECT LOCATION APPROVED BY AMEREN.
3. NO GREATER THAN 5 FT FROM AMEREN SOURCE AND NOT HINDER TRANSFORMER DOOR OPENING & OPERATING.

AMEREN
PADMOUNT TRANSFORMER
OR PEDESTAL

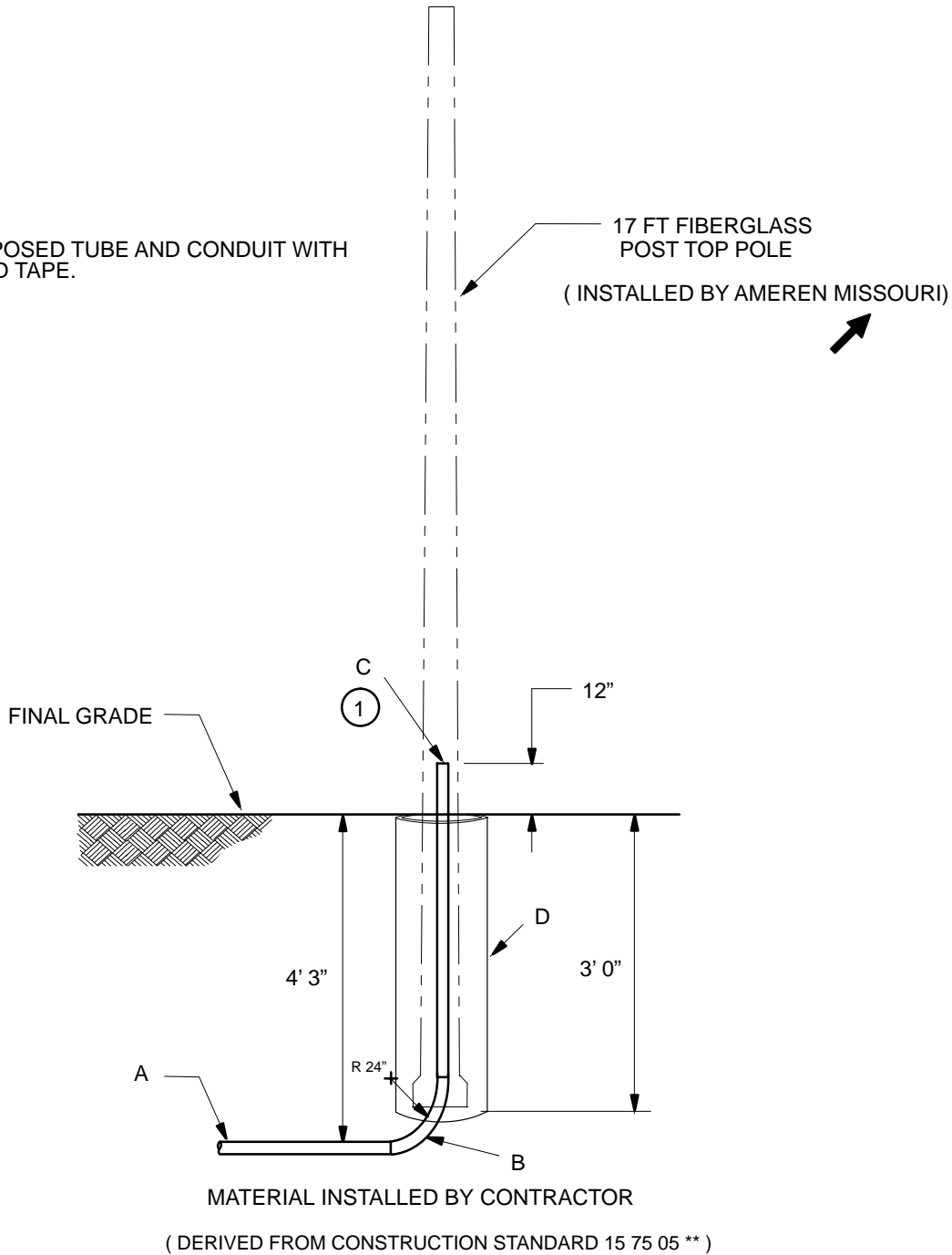


CUSTOMER TO INSTALL UG CABLE OR CONDUIT AND CABLE
INTO AMEREN TRANSFORMER OR PEDESTAL.
AMEREN TO CONNECT WITH PLUG FUSE.

OUTDOOR LIGHTING – STREETLIGHT
 Post Top Installation Fiberglass Pole
 14 Foot Mounting Height

NOTE:

- ① SEAL EXPOSED TUBE AND CONDUIT WITH PLUG AND TAPE.



	Material / Stk. No.	Description	Qty.
A	12 01 298	Conduit – Plastic, PVC, Sch. 40, 1-1/2" X 20' w Coupling	As Req'd
B	12 51 331	Bend – Plastic, 1-1/2", 24" Rad.	1
C	12 51 330	Plug – Conduit, Plastic, 1-1/2"	1
D		Pipe – Plastic Culvert, 15" I.D.	3'

1. Conduit must be centered in tube and both conduit and tube must be plumb before backfilling.

TECHNICAL SPECIFICATIONS

SECTION 01100 - SUMMARY**PART 1 - GENERAL****1.1 SUMMARY**

- A. This Section includes the following:
 - 1. Use of premises.
 - 2. Owner's occupancy requirements.
 - 3. Specification formats and conventions.

1.2 USE OF PREMISES

- A. General: Contractor shall have full use of premises for construction operations, including use of Project site, during construction period. Contractor's use of premises is limited only by Owner's right to perform work or to retain other contractors on portions of Project.
- B. General: Contractor shall have limited use of premises for construction operations as indicated on Drawings by the Contract limits.
- C. Use of Site: Limit use of premises to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
 - 1. Owner Occupancy: Allow for Owner occupancy of Project site and use by the public.
 - 2. Driveways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
 - a. Schedule deliveries to minimize use of driveways and entrances.
 - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

1.3 SPECIFICATION FORMATS AND CONVENTIONS

- A. Specification Format: The Specifications are organized into Divisions and Sections using the 16-division format and CSI/CSC's "MasterFormat" numbering system.
 - 1. Division 1: Sections in Division 1 govern the execution of the Work of all Sections in the Specifications.
- B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
 - 2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.

- a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01100

SECTION 01330 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. See Division 1 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.

1.2 DEFINITIONS

- A. Action Submittals: Written and graphic information that requires Engineer's responsive action.
- B. Informational Submittals: Written information that does not require Engineer's responsive action. Submittals may be rejected for not complying with requirements.

1.3 SUBMITTAL PROCEDURES

- A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - 2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- B. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Engineer's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
 - 1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Engineer will advise Contractor when a submittal being processed must be delayed for coordination.
 - 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 - 3. Resubmittal Review: Allow 15 days for review of each resubmittal.
- C. Deviations: Highlight, encircle, or otherwise specifically identify deviations from the Contract Documents on submittals.
- D. Additional Copies: Unless additional copies are required for final submittal, and unless Engineer observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.
 - 1. Additional copies submitted for maintenance manuals will not be marked with action taken and will be returned.

- E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

- A. General: Prepare and submit Action Submittals required by individual Specification Sections.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
 2. Mark each copy of each submittal to show which products and options are applicable.
 3. Include the following information, as applicable:
 - a. Manufacturer's written recommendations.
 - b. Manufacturer's product specifications.
 - c. Manufacturer's installation instructions.
 - d. Manufacturer's catalog cuts.
 - e. Wiring diagrams showing factory-installed wiring.
 - f. Printed performance curves.
 - g. Operational range diagrams.
 - h. Compliance with specified referenced standards.
 - i. Testing by recognized testing agency.
 4. Number of Copies: Submit three copies of Product Data, unless otherwise indicated. Engineer will return two copies. Mark up and retain one returned copy as a Project Record Document.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Dimensions.
 - b. Identification of products.
 - c. Fabrication and installation drawings.
 - d. Roughing-in and setting diagrams.
 - e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
 - f. Shopwork manufacturing instructions.
 - g. Templates and patterns.
 - h. Schedules.
 - i. Notation of coordination requirements.
 - j. Notation of dimensions established by field measurement.
 - k. Relationship to adjoining construction clearly indicated.
 - l. Seal and signature of professional engineer if specified.
 - m. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
 2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm) but no larger than 30 by 40 inches (750 by 1000 mm).
 3. Number of Copies: Submit four opaque (bond) copies of each submittal. Engineer will return three copies.

- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 2. Identification: Attach label on unexposed side of Samples that includes the following:
 - a. Generic description of Sample.
 - b. Product name and name of manufacturer.
 - c. Sample source.
 - d. Number and title of appropriate Specification Section.
 3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit two full sets of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Engineer will return submittal with options selected.
 5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit three sets of Samples. Engineer will retain two Sample sets; remainder will be returned.
- E. Product Schedule or List: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location.
1. Number of Copies: Submit three copies of product schedule or list, unless otherwise indicated. Engineer will return two copies.
- F. Submittals Schedule: Comply with requirements specified in Division 1 Section "Construction Progress Documentation."
- G. Application for Payment: Comply with requirements specified in General Conditions.
- H. Schedule of Values: Comply with requirements specified in General Conditions.

2.2 INFORMATIONAL SUBMITTALS

- A. General: Prepare and submit Informational Submittals required by other Specification Sections.
1. Number of Copies: Submit two copies of each submittal, unless otherwise indicated. Engineer will not return copies.
 2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
 3. Test and Inspection Reports: Comply with requirements specified in Division 1 Section "Quality Requirements."

- B. Coordination Drawings: Comply with requirements specified in Division 1 Section "Project Management and Coordination."
- C. Contractor's Construction Schedule: Comply with requirements specified in Division 1 Section "Construction Progress Documentation."
- D. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of Engineers and owners, and other information specified.
- E. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.
- F. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- G. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- H. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- I. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- J. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- K. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- L. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project.
- M. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- N. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- O. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- P. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements specified in Division 1 Section "Operation and Maintenance Data."
- Q. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

- R. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer.
- S. Material Safety Data Sheets (MSDSs): Submit information directly to Owner; do not submit to Engineer.
 - 1. Engineer will not review submittals that include MSDSs and will return them for resubmittal.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Engineer.
- B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ENGINEER'S ACTION

- A. General: Engineer will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Action Submittals: Engineer will review each submittal, make marks to indicate corrections or modifications required, and return it. Engineer will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:
 - 1. Rejected.
 - 2. Revise and Resubmit.
 - 3. Exceptions Taken.
 - 4. No Exceptions Taken.
- C. Informational Submittals: Engineer will review each submittal and will not return it, or will return it if it does not comply with requirements. Engineer will forward each submittal to appropriate party.
- D. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.
- E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 01330

SECTION 01500 – MOBILIZATION AND TRAFFIC CONTROL**PART 1 – GENERAL**

1.1 SUMMARY

- A. Section Includes
 - 1. Mobilization
 - 2. Traffic Control

1.2 DEFINITIONS

- A. Acronyms and Abbreviations
 - ANSI – American National Standards Institute
 - MoDOT – Missouri Department of Transportation
 - MUTCD – Manual on Uniform Traffic Control Devices

1.3 QUALITY ASSURANCE

- A. The Engineer shall have the right to reject construction tools, equipment, materials, and supplies that are, in their opinion, unsafe, improper, or inadequate. The Contractor shall bring rejected tools, equipment, materials, and supplies to acceptable conditions or remove them from the project site.

PART 2 – PRODUCTS

2.1 Traffic Control Devices. All temporary traffic control devices shall be manufactured as shown on the plans and as specified, in accordance with MUTCD requirements and MoDOT Quality Standards for Temporary Control Devices. Devices shall be NCHRP 350 compliant. All temporary traffic control devices shall exhibit good workmanship and shall be free of objectionable marks or defects that affect appearance or serviceability.

2.2 Channelizers and Tubular Markers. All channelizers and tubular markers shall be manufactured from a non-metallic material, pigmented and molded of a Highway Orange color throughout and stabilized against fading by ultraviolet or other light rays by the incorporation of adequate inhibitors. Drum-like channelizers shall be closed-top. Slim-line channelizers will be acceptable for use on the project.

2.3 Signs

- A. Rigid Signs.
 - 1. Sign Substrate. All signs shall be fabricated of substrate designed to provide satisfactory structural rigidity.
 - 2. Sign Sheeting. All signs shall have a retroreflectorized background. Sheeting shall be applied to the sign substrate in accordance with the manufacturer's recommendations and the surface shall be free of air bubbles, wrinkles or other blemishes as determined by the Engineer.
- B. Roll-up Signs.
 - 1. Sign Substrate. Sign and overlay blanks shall consist of fluorescent orange microprismatic retroreflective sheeting sealed to a heavy-duty coated fabric or vinyl material.

PART 3 – EXECUTION3.1 MOBILIZATION

Mobilization shall consist of preparatory work and operations, including, but not limited to, those necessary for the movement of personnel, equipment, supplies, and incidentals to the project site; for the establishment of all offices, buildings, and other facilities necessary for work on the project except as provided in the contract as separate pay items; and for all other work and operations which must be performed or costs incurred prior to beginning work on the various items on the project site.

- A. DELIVERY. Delivery to the project site of construction tools, equipment, materials, and supplies shall be accomplished in conformance with local governing regulations.

B. EXECUTION

Provide personnel, construction tools, equipment, materials, and supplies that will facilitate the timely execution of the work. Upon completion of the work, remove construction tools, apparatus, equipment, unused materials and supplies, plants, and personnel from the project site.

3.2 TRAFFIC CONTROL

A. Traffic control shall consist of furnishing, installing, relocating, maintaining and removing, temporary or permanent traffic control devices in accordance with the contract and as directed by the Engineer. Traffic control shall be the responsibility of the Contractor and shall be in accordance with the latest edition of the Manual on Uniform Traffic Control Devices (MUTCD).

B. Safety Requirements.

1. All workers within highway right of way who are exposed to traffic or construction equipment shall wear high-visibility safety apparel meeting Class 2 or Class 3 requirements of ANSI/ISEA 107-2004 publication entitled, "American National Standard for High-Visibility Safety Apparel and Headwear".
2. All traffic control devices shall be in accordance with the MUTCD and any applicable safety and design codes.
3. The Contractor shall: (a) Designate a trained person at the project level who has the primary responsibility, with sufficient authority, for implementing the traffic management plan and other safety and mobility aspects of the project. The name of that person and a 24-hour contact number for that person shall be provided to the Engineer at the pre-construction meeting. (b) Ensure all Contractor personnel are trained in traffic control to a level commensurate with their responsibilities. (c) Advise the Engineer, as required, at least two working days before any work requiring a lane closure begins and 14 calendar days prior to the imposition of height, width and weight restrictions. (d) Perform quality control of work zones to promote consistency and ensure compliance with contract documents, policies and guidelines.

C. Construction Requirements.

1. Performance and operational aspects of the devices shall be in accordance with the latest editions of the MUTCD and the Missouri Quality Standards for Temporary Traffic Control Devices.
2. All traffic control devices shall be removed as soon as practical when the devices are no longer needed. When work is suspended for short periods of time, traffic control devices that are no longer appropriate shall be turned away from traffic, removed or covered. All temporary traffic control devices shall be removed after the completion of construction and shall remain the property of the Contractor unless specified otherwise. All permanent traffic control devices that are in conflict with temporary traffic control devices shall be covered or removed as shown on the plans or as directed by the Engineer. Upon completion of the work, all permanent traffic control devices to remain in place shall be restored to original condition.
3. All sign covers shall meet the requirements of the MoDOT Quality Standards for Temporary Traffic Control Devices.
4. All permanent traffic control devices relocated on a temporary basis shall be moved in the timeframe designated by the Engineer, and shall remain visible to the traveling public during all stages of construction. The Contractor shall place temporarily relocated permanent traffic control devices in the final location when construction is complete. Damaged devices shall be replaced by the Contractor at the Contractor's expense.
5. With the Engineer's approval, the Contractor may add to the traffic control plan any temporary traffic control devices or services the Contractor considers necessary to adequately protect the public and the work.
6. All changes to the traffic control plan resulting from Contractor staging revisions, including proposed total road closures for the Contractor's convenience, shall be submitted in writing to the Engineer for review and acceptance prior to implementation.
7. If the Engineer determines the need for additional traffic control devices not included in the traffic control plan, the Contractor will be notified in writing to provide the additional devices at no cost to the project.
8. The Contractor shall monitor traffic flow through the project and verify that all traffic control devices are in place and functioning properly during both daytime and nighttime conditions, as applicable. If the Contractor determines that a deficiency in any traffic control device exists, the Contractor shall take corrective action. No payment will be made for the corrective action.

9. As soon as possible after observing a traffic control deficiency, the Engineer will report the deficiency to the Contractor, either verbally or in writing. After receiving notification, if the Contractor does not make corrections within 24 hours, suspension of the work may occur. Regardless of the severity of the deficiency, corrections shall be made as soon as possible to maintain a quality work zone.
 10. The Contractor shall provide written notice to the Engineer of any pedestrian or vehicular accident when physical evidence or other information suggests an accident has occurred in the work zone. The Contractor shall obtain and provide to the Engineer copies of law enforcement accident reports for any accidents in the work zone.
- D. Lighting Requirements.
1. Flashing Arrow Panel. The Contractor shall deploy, operate and maintain flashing arrow panels as specified on the plans for the duration of the project, in accordance with the manufacturer's recommendations, at the Contractor's expense. A minimum vertical clearance of 7 feet (2.1 m) shall be maintained from the edge of pavement to the bottom of the flashing arrow panel.

END SECTION 01500

SECTION 01770 - CLOSEOUT PROCEDURES**PART 1 - GENERAL****1.1 SUMMARY**

- A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Inspection procedures.
 - 2. Warranties.
 - 3. Final cleaning.
- B. See Section 01781 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
- C. See Divisions 2 through 16 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.2 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
 - 1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
 - 2. Advise Owner of pending insurance changeover requirements.
 - 3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 5. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs, damage or settlement surveys, property surveys, and similar final record information.
 - 6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
 - 7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 - 8. Complete startup testing of systems.
 - 9. Submit test/adjust/balance records.
 - 10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 - 11. Advise Owner of changeover in heat and other utilities.
 - 12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
 - 13. Complete final cleaning requirements, including touchup painting.
 - 14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

1.3 FINAL COMPLETION

- A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:
 - 1. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 - 2. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.

- B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
 - 1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.4 WARRANTIES

- A. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
 - 1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (215-by-280-mm) paper.
 - 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 - 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
- B. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
 - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Remove labels that are not permanent.
 - f. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

- 1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
 - g. Replace parts subject to unusual operating conditions.
 - h. Leave Project clean and ready for use.
- B. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION 01770

SECTION 01781 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Record Product Data.
- B. See Divisions 2 through 16 Sections for specific requirements for Project Record Documents of the Work in those Sections.

1.2 SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit one set of marked-up Record Prints.
- B. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit one copy of each Product Data submittal.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.
 - 1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
 - 2. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
 - 3. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 - 4. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

- B. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize Record Prints and newly prepared Record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 2. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Architect.
 - e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
 4. Note related Change Orders and Record Drawings where applicable.

2.3 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.

2.4 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.
- B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition,

protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

END OF SECTION 01781

SECTION 01782 - OPERATION AND MAINTENANCE DATA**PART 1 - GENERAL****1.1 SUMMARY**

- A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Emergency manuals.
 - 2. Operation manuals for systems, subsystems, and equipment.
 - 3. Maintenance manuals for the care and maintenance of products, materials, and finishes and systems and equipment.
- B. See Divisions 2 through 16 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

PART 2 - PRODUCTS**2.1 MANUALS, GENERAL**

- A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain a title page, table of contents, and manual contents.
- B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:
 - 1. Subject matter included in manual.
 - 2. Name and address of Project.
 - 3. Name and address of Owner.
 - 4. Date of submittal.
 - 5. Name, address, and telephone number of Contractor.
 - 6. Name and address of Architect.
 - 7. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
 - 1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch (215-by-280-mm) paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - a. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
 - 2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in

the section on each divider, cross-referenced to Specification Section number and title of Project Manual.

3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
4. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.2 OPERATION MANUALS

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and equipment descriptions, operating standards, operating procedures, operating logs, wiring and control diagrams, and license requirements.
- B. Descriptions: Include the following:
 1. Product name and model number.
 2. Manufacturer's name.
 3. Equipment identification with serial number of each component.
 4. Equipment function.
 5. Operating characteristics.
 6. Limiting conditions.
 7. Performance curves.
 8. Engineering data and tests.
 9. Complete nomenclature and number of replacement parts.
- C. Operating Procedures: Include start-up, break-in, and control procedures; stopping and normal shutdown instructions; routine, normal, seasonal, and weekend operating instructions; and required sequences for electric or electronic systems.
- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.3 PRODUCT MAINTENANCE MANUAL

- A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Product Information: Include the following, as applicable:
 1. Product name and model number.
 2. Manufacturer's name.
 3. Color, pattern, and texture.
 4. Material and chemical composition.
 5. Reordering information for specially manufactured products.

- D. Maintenance Procedures: Include manufacturer's written recommendations and inspection procedures, types of cleaning agents, methods of cleaning, schedule for cleaning and maintenance, and repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

2.4 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including maintenance instructions, drawings and diagrams for maintenance, nomenclature of parts and components, and recommended spare parts for each component part or piece of equipment:
- D. Maintenance Procedures: Include test and inspection instructions, troubleshooting guide, disassembly instructions, and adjusting instructions that detail essential maintenance procedures:
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

- A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
- D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component

incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

- E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.
 - 1. Do not use original Project Record Documents as part of operation and maintenance manuals.
- F. Comply with Division 1 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 01782

SECTION 02220 – SITE DEMOLITION**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes
 - 1. Demolition as depicted on the Contract Drawings.

1.2 REGULATORY REQUIREMENTS

- A. Obtain required permits and licenses from appropriate authorities. Pay associated fees including disposal charges.
- B. Notify affected utility companies before starting work and comply with their requirements.
- C. Do not close or obstruct public or private roadways, sidewalks, or fire hydrants without appropriate permits or written authorization.
- D. Conform to applicable regulatory procedures when hazardous or contaminated materials are discovered.

1.3 SUBMITTALS

- A. Project Record Documents: Accurately record actual locations of capped utilities and subsurface obstructions that will remain after demolition.

1.4 PROJECT CONDITIONS

- A. Blasting is prohibited. Rock excavation shall be by mechanical means only and shall be incidental to the contract.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION**3.1 PREPARATION**

- A. Provide, erect, and maintain erosion control devices, temporary barriers, and security devices at locations indicated on Construction Drawings.
- B. Protect existing landscaping materials, appurtenances, and structures, which are not to be demolished. Repair damage to existing items to remain caused by demolition operations.
- C. Prevent movement or settlement of adjacent structures. Provide bracing and shoring as necessary.
- D. Mark location of utilities. Protect and maintain in safe and operable condition utilities that are to remain. Prevent interruption of existing utility service to occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities as acceptable to governing authorities and Owner.
- E. Notify adjacent property owners of work that may affect their property, potential noise, utility outages, or other disruptions. Obtain written permission from adjacent property owners when demolition equipment will traverse, infringe upon, or limit access to their property. Coordinate notice with Owner.

3.2 GENERAL DEMOLITION REQUIREMENTS

- A. Conduct demolition to minimize interference with adjacent structures or pavements to remain.
- B. Cease operations immediately if adjacent structures appear to be in danger. Notify authority having jurisdiction. Do not resume operations until directed by authority.
- C. Conduct operations with minimum of interference to public or private access. Maintain ingress and egress at all times.
- D. Sprinkle work with water to minimize dust. Provide hoses and water connections for this purpose.
- E. Comply with governing regulations pertaining to environmental protection.
- F. Clean adjacent structures and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to condition existing prior to start of work.

3.3 DEMOLITION

- A. Demolish site improvements designated to be removed as shown on the drawings. Site improvements shall include but not be limited to structures, retaining walls, foundations, pavements, curbs and gutters, drainage structures, utilities, storm sewer, signage or landscaping.
- B. Disconnect and cap or remove utilities to be abandoned as shown on the drawings.
- C. Fill or remove underground tanks, piping, and appurtenances as shown.
- D. Demolish concrete and masonry in small sections. Break up concrete slabs-on-grade that are 2-feet or more below proposed subgrade to permit moisture drainage. Remove slabs-on-grade and below grade construction within 2-feet of proposed subgrade.

3.4 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove from site debris, rubbish, and other materials resulting from demolition operations. Leave areas of work in clean condition.
- B. No burning of any material, debris, or trash onsite or offsite will be allowed except when allowed by appropriate governing authority and Owner. If allowed as stated above, burning shall be performed in manner prescribed by governing authority. Attend burning materials until fires have burned out and have been completely extinguished.
- C. Transport materials removed from demolished structures with appropriate vehicles and dispose off-site to areas that are approved for disposal by governing authorities and appropriate property owners.

END OF SECTION 2300

SECTION 02230 - SITE CLEARING**PART 1 - GENERAL**

1.1 SUMMARY

A. Section Includes

1. Cleaning project work area of debris, trees, brush and other plant life in preparation for site work.
2. Protection of existing structures, trees, or vegetation indicated on the Construction Drawings to remain.

1.2 ENVIRONMENTAL REQUIREMENTS

- A. Construct temporary erosion control systems as shown on Construction Drawings to protect adjacent properties and water resources from erosion and sedimentation, or as directed by Owner, Engineer, or local or state authority.
- B. In event that sitework on this project will disturb 1 or more acres; Contractor shall not begin construction without "National Pollution Discharge Elimination System" (NPDES) permit governing discharge of storm water from site for entire construction period. NPDES permit requires SWPPP to be in place during construction.
- C. Contractor shall conduct storm water management practices in accordance with NPDES permit and shall enforce action taken or imposed by Federal or State agencies, including cost of fines, construction delays, and remedial actions resulting from Contractor's failure to comply with provisions of NPDES permit.

1.3 PROJECT CONDITIONS

- A. Conditions existing at time of inspection for bidding purposes will be maintained by Owner as reasonably practical.
- B. Access to adjacent properties by driveway/roadway will be maintained at all times during clearing and construction.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.1 PREPARATION

- A. Identify existing plant life that is to remain and verify clearing limits are clearly tagged, identified, and marked in such manner as to ensure their protection throughout construction operations.

3.2 PROTECTION

- A. Locate, identify, and protect existing utilities that are to remain.
- B. Protect trees, plant growth, and features designated to remain as part of final landscaping.

- C. Conduct operations with minimum interference to public or private accesses and facilities. Maintain ingress and egress at all times and clean or sweep roadways daily as required by governing authority. Dust control shall be provided with sprinkling systems of equipment provided by Contractor.
- D. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by a licensed land surveyor and replaced, as necessary, in kind.
- E. Provide traffic control as required, in accordance with the US Department of Transportation's "Manual on Uniform Traffic Control Devices" and applicable state highway department requirements.

3.3 EQUIPMENT

- A. Material shall be transported to and from the project site using well-maintained and operating vehicles. Transporting vehicles operating on site shall stay on designated haul roads and shall not endanger improvements by rutting, overloading, or pumping.

3.4 CLEARING

- A. Clear areas required for access to site and execution of work.
- B. Unless otherwise indicated on Construction Drawings, remove trees, shrubs, grass, other vegetation, improvements, or obstructions interfering with installation of new construction. Removal includes digging out stumps and roots. Depressions caused by clearing and grubbing operations shall be filled to subgrade elevation to avoid ponding of water. Satisfactory fill material shall be placed in accordance with Section 02300-Earthwork.
- C. All hardwood vegetation (trees) shall be chipped or mulched and disposed of at a site suitable for handling such material according to state law and regulations.
- D. Remove grass, plant life, stumps, and other construction debris from site to dump site that is suitable for handling such material according to state laws and regulations.
- E. Cut heavy growths of grass from areas before stripping and topsoil removal and remove cuttings with remainder of cleared vegetative material.

END OF SECTION 02230

SECTION 02300 - EARTHWORK**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes:
 - 1. Trenching and backfilling for utilities.
 - 2. Dewatering.
- B. Related Sections
 - 1. Section 02318 – Solid Rock Excavation
 - 2. Section 02510 – Water Distribution System
 - 3. Section 02920 – Finish Grading and Seeding

1.2 QUALITY ASSURANCE

- A. An Independent Testing Laboratory (ITL), selected and paid for by the Owner, will be retained to perform construction testing on site.
 - 1. The ITL shall prepare test reports that indicate test location, elevation data, and test results. Owner, Engineer, and Contractor shall be provided with copies of reports within 96 hours of time that test was performed. In event that test performed fails to meet Specifications, the ITL shall notify Owner and Contractor immediately.
 - 2. Costs related to retesting due to failures shall be paid for by the Contractor at no additional expense to Owner. Contractor shall provide free access to site for testing activities.
 - 3. Quality assurance testing will be conducted in accordance with Paragraph "Field Testing" in Part 3 hereinafter.

1.3 DEFINITIONS

- A. Satisfactory Materials: ASTM D 2487 soil classification groups GW, GP, GM, SW, SP, SM, ML, CL, or a combination of these group symbols.
 - 1. Fill material shall further conform to a maximum allowable plasticity index (PI) of 15 and a maximum allowable liquid limit (LL) of 45.
 - 2. Satisfactory materials shall be free of rock or gravel larger than allowed for fill or backfill material as specified hereinafter or as shown on the drawings.
 - 3. Satisfactory materials shall contain no debris, waste, frozen materials, vegetation, and other deleterious matter.
- B. Unsatisfactory Materials: Materials which do not comply with the requirements for satisfactory materials are unsatisfactory.
 - 1. Unsatisfactory materials also include man-made fills; trash; refuse; backfills from previous construction; and material classified as satisfactory materials which contains root and other organic matter or frozen material. The ITL shall be notified of any contaminated materials.
 - 2. Unsatisfactory materials also include satisfactory materials not maintained within 2 percent of optimum moisture content at time of compaction.
- C. Rock: Rock shall be as defined in Section 02318. Trench rock excavation is defined in Section 02510 and in this Section, and will be paid for on a cubic yard basis.

1.4 SUBMITTALS

- A. Submit name of each material supplier and specific type and source of each material. Change in source throughout project requires approval of Owner.
- B. Shop drawings or details pertaining to site utilities are not required unless required by regulatory authorities or unless uses of materials, methods, equipment, or procedures that are contrary to The Drawings or Specifications are proposed. Do not perform work until Owner has accepted required shop drawings.

- C. Submit certification that all material obtained from off-site sources complies with specification requirements.
- D. Shop drawings or details pertaining to excavating and filling are not required unless otherwise shown on the Drawings or if contrary procedures to Construction Documents are proposed.
- E. Contact utility companies and determine if additional easements will be required to complete project.

PART 2 - PRODUCTS

2.1 SOIL AND ROCK MATERIALS

- A. Trench Backfill: ASTM D 2321 unless otherwise specified or shown on the drawings.
- B. Bedding: Aggregate Type as indicated on the plans, or fine, clean, durable particles of sand or crushed stone. Crushed stone used for this purpose shall consist of materials passing a ¾ -inch sieve to dust.
- C. Fill and Backfill. Satisfactory materials excavated from the site.
- D. Imported Fill Material: Satisfactory material provided from offsite borrow areas when sufficient satisfactory materials are not available from required excavations.
- E. Drainage Fill: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2- inch sieve and 0 to 5 percent passing a No.8 sieve.
- F. Topsoil: Topsoil shall consist of stripping material excavated from the site. Topsoil shall consist of organic surficial soil found in depth of not more than 6-inches. Topsoil shall be as further defined in Section 02920 – Finish Grading and Seeding .

2.2 EQUIPMENT

- A. Transport off-site materials to project using well-maintained and operating vehicles. Once on site, transporting vehicles shall stay on designated haul roads and shall at no time endanger improvements by rutting, overloading, or pumping.

2.3 SOURCE QUALITY CONTROL

- A. The following tests shall be performed on each type of on-site or imported soil material used as compacted fill:
 - 1. Moisture and Density Relationship: ASTM D 698 or ASTM D 1557.
 - 2. Mechanical Analysis: AASHTO T 88 or ASTM D422.
 - 3. Plasticity Index: ASTM D 4318.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Identify required lines, levels, contours, datum, elevations, and grades necessary for construction as shown on the drawings. Finish grading shall match the general contours of the surrounding area.
- B. Notify utility companies to remove or relocate public utilities that are in conflict with proposed improvements.
- C. Protect plant life, lawns, fences, existing structures, sidewalks, paving, and curbs, unless otherwise noted on the drawings from excavating equipment and vehicular traffic.

- D. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by licensed land surveyor and replaced, as necessary, by same.
- E. Remove from site, material encountered in grading operations that, in opinion of Owner or the Owner's Independent Testing Laboratory (ITL) is unsatisfactory material or undesirable for backfilling purposes. Dispose of in manner satisfactory to Owner and local governing agencies. Backfill areas with layers of satisfactory material and compact as specified herein.
- F. Locate and identify existing utilities that are to remain and protect from damage.
- G. Maintain in operating condition existing utilities, previously installed utilities, and drainage systems encountered in utility installation. Repair surface or subsurface improvements shown on The Drawings.
- H. Verify location, size, elevation, and other pertinent data required making connections to existing utilities and drainage systems as indicated on The Drawings.
- I. Over excavate and properly prepare areas of subgrade that are not capable of supporting proposed systems.

3.2 DEWATERING

A. General:

1. Maintain site using accepted and professional methods consistent with current industry practice to eliminate water entering the excavation under hydrostatic head from the bottom or sides. Design system to prevent differential hydrostatic head, which would result in floating out soil particles in a manner, termed as a "quick" or "boiling" condition. System shall not be dependent solely upon sumps or pumping water from within the excavation where differential head would result in a quick condition, which would continue to worsen the integrity of the excavation's stability.
2. Maintain site to prevent ground and surface water flow into the excavation and to allow Work to be installed in a dry condition.
3. Control, by acceptable means, all water regardless of source. Contractor shall be responsible for disposal of the water.
4. Confine discharge piping or ditches to available easement or to additional easement obtained by Contractor. Provide necessary permits or easement.
5. Control groundwater in a manner that does not cause instability or raveling of excavation slopes and does not result in damage to existing structures.
6. Commence dewatering prior to any appearance of water in excavation and continue until Work is complete to the extent that no damage results from hydrostatic pressure, flotation, or other causes.
7. Open pumping with sumps and ditches will be allowed provided it does not result in boils, loss of fines, softening of the ground, or instability of slopes.
8. Control grading around excavations to prevent surface water from flowing into excavation areas.
9. No additional payment will be made for any supplemental measures to control seepage, groundwater, or artesian head.

B. Damages:

1. Contractor shall be responsible for and shall repair any damage to work in place, other contractor's equipment, utilities, residences, highways, roads, railroads, private and municipal well systems, adjacent structures, natural resources, habitat, existing wells, and the excavation. Contractor responsibility shall also include, damage to the bottom due to heave and including but not limited to, removal and pumping out of the excavated area that may result from Contractor's negligence, inadequate or improper design and operation of the dewatering system, and any mechanical or electrical failure of the dewatering system.
2. Remove subgrade materials rendered unsatisfactory by excessive wetting and replace with approved backfill material at no additional cost to the Owner.

C. Maintaining Excavation in Dewatering Condition:

1. Dewatering shall be a continuous operation. Interruptions due to power outages, or any other reason will not be permitted.
2. Continuously maintain excavation in a dry condition with positive dewatering methods during preparation of subgrade, installation of pipe, and construction of structures until the critical period of

construction or backfill is completed to prevent damage of subgrade support, piping, structure, side slopes, or adjacent facilities from flotation or other hydrostatic pressure imbalance.

3. Provide standby equipment on site, installed, wired, and available for immediate operation if required to maintain dewatering on a continuous basis in the event any part of the system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, perform such work as may be required to restore damaged structures and foundation soils at no additional cost to Owner.

- D. System Removal: Upon completion of the work, remove dewatering equipment from the site, including related temporary electrical service.

3.3 TOPSOIL EXCAVATION

- A. Cut heavy growths of grass from areas before stripping and remove cuttings with remainder of cleared vegetative material.
- B. Strip topsoil to a depth of not less than 6 inches from areas that are to be filled, excavated, landscaped, or re-graded, to such depth that it prevents intermingling with underlying subsoil or questionable material.
- C. Stockpile topsoil in storage piles in areas shown on The Drawings or where directed by Owner. Construct storage piles to freely drain surface water. Cover storage piles as required to prevent windblown dust. Dispose of unsuitable topsoil as specified for waste material, unless otherwise specified by Owner. Remove excess topsoil from site unless specifically noted otherwise on The Drawings.

3.4 GENERAL EXCAVATION

- A. Classification of Excavation:
 1. The contractor shall assure himself by site investigation or other necessary means that he is familiar with the type, quantity, quality, and character of excavation work to be performed. Excavation shall be considered Class "A" excavation, except at indicated in the Contract Documents.
 2. Rock (Class "B") Excavation is specified in Section 02318.
- B. The decision of the Engineer shall be final in determining the classification of excavation.
- C. When performing grading operations during periods of wet weather, provide adequate dewatering, drainage and ground water management to control moisture of soils.
- D. Shore, brace, and drain excavations as necessary to maintain excavation as safe, secure, and free of water at all times.
- E. Place satisfactory excavated material into project fill areas.
- F. Unsatisfactory excavated material shall be disposed of in manner and location that is acceptable to Owner and local governing agencies.
- G. Perform excavation using capable, well-maintained equipment and methods acceptable to Owner and local governing agencies.

3.5 TRENCHING EXCAVATION FOR UTILITIES

- A. Contact local utility companies before excavation begins. Dig trench at proper width and depth for laying pipe, conduit, or cable. Cut trench banks vertical, if possible, and remove stones from bottom of trench as necessary to avoid point-bearing. Over-excavate wet or unstable soil, if encountered, from trench bottom as necessary to provide suitable base for continuous and uniform bedding. Replace over-excavation with satisfactory material and dispose of unsatisfactory material.
 1. The Contractor shall bear the cost for any overexcavation not directed by the Engineer.

- B. Trench excavation sidewalls shall be sloped, shored, sheeted, braced, or otherwise supported by means of sufficient strength to protect workmen in accordance with applicable rules and regulations established for construction by the Department of Labor, Occupational Safety and Health Administration (OSHA), and by local ordinances. Lateral travel distance to exit ladder or steps shall not be greater than 25 feet in trenches 4 feet or deeper.
- C. Perform trench excavation as indicated on the Drawings for specified depths. During excavation, stockpile materials suitable for backfilling in orderly manner far enough from bank of trench to avoid overloading, slides, or cave-ins.
- D. Remove excavated materials not required or not satisfactory as backfill or embankments and waste off-site or at on-site locations approved by the Owner and in accordance with governing regulations.
- E. Prevent surface water from flowing into trenches or other excavations by temporary grading or other methods, as required. Remove accumulated water in trenches and other excavations as specified.
- F. Open cut excavation with trenching machine or backhoe. Where machines other than ladder or wheel-type trenching machines are used, do not use clods for backfill.
- G. Accurately grade trench bottom to provide uniform bearing and support for each section of pipe on bedding material at every point along entire length except where necessary to excavate for bell holes, proper sealing of pipe joints, or other required connections. Dig bell holes and depressions for joints after trench bottom has been graded. Dig no deeper, longer, or wider than needed to make joint connection properly.
- H. Trench width below top of pipe shall not be wider than 1 and 4/10 (1.4) times the nominal diameter of the pipe plus twelve (12) inches; or as designated by the owner.
- I. Trench depth requirements measured from finished grade or paved surface shall meet the following requirements or applicable codes and ordinances, whichever is more stringent:
 - 1. Water Mains: 42 inches to top of pipe barrel or 6 inches below frost line, established by local building official, whichever is deeper.
 - 2. Storm Sewer: Elevations and grades as indicated on the Drawings.
 - 3. Electrical Conduits: 24 inches minimum to top of conduit or as required by NEC 300-5, NEC 710-36 codes, or local utility company requirements, whichever is deeper.
 - 4. Telephone Conduits: 18 inches minimum to top of conduit, or as required by local utility company, whichever is deeper.

3.6 PIPE BEDDING

- A. Excavate trenches for pipe or conduit according to Drawings. Place bedding material according to Drawings, compact in bottom of trench, and shape to conform to lower portion of pipe barrel.
- B. Place geotextile fabric as specified on the Drawings and in accordance with Section 02340.

3.7 TRENCH BACKFILLING

- A. Materials used for trench backfill shall comply with requirements as specified herein.
- B. Backfill and compact in accordance with fill and compaction requirements in accordance with ASTM D698 unless otherwise shown on the drawings.
- C. Do not backfill trenches until required tests are performed and utility systems comply with and are accepted by applicable governing authorities.
- E. Backfill trenches to contours and elevations shown on the Drawings.
- F. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.

3.8 COMPACTION

- A. Compact backfill to 95 percent of the Standard Proctor Density (ASTM D698).
- B. Maintain moisture content of not less than 1 percent below and not more than 3 percent above optimum moisture content of fill materials to attain required compaction density.
- C. Exercise proper caution when compacting immediately over top of pipes or conduits. Water jetting or flooding is not permitted as method of compaction.
- D. Corrective Measures for Non-Complying Compaction: Remove and recompact deficient areas until proper compaction is obtained. Continual failure areas shall be properly stabilized, at no additional cost to Owner.

3.9 MAINTENANCE OF GRADING

- A. Verify finished grades to ensure proper elevation and drainage.
- B. Protect graded areas from excessive wheel loading during construction, including concrete trucks, dump trucks, and other construction equipment.
- C. Construct temporary ditches and perform such grading as necessary to maintain positive drainage away from trenches at all times.

3.10 BORROW AND SPOIL SITES

- A. Comply with NPDES and local erosion control permitting requirements for any and all on-site and off-site, disturbed spoil and borrow areas. Upon completion of spoil or borrow operations, clean up spoil or borrow areas in a neat and reasonable manner to the satisfaction of Owner or off-site property owner, if applicable.

3.11 FINISH GRADING

- A. Graded areas shall be uniform and smooth, free from rock, debris, or irregular surface changes. Ground surfaces shall vary uniformly between indicated elevations. Grade finished ditches to allow for proper drainage without ponding and in manner that will minimize erosion potential. For topsoil and seeding requirements refer to Section 02920 – Finish Grading and Seeding.
- B. Correct settled and eroded areas within 1 year after date of completion at no additional expense to Owner. Bring grades to proper elevation.

3.12 QUALITY ASSURANCE TESTING AND INSPECTION

- A. Responsibilities: Unless otherwise specified, quality control tests and inspection specified below will be conducted by the Owner's Independent Testing Laboratory (ITL) as requested by the Owner at no cost to the Contractor. The Contractor shall perform additional testing or inspection as considered necessary by the Contractor for assurance of quality control.
- B. Field testing, frequency, and methods may vary as determined by and between the Owner and the ITL.
- C. Work shall be performed by Qualified Inspector. Report of testing and inspection results shall be made upon the completion of testing.
- D. Classification of Materials: Perform test for classification of materials used and encountered during construction in accordance with ASTM D2488 and ASTM D2487.

- E. Laboratory Testing Of Materials: Perform laboratory testing of materials (Proctor, Sieve Analysis, Atterberg Limits, Consolidation Test, etc.) as specified.

- F. Field Density Tests.
 - 1. Utility Trench Backfill: Intervals not exceeding 200-feet of trench for first and every other 8-inch lift of compacted trench backfill.
 - 2. Test Method: In-place nuclear density, ASTM D 2922 (Method B-Direct Transmission).

- G. Corrective Measures For Non-Complying Compaction: Remove and recompact deficient areas until proper compaction is obtained at no additional expense to Owner. Adjust moisture content as necessary to conform to the requirements of this section.

- H. Observation and Inspection:
 - 1. Observe all trench excavation depths to ensure proper cover over water mains.
 - 2. Observe and document presence of groundwater within excavations.
 - 3. Observe backfill placement, confirming that only satisfactory materials are used for backfill.

END OF SECTION 02300

SECTION 02318 - ROCK EXCAVATION (CLASS "B" EXCAVATION)**PART 1 - GENERAL****1.1 SUMMARY****A. Section Includes**

1. Removal including, drilling, blasting, and protection of rock excavation.

1.2 DEFINITIONS

A. Rock Excavation: Removal of igneous, metamorphic, or sedimentary rock or stone, boulders over two cubic yards in volume in open areas and one cubic yard in volume in trenches; and masonry, concrete, or solid frozen soil that cannot be removed by an excavator with an operating weight of at least 52,600 pounds and flywheel horse power of at least 153 HP, by rippers or other mechanical methods and, therefore, requires drilling and blasting.

1. The excavation and disposal of all "Solid Rock Excavation" that is part of site excavation shall be considered incidental to the sitework grading.
2. If "Solid Rock Excavation" is required, the Engineer shall be notified prior to such rock excavation, and he must then visit the site and verify the necessity for excess "Rock Excavation," determine an estimated quantity and provide the Contractor written approval to proceed. In the event the estimated quantity is exceeded, the Engineer shall again be notified to establish a revised estimated quantity and authorize the Contractor to proceed. Payment for the authorized work shall be by a Change Order to the Contract.

B. Trenches: Excavations having vertical sides whose depths exceed its width, made for storm water drainage, sanitary sewer, water, and gas pipes, electric, communications, and steam conduits, and related uses.

C. Pay Width: Pay width for trench shall not be wider than 1-4/10 times the pipe diameter in inches plus 12 inches (1.4d" + 12").

1.3 SUBMITTALS

A. Submit Blasting Plan prior to any blasting and Monitoring Reports to the Owner and Governing Agencies for review.

1.4 REGULATORY REQUIREMENTS

A. Blasting will not be allowed.

1.5 SITE CONDITIONS

A. Environmental Requirements: Determine environmental effects associated with proposed work and safeguard those concerns as regulated by law and local governing agencies by reasonable and practical methods.

B. Existing Conditions: The Contractor shall be responsible for any and all damage and/or injury from the use of explosives. The Contractor shall save and hold harmless the Owner and Engineer from any and all claims from the use of explosives. Removal of materials of any nature by blasting shall be done in such a manner and at such times as to avoid damage affecting integrity of existing construction and damage to new or existing dwellings, structures and water wells in or adjacent to the area of the work. It shall be the Contractor's responsibility to determine the method of operation to ensure desired results and integrity of completed work. All damage caused by the Contractor's blasting operations shall be repaired to the full satisfaction of the Owner at no additional cost to the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

NOT USED

PART 3 - EXECUTION

3.1 PREPARATION

- A. Verify site conditions and note subsurface conditions affecting work of this section.
- B. Identify required lines, levels, and elevations that will determine extent of proposed removals.

3.2 ROCK EXCAVATION

- A. Cut rock to form level bearing at bottom of footing and trench excavations. Remove shaled layers to provide sound and unshattered base for footings or foundations. Contractor shall consider reuse of excavated materials on site in accordance with Section 02300. If material cannot be utilized on site, dispose of material offsite.

3.3 ROCK BLASTING

- A. Blasting will not be allowed on the project.

3.4 ROCK CUT FACE EXCAVATION

NOT USED

3.5 ROCK TRAP

NOT USED

3.6 OVEREXCAVATION AND BACKFILL

- A. Over excavation which is required to remove unsuitable natural undisturbed bedrock weakened by weathering or other cause not inflicted by the Contractor shall be immediately reported to the Owner and performed as directed by the Owner, and the theoretical lines and grades will be adjusted accordingly. Material outside the excavation limits which are disturbed due to the fault or negligence of the Contractor or due to his failure to exercise sound construction practices, shall be either replaced by the Contractor with suitable materials (earth or concrete), or bolted, or both as directed, at no cost to the Owner.

END OF SECTION 02318

SECTION 02350 – EROSION CONTROL**PART 1 – GENERAL****1.1. SUMMARY**

- A. This work shall consist of furnishing, installing, maintaining and removing temporary pollution, erosion and sediment control measures; furnishing and placing permanent erosion control features; or a combination of both as shown on the plans or as directed by the Engineer.

1.2. SUBMITTALS

- A. Prior to the preconstruction conference and the start of construction, the Contractor shall submit schedules for the implementation of temporary and permanent erosion control work, as applicable, for construction operations. No work shall start until the erosion control schedules and methods of operations have been approved by the Engineer.

1.3. GENERAL CONSTRUCTION

- A. The Engineer may direct the Contractor to provide immediate permanent or temporary pollution control measures to prevent contamination of adjacent streams or other bodies of water. Such work may involve the construction of temporary berms, dikes, dams, sediment basins and slope drains, and use of temporary mulches, seeding or other control devices or methods as necessary to control erosion and pollution.
- B. If the Engineer determines ditch checks, as shown on the plans, are not suitable due to site conditions, a combination of ditch checks and erosion control blankets or rock blankets shall be designed to effectively reduce flow velocities.
- C. The Contractor shall exercise effective management practices throughout the life of the project to control pollution. Pollutants such as chemicals, fuels, lubricants, bitumen, raw sewage or other harmful material shall not be discharged on or from the project. Temporary pollution control measures, such as storage and handling of petroleum products and other pollutants, shall be coordinated with temporary and permanent erosion control features specified in the contract to ensure economical, effective and continuous erosion and pollution control. These requirements will also apply to work within easements designated by the Owner.
- D. The Contractor shall incorporate all permanent erosion and pollution control features into the project at the earliest practical time. Temporary measures shall be used to correct conditions that develop during construction which were not foreseen during the design stage, that are needed prior to installation of permanent pollution control features, or that are needed temporarily to control erosion that develops during normal construction practices, but are not associated with permanent control features on the project.
- E. Clearing and grubbing operations shall be scheduled and performed such that grading operations and erosion control features will follow immediately thereafter.
- F. Erosion from construction operations and pollution control measures shall not cause water pollution. In the event of conflict between these requirements and the pollution control laws, rules or regulations of other federal, state or local agencies, the more restrictive laws, rules or regulations will apply.
- G. Unless otherwise specified, or directed by the Engineer, all temporary erosion control measures shall be removed by the Contractor after permanent erosion control measures are established. All temporary erosion control measures shall be removed prior to acceptance of the project and before final payment.

1.4. TEMPORARY BERMS

- A. Temporary berms shall consist of graded material from within the project limits or any other suitable material approved by the Engineer and shall be constructed to the approximate dimensions shown on the plans.
- B. Type A Berms: shall be machine compacted with a minimum of one pass over the entire width of the berm.
- C. Type B Berms: shall be machine compacted with a minimum of three passes over the entire width of the

berm. Material removed from Type B berms shall be incorporated in the embankment when possible. The Contractor shall remove and dispose of any excess or unsuitable material to a location approved by the Engineer.

- D. Type A and Type B Berms. Temporary berms shall drain to a compacted outlet at a slope drain. On transverse berms, the top width of the berms may be wider and the sideslopes flatter to allow equipment to pass over these berms with minimal disruption.
- E. Type C Berms: shall be constructed of rock base material as approved by the Engineer. Vegetative mulch or an equivalent erosion control blanket shall be placed on the upslope side of the Type C berm. The vegetative mulch shall be placed in such a manner that the final compacted thickness is 2 inches. The straw layer or equivalent erosion control blanket shall be removed and replaced as directed by the Engineer.

1.5. TEMPORARY SLOPE DRAINS

- A. This work shall consist of constructing and maintaining temporary slope drains to carry water down slopes and to reduce erosion. The method selected shall be approved by the Engineer prior to construction.
- B. The Contractor shall provide temporary, impermeable slope drains to carry water or water with suspended solids down fill slopes until permanent erosion control measures are established. The Contractor shall provide temporary slope drains on fill slopes at approximately 500-foot intervals or as directed by the Engineer. All temporary slope drains shall be adequately anchored to the slope to prevent disruption of flow. Inlet ends shall be properly constructed to channel water into the temporary slope drain. Outlet ends shall have some means of dissipating the energy of the water to reduce erosion downstream. The Contractor shall restore the site of the slope drains to the satisfaction of the Engineer.

1.6. DITCH AND INLET CHECKS

- A. This work shall consist of constructing and maintaining temporary or permanent ditch and inlet checks, removing sediment deposits from these checks and disposing of the sediment at a location approved by the Engineer.
- B. Materials
 - 1. Posts: Wood, steel or synthetic posts may be used. Posts shall be of sufficient length, but no less than 4 feet, to ensure adequate embedment while fully supporting the silt fence and shall have sufficient strength to resist damage during installation and to support applied loads while in service.
 - 2. Support Fence: All geotextile silt fences shall be supported either externally by wire or other approved mesh to a height of at least 24 inches or by a suitably designed support system capable of keeping the material erect. Either method shall be strong enough to withstand applied loads.
- C. Type I Ditch Checks: shall be constructed of straw bales, silt fence or an approved alternative erosion control measure as specified in the contract. Type I ditch checks shall not be used where drainage areas exceed 3 acres or where ditch slopes exceed 10 percent. Type II ditch checks may be substituted for Type I ditch checks at the Contractor's expense. Straw bale and silt fence ditch checks shall be constructed as shown on the plans in accordance with the contract documents. Approved alternate Type I ditch checks shall be installed and maintained according to the manufacturer's recommendations.
- D. Ditch Checks: Approved alternate Type II ditch checks may be used as shown in the contract. Type II ditch checks shall not be used where drainage areas exceed 50 acres or where ditch slopes exceed 10 percent.
- E. Rock Ditch Checks: shall be constructed with clean rock. A minimum of 50 percent of the rock shall have a diameter of 6 inches or greater, with a maximum size of 12 inches. Silt fence or an equivalent filter fabric shall be placed beneath the rock ditch check as shown on the plans.
- F. Sand Bag Ditch Checks: Sand or rock for sand bags shall be a uniform granulation with a maximum aggregate size of 2 inches, shall be clean to allow percolation of water through the sand bag and shall meet the approval of the Engineer. Sand bags shall be of tightly woven burlap or other material that is sufficiently durable to remain intact for the time intended. Sand bags shall be filled approximately three-fourths full, shall be laid in horizontal courses, and successive courses shall break joints with preceding ones. The bags shall be packed against each other and tamped to provide a uniform surface.

- G. Drop Inlet Checks: Shall be constructed adjacent to the drop inlets as shown on the plans or as directed by the Engineer, as necessary to prevent sediment from entering the inlet. Material shall be in accordance with the requirements of the Type II Ditch Checks or as approved by the Engineer.
- H. Maintenance: The Contractor shall replace checks as directed by the Engineer. Periodic sediment removal shall include removal and disposal of sediment to a location where sediment will not erode into construction areas, streams or other bodies of water. The Contractor shall inspect the ditch checks for sediment accumulation after each storm event and shall remove the sediment when deposits reach approximately one-half the original height of the check. Alternate temporary erosion control methods shall be maintained in accordance with the manufacturer and as directed by the Engineer.

1.7. EROSION CONTROL BLANKET

- A. This work shall consist of furnishing and installing the erosion control blanket; including fine grading, blanket installation, stapling, and miscellaneous related work in accordance with these standard specifications, plan details and recommended manufactures instalment practices. This work shall include all necessary materials, labor and equipment for installation of a complete system.
- B. The erosion control blanket shall be used to prevent surface erosion and enhance revegetation. The erosion control blanket should contain coconut fibers for purpose of erosion control and revegetation. The blanket shall be suitable for the following:
 - 1. Slope protection
 - 2. Channel and ditch linings
 - 3. Culvert inlets and outfalls
- C. Performance Requirements:
 - 1. Erosion control blanket shall provide a temporary, biodegradable cover material to reduce slope and/or channel erosion and enhance revegetation. Erosion control blanket performance capabilities shall be determined by ASTM D 6459, "Determination of Erosion Control Blanket (ECB) Performance in Protecting Hillslopes from Rainfall-Induced Erosion", and ASTM D 6460, "Determination of Erosion Control Blanket (ECB) Performance in Protecting Earthen Channels from Stormwater-Induced Erosion".
- D. Blanket Requirements:
 - 1. Velocity: 10.0 ft/sec
 - 2. Unvegetative Shear Stress: 3.30 lb/sq. ft.
 - 3. Mass per Unit Area: 9.5 oz/sq. yd.
 - 4. Thickness: 0.30 inches
- E. Submittals: Submittals shall include complete design data, Product Data Sheets, Product Netting Information, SDS, Staple Pattern Guides, Installation Guidelines, Manufacturing Material Specifications, Manufacturing Certifications, and CAD details. In addition, the Manufacturer shall provide a test report providing data showing the performance capabilities of the erosion control blanket along with reference installations similar in size and scope to that specified for the project.
- F. Delivery, Storage and Handling:
 - 1. Erosion control blanket shall be furnished in rolls and wrapped with suitable material to protect against moisture intrusion and extended ultraviolet exposure prior to placement.
 - 2. Erosion control blanket shall be of consistent thickness with fibers distributed evenly over the entire area of the blanket.
 - 3. Erosion control blanket shall be free of defects and voids that would interfere with proper installation or impair performance.

4. Erosion control blanket shall be stored by the Contractor in a manner that protects them from damage by construction activities.
- G. Staples: The Contractor shall use the recommended staples/stakes of the chosen erosion control blanket manufacturer.
- H. High Velocity Channels: Contractor shall follow details shown on the plans in areas that are designated "High Velocity" on the plans.
- I. Execution:
1. Before placing erosion control blanket, the Contractor shall certify that the subgrade has been properly compacted, graded smooth, has no depressions, voids, soft or uncompacted areas, is free from obstructions such as tree roots, protruding stones or other foreign matter, and is seeded and fertilized according to project specifications. The Contractor shall not proceed until all unsatisfactory conditions have been remedied. By beginning construction, the Contractor signifies that the receding work is in conformance with this specification.
 2. Contractor shall fine grade the subgrade by hand dressing where necessary to remove local deviations.
 3. The Contractor shall install the erosion control blanket as directed by the owner's representative in accordance with manufacturer's Installation Guidelines, Staple Patter Guides, and plan details. The extent of the erosion control blanket shall consist of the ditch bottom and both side slopes to a maximum of 9 feet from ditch bottom and/or top of side slopes.
 4. Erosion control blanket shall be orientated in vertical strips and anchored with staples, as identified by the manufacturer's recommended installation practices. Adjacent strips shall be overlapped to allow for installation of a common row of staples that anchor through the nettings of both blankets. Horizontal joints between erosion control blankets shall be sufficiently overlapped with the uphill end on top for a common row of staples so that the staples anchor through the nettings of both blankets.
 5. Where exposed to overland sheet flow, a trench shall be located at the uphill termination. Erosion control blanket shall be stapled to the bottom of the trench. The trench shall be backfilled and compacted. Where feasible, the uphill end of the blanket shall be extended three feet over the crest of the slope.
 6. Slope erosion control blanket shall be overlapped by the channel erosion control blanket sufficiently for a common row of staples to anchor through the nettings of both blankets when terminating into a channel.
 7. Erosion control blankets in channels shall be installed parallel to the flow of water. The first roll shall be centered longitudinally in mid-channel and anchored with staples as identified in the manufacturer's recommended installation guidelines. Subsequent rolls shall follow from channel center outward and be overlapped to allow installation of a common row of staples so that the staples anchor through the nettings of both blankets.
 8. Successive lengths of erosion control blanket shall be overlapped sufficiently for a common row of staples with the upstream end on top. Staple the overlap across the end of each of the overlapping lengths so the staples anchor through the nettings of both blankets.
 9. A termination trench shall be located at the upstream termination. Erosion control blanket shall be stapled to the bottom of the trench. The trench shall be backfilled and compacted.
- J. Quality Assurance:
1. Erosion control blanket shall not be defective or damaged. Damaged or defective materials shall be replaced at no additional cost to the owner.
 2. Each individual erosion control blanket shall be inspected and weighed prior to packaging for conformance to manufacturer's specifications.

3. Every roll shall be visually inspected at time of delivery to site for damages and/or defective areas.

K. Clean Up

1. At the completion of this scope of work, Contractor shall remove from the job site and properly dispose of all remaining debris, waste materials, excess materials, and equipment required of or created by Contractor. Disposal of waste materials shall be solely the responsibility of the Contractor and shall be done in accordance with applicable waste disposal regulations.

1.8. SEDIMENT BASINS

- A. This work shall consist of constructing sediment basins as shown on the plans or as directed by the Engineer to detain sediment. This work shall also include disposal of excavated material, sediment and basin removal and site restoration.
- B. The area where a sediment basin is to be constructed shall be cleared of vegetation to enable sediment removal. The sediment basin shall be an excavated or dammed storage area with defined side slopes. Inlet and outlet areas shall be lined with rock riprap.
- C. The inlet of a sediment basin shall be constructed with a wide cross-section and a minimum grade to prevent turbulence and to allow deposition of soil particles. When the depth of sediment reaches one-half the original depth of the sediment basin in any part of the pool, all accumulation shall be removed.
- D. The Contractor shall dispose of accumulated sediment and excavated material removed during the construction of the sediment basin in locations where the material will not erode into the construction areas, streams or other bodies of water.
- E. Sediment basins shall remain in service until all disturbed areas draining into the structure have been satisfactorily stabilized. When use of a temporary sediment basin is to be discontinued, the Contractor shall remove any sediment and backfill, properly compact all excavations, restore the area to the existing ground's natural or intended condition, and sod.

1.9. SILT POND OVERFLOW

- A. Silt pond overflow shall be installed with erosion control fabric as shown on the plans. Berm to be constructed of clean shot rock limestone 4" to 8" in size.

1.10. TEMPORARY SEEDING AND MULCHING

- A. This work shall consist of furnishing and applying fertilizer, seed, vegetative mulch or other acceptable cover authorized by the Engineer. This work shall produce a quick ground cover to reduce erosion in disturbed areas expected to be redisturbed at a later date. Finish grading of areas will not be required. Hydraulic seeding and fertilizing will be permitted.
- B. Seeding and mulching shall be a continuous operation on all cut and fill slopes, excess material sites and borrow pits during the construction process. All disturbed areas shall be seeded and mulched as necessary to eliminate erosion.
- C. The Contractor shall provide permanent sodding as shown on the plans following temporary seeding.
- D. Temporary seeding mixtures of cereal grains shall be applied at a rate of 100 pounds per acre (110 kg/ha). All erodible seeded areas shall provide a minimum of 20 plants of the species planted per square foot on at least two random counts per acre in representative areas of the field. For areas with a large percentage of rock, the number of living plants shall be proportional to the percentage of erodible surface, as determined by the Engineer. The counts will be conducted 60 days after the species is planted.
- E. Fertilizer shall be applied at a rate of 40 pounds nitrogen (N) per acre.

1.11. SILT FENCE

- A. This work shall consist of furnishing, installing, maintaining, removing and disposing of a silt fence designed to remove suspended particles from sheet flow passing through the fence and to prevent sediment from polluting nearby streams or other bodies of water. At the Engineer's discretion, the location may be modified to fit field conditions. Such variations in quantity will not be considered as a change in work.
- B. Materials
 - 1. Posts: Wood, steel or synthetic posts may be used. Posts shall be of sufficient length, but no less than 4 feet, to ensure adequate embedment while fully supporting the silt fence and shall have sufficient strength to resist damage during installation and to support applied loads while in service.
 - 2. Support Fence: All geotextile silt fences shall be supported either externally by wire or other approved mesh to a height of at least 24 inches or by a suitably designed support system capable of keeping the material erect. Either method shall be strong enough to withstand applied loads.
 - 3. Prefabricated Fence: Prefabricated fence systems may be used if the systems meet all of the above material requirements.
- C. Straw Bales: The Contractor shall place bales at the bottom of embankment slopes or on the lower side of cleared areas to divert runoff and to detain sediment from sheet flow. When used to divert runoff or detain sediment, the bales shall be adequately anchored to withstand the applied load.
- D. Fabric Fence: The Contractor shall install silt fence as shown on the plans and at other locations directed by the Engineer. Fence construction shall be adequate to handle the stress from hydraulic and sediment loading. Fabric at the bottom of the fence shall be buried a minimum of 6 inches to prevent flow under the barrier. The trench shall be backfilled, and the soil compacted over the fabric. Fabric splices with a minimum 2-foot overlay shall be located only at a support post. Any installation method acceptable to the Engineer will be allowed as long as the effectiveness and intent of the silt fence is achieved.
- E. Post spacing shall not exceed 5 feet. Posts shall be driven a sufficient depth into the ground or placed on closer spacing as necessary to ensure adequate resistance to applied loads.
- F. The silt fence shall be fastened securely to the upslope side of the post. When wire support fence is used, the wire shall extend into the trench a minimum of 2 inches.
- G. Maintenance: The Contractor shall maintain the integrity of silt fences as long as the fences are necessary to contain sediment runoff. The Contractor shall inspect all silt fences immediately after each rainfall and at least daily during prolonged rainfalls. Any deficiencies shall be immediately corrected by the Contractor. In addition, the Contractor shall make a daily review of the silt fences in areas where construction activities have changed the natural contour and drainage runoff to ensure the silt fences are properly located for effectiveness. Where deficiencies exist, additional silt fences shall be installed as approved or directed by the Engineer.
- H. Sediment: The Contractor shall remove and dispose of sediment when accumulations reach approximately one-half the fence height, or sooner when directed by the Engineer. If required by heavy sediment loading, a second silt fence shall be installed as directed by the Engineer.
- I. Removal: The silt fence shall remain in place until removal is directed by the Engineer. Upon removal, the Contractor shall remove and dispose of any excess silt accumulation, grade and dress the area to the satisfaction of the Engineer, and establish vegetation on all bare areas in accordance with the contract requirements. The fence material shall remain the property of the Contractor.

1.12. TEMPORARY PIPE

- A. This work shall consist of installing and removing temporary pipe utilized to carry water under temporary roadways, silt fences, berms or other locations determined by the Engineer and to prevent the Contractor's equipment from coming in direct contact with water when crossing an active stream, intermittent streams created during heavy rainfalls or other bodies of water. Any pipe approved by the Engineer may be used.

- B. Installation of temporary pipe shall be in accordance with the specifications for permanent pipe and shall prevent water from causing erosion around the pipe. All backfill material for pipes shall be placed in 6-inch lifts and mechanically compacted. Compaction tests will not be required. Temporary pipe placed in intermittent or active streams shall be backfilled with clean rock.

1.13. TEMPORARY & PERMANENT EROSION CONTROL BLANKETS

- A. This work shall consist of furnishing and placing erosion control blankets on slopes or ditches for short-term or permanent protection of seeded areas at locations shown on the plans or as directed by the Engineer.
- B. Erosion control blankets shall be used as designated in the contract or as approved by the Engineer. The Contractor shall provide prequalified erosion control blankets of the class and type specified in the contract documents or as approved by the Engineer. Erosion control blankets shall be installed and maintained according to the manufacturer's recommendations.

1.14. TEMPORARY STREAM CROSSING

- A. This work shall consist of constructing a temporary stream crossing to facilitate the movement of equipment across a stream.
- B. The Contractor shall be responsible for the design, installation, maintenance and removal of the temporary stream crossing and any structures installed for the construction of the temporary stream crossing. Appropriate measures shall be taken to maintain near normal downstream flows and to minimize flooding upstream. The temporary stream crossing shall be constructed to permit the free movement of the stream's aquatic life.
- C. Prior to construction of the temporary stream crossing, all information shall be submitted to the Engineer as needed for the issuance or modification of the Corps of Engineer permit. The Contractor shall not begin construction on any temporary stream crossing without written permission from the Engineer.
- D. All approaches to the temporary stream crossing shall be maintained such that all storm water runoff is diverted to retention devices.
- E. When the temporary stream crossing is no longer needed, the crossing shall be removed as soon as possible and the area shall be restored to pre-project conditions or to the satisfaction of the Engineer.

1.15. GENERAL MAINTENANCE

- A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades in settled, eroded, and rutted areas to specified tolerances.
- C. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.
- D. Settling: Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn, or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

END OF SECTION 02350

SECTION 02510 – WATER SYSTEM SPECIFICATIONS**SECTION 1 – WATER DISTRIBUTION SYSTEM MATERIALS****ARTICLE 1 - GENERAL**

Materials for use at any location in the water distribution system (extensions or existing) shall meet the requirements as set forth in the following Articles under this Section.

ARTICLE 2 – PIPE, PIPE JOINTS AND FITTINGS

2.1 Ductile Iron Pipe, Joints & Fittings: Pipe for use under this heading shall consist of durable, solid, cast-iron materials with the matrix being predominately ferrite. This material shall meet the following minimum physical strength requirements of: 60,000 psi, tensile, 42,000 psi, yield, and ten (10) percent maximum elongation. Each piece of pipe shall have the: weight, thickness, class manufacturer's mark, the year of manufacture, and the letters DI or word "DUCTILE" clearly stamped on the pipe. The pipe materials and construction shall be in accordance with all the requirements of A.S.A. Standard A21.51 (A.W.W.A. C-151). Minimum thickness class shall be Class 52 (Class 53 for flanged pipe). The pipe may be furnished with mechanical, push on, or flange joint ends as required.

A. Mechanical Joint Pipe & Fittings: Pipe and fittings of this joint type shall be furnished complete with all glands, gaskets, tee head bolts, hex nuts, etc., all properly sized and manufactured for the required pipe and fitting sizes. All fittings and bends shall be constructed of cast or ductile iron. Materials for this service shall consist of durable, solid, cast or ductile iron meeting the minimum physical requirements of 18,000 psi. tensile strength of 40,000 psi. modulus of rupture. Fittings and bend items shall be designed and tested to permit a minimum working pressure of 250 psi. prior to being shipped from the factory. All mechanical joint fittings, bends, and joint accessory materials shall conform to A.S.A. Standard A21.10 and A21.11.

B. Slip Joint Pipe & Fittings: Slip joint pipe shall be made of ductile iron as previously specified. The plain end of the pipe shall be tapered to permit easy assembly. The pipe joint gasket shall meet all applicable requirements of A.S.A. Standard A21.10 with joints in accordance with Section 11-2.3 of A.S.A. Standard A21.11. Fittings and bends for use with slip joint piping shall be mechanical joint as previously specified.

C. Flanged Pipe & Fittings: Pipe for use with flanged ends shall be ductile iron as previously specified. Threads for the screwed-on flanges shall be designed in accordance with A.S.A. Standard B2.1 Flanges for use shall be faced and drilled in accordance with A.S.A. Standard B16.1, 125 lb. All joint and joint materials shall be designed and tested for a minimum working pressure of 250 psi. Flanged branch fittings and bends shall meet or exceed the pipe and joint materials requirements. The flange joint bolt circle and drilled holes shall match those of A.S.A. Standard B16.1, 125 lb. All pipe and fittings shall be furnished with the properly sized; bolts, nuts, and best quality, 1/8-inch thick rubber gaskets.

The pipe and fittings shall be cement-lined and seal-coated in conformance with A.S.A. Standard A21.4 (A.W.W.A. C-104).

2.2 Rigid Plastic Pipe, Joints & Fittings – Pipe for use under this heading shall be approved and accepted by Underwriter' Laboratories, Inc.

A. Class 200, standard dimension ratio (S.D.R.) 21, P.V.C.:

1. Materials: Pipe for use under this heading shall be manufactured from clean, virgin, N.S.F. approved, Type 1, Grade 1, 1120 P.V.C. conforming to A.S.T.M. specification D2241. The pipe shall be pressure rated for a hydrostatic working pressure of 200 psi. at 73.4 degrees F. and shall meet all applicable requirements as set forth under Commercial Standard (CS) 256-63. The pipe shall also conform to the following tests conducted at 73.4 degrees F.

- a. Hydrostatic Integrity: The pipe shall withstand without failure, a pressure of 420 psi. for at least 1,000 hours, in accordance with A.S.T.M. Specifications 1598-63T. The pipe shall withstand without failure, a pressure of 630 psi. applied in 60 to 90 seconds in accordance with Specifications 2599-62T.
- b. Vice Flattening Test: A 2-inch-wide ring of pipe shall be flattened in less than one minute, to 100% without showing evidence of shattering or splitting at 73.4 degrees F.
- c. Pipe Wall Thickness – Rigid plastic pipe shall be manufactured to provide a minimum pipe wall, and bell or coupling thickness in accordance with the following schedules:

<u>I.D. Size</u>	<u>Minimum Wall Thickness</u>	
	<u>Barrel</u>	<u>Bell or Coupling</u>
2 in.	.113 in.	.146 in.
4	.214	.258
6	.316	.376
8	.410	.481
10	.511	.607
12	.606	.735

Concentricity: The outer diameter of the pipe shall be concentric within .003 of an inch.

- 2. Slip Joint Pipe: All pipe shall be joined by means of a rubber ring slip joint. Cement weld or glued joints will not be permitted. The slip joint may be formed by either a bell joint or a double ring coupling. The bell joint where used, shall be an integral and homogenous part of the pipe formed by extrusion, with a ring groove for seating the rubber ring gasket. The rubber ring gasket shall be partially split or perforated to permit expansion and contraction with respective increased or decreased pressure in the main. The double ring coupling shall be extruded from pipe materials as previously specified. The coupling interior shall be machined for two square-bottom gaskets and a center tapered stop. The double ring coupling shall be used with plain end pipe on which all ends are tapered to permit pushing the pipe into the coupling. The rubber ring gasket to be used with this coupling shall have a squared seating edge for placement in the coupling grooves. The rubber ring gasket shall also be partially split or perforated to permit expansion and contraction with main pressure changes.
- 3. Markings: Pipe markings shall include the following, marked continuously down the length:
 - a. Manufacturer’s name.
 - b. Nominal Size.
 - c. Class Pressure Rating
 - d. Dimension Ratio Number.
 - e. PVC 1120.
 - f. NSF Logo.
 - g. Identification Code.
- 4. Lubrication: Lubrication shall be water soluble, non-toxic, be non-objectionable in taste and odor imparted to the fluid, be non-supporting of bacteria growth and have no deteriorating effect on the PVC or rubber gaskets.
- 5. Pipe Fittings: Branch, bend, transition, or cap type fittings to be used with rigid plastic shall be flanged or mechanical joint cast or ductile iron as previously specified. The fitting item shall be furnished with and include all; bolts, glands, transition gasket, etc., as required to fully make up the fitting connection joints.

2.3 Restrained Joint PVC Pipe

- A. Restrained joint PVC pipe shall meet the performance requirements of ASTM D2241. The PVC compound shall meet cell classification 12454 per ASTM D1784. All joints shall meet the requirements of ASTM D3139. O-rings shall meet the requirements of ASTM F477 "Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.)
- B. Restrained joint PVC shall be installed using a "permanent" joint system. Joint system shall provide a noncorrosive restrained joint by using machined grooves on the pipe and in the coupling which, when aligned, allow a spline to be inserted locking the pipe and coupling together. Provide an O-ring in the coupling to create a hydraulic seal.
- C. Mechanical Joint Restraints
 1. Restraint devices for nominal pipe sizes 3 inch through 36 inch shall consist of multiple gripping wedges incorporated into a follower gland meeting the applicable requirements of ANSI/AWWA C110-A221.10.
 2. The devices shall have a working pressure rating equal to that found in the most current product brochure. Ratings are for water pressure and must include a minimum safety factor of 2:1 in all sizes.
 3. Gland body, wedges and wedge actuating components shall be cast from grade 65-45-12 ductile iron material in accordance with ASTM A536.
 4. Three (3) test bars shall be incrementally poured per production shift as per Underwriter's Laboratory (U.L.) specifications and ASTM A536. Testing for tensile, yield and elongation shall be done in accordance with ASTM E8.
 5. Chemical and nodularity tests shall be performed as recommended by the Ductile Iron Society, on a per ladle basis.

- 2.4 HDPE Tubing: HDPE tubing for all underground use as water main and service lines, shall be "copper tube size, SDR 9, 200 psi rated". All HDPE tubing produced for this service shall be in accordance with applicable standards of ASTM 3350, ASTM 2737, and AWWA C901. Pipe Dimensions shall meet Copper Tubing Size (CTS) Standards. Fittings for use with the HDPE tubing material shall be constructed of brass or bronze, of the joint type as required for the specific connections and are subject to District approval. Insert stiffeners are required when using HDPE tubing, and shall be solid 304 tubular stainless steel, dimpled and flanged on one end. Stiffeners shall be Ford Series 50, or approved equal.

ARTICLE 3 – VALVES AND VALVE BOXES

3.1 Gate Valves:

- 1 All gate valves shall be non-rising stem, ductile iron body and wedge, bronze trim and stem, resilient seat gate valves conforming to AWWA C515, unless otherwise indicated. The disc shall have a resilient rubber seat ring mounted securely with stainless steel screws. All internal parts shall be epoxy coated. The valve stem seal shall be double "O"-ring and shall contain an anti-friction washer. The valve shall be as supplied by Mueller, Clow, American or approved equal.
- 2 Valve ends shall be compatible with the pipe in which they are installed. Tapping valves shall be flanged by mechanical joint and shall be compatible with the specified tapping sleeve.
- 3 All valves shall open left (counterclockwise) and have an operating nut capable of being turned by a standard gate valve key for buried valves and a handwheel for exposed valves.
- 4 Each buried valve located within a paved area shall have a cast-iron (bituminous coated) valve box. Valve box shall be Tyler Pipe 564-S or approved equal.
- 5 Each buried valve, which is not located within pavement, shall have a valve box consisting of a length of six-inch PVC pipe topped with a Clay and Bailey Model 2194 cast iron valve box cover with a carsonite glass fiber/resin reinforced composite utility stake with the words "Water Valve". The utility stake shall be "white" in color with "blue" lettering.

ARTICLE 4 – CONCRETE FOR THRUST BLOCKING AND PIPE ENCASEMENT

Concrete to be used for thrust blocking with various bends, tees, valves, fire hydrants, etc. shall consist of ingredients designed to produce a mixture having a 3,500 psi. compressive strength of 28 days curing item. The mix shall be a “dry” as possible using only sufficient water to permit mixing and placement. Excessive water will not be permitted. Cement for use shall be the “high early” type to provide initial set as soon as possible. Concrete may be placed and covered with earth fill to prevent freezing during periods of cold weather. However, frozen ingredients will not be permitted for use. All concrete used and placed for this purpose shall be given at least three (3) days curing time before being placed under stress. Installation shall be in strict accordance with the applicable Articles under the following Section of these specifications.

Concrete for pipe encasement shall be of similar mix and design. Placement of the concrete shall be performed in such a manner so as to insure provision of a bed or cradle under the entire pipe length.

Where joints are to be encased, the piping shall be tested prior to concrete placement to maintain a pressure 50 percent greater than normal working pressure for a period of 4 hours. The Contractor shall provide all necessary equipment for conducting the pressure test as directed by the Water District. All necessary precautions shall be taken to prevent flotation of the piping during or following placement of the encasement materials.

ARTICLE 5 – PIPE BEDDING

Materials to be used for this purpose shall consist of fine, clean, durable particles of crushed stone. Crushed stone used for this purpose shall consist of materials passing a $\frac{3}{4}$ -inch sieve to dust.

ARTICLE 6 – WATER MAIN TRACER TAPE

Water main tracer tape shall be installed with all water main. The materials to be installed for this purpose shall consist of three (3) inch wide tape made of bonded layer plastic with a metallic foil core. Tape splices shall be knotted to prevent tensile pressure on the splice. The material to be used for this service shall be “Terra Tape D” as manufactured by the Griffolyn Company of Houston, Texas, or approved equal. The metallic tape shall be colored to contrast with the soil and shall bear an imprint identifying the line below, such as, “ Caution, Water Main Buried Below”.

Installation of the tracer tape shall be in accordance with applicable Articles of these specifications.

ARTICLE 7 – WATER MAIN LOCATOR WIRE

Water main locator wire shall be installed with all water main, fittings, and valve installation. The material to be installed for this purpose shall consist of standard electric service wire, a single No. 12 U.L. approved copper wire of the solid type with insulation for 600 volts. Insulated wire for this service shall be provided in standard rolls of not less than five hundred (500) foot lengths.

7.1 Splices: Splices shall only be allowed where accessible. Buried splices will not be allowed.

Wire Contact: In order to make use of the wire for water main location purposes, a splice point shall be placed adjacent to a valve box location. If valve box locations are spaced more than 500 feet apart, Contractor shall install a vertical piece of 6-inch diameter Schedule 40 PVC adjacent to the water main, topped with a Clay and Bailey Model 2194-01-1009 cast iron cover, to maintain the required maximum distance between wire contact points. The wire shall be brought to the ground surface at these locations so a power source can be connected. The wire shall run outside up alongside the valve box, then through a hole into the valve box just below ground level. The splice connector shall be left exposed at the top of the valve box at the wire contact locations. Wire contact points shall be provided at no more than 500-foot intervals. Wire shall also be run to allow for the location of water services. Wire shall be installed with service line from main to meter.

Water main locator wire installation shall be in accordance with applicable Articles of these specifications.

Prior to final acceptance by Owner, Contractor shall demonstrate that the locator wire works to the satisfaction of the Owner and/ or his representative.

ARTICLE 8 – CONNECTION TO PRESENT SYSTEM

Materials to be used for connections to the present water distribution system shall be in accordance with the preceding Articles as applicable, under this Section of these specifications. Installation, testing and sterilization of all items shall be in strict accordance with the following Section of these specifications. Under all circumstances, extreme care must be exercised when connecting to the present system. Foreign materials of whatever nature, must not be permitted to enter the system. All direct connection fittings and valves shall be thoroughly rinsed or washed with a chlorine solution just prior to installation and connection. The chlorine solution to be used shall be mixed as stated in the following Section of the specifications.

The Contractor shall notify the District when system shutdown is required so that proper notification to those affected by the shutdown can be provided. Where system segment shutdown is required, the actual shutdown is not to be done until all connection materials, equipment, and personnel are at the site, and the existing system point of connection has been exposed, thoroughly cleaned, and prepared for immediate installation of the connection materials. All personnel shall be thoroughly instructed as to the procedure to be followed and ready for work. All connections are then to be made in an efficient manner requiring the least amount of time and maximum amount of care.

ARTICLE 9 – ROAD CROSSING MATERIALS

State highway and permanent surfaced County Road crossings shall be made in strict accordance with the State and County Highway Department rules and regulations. The required excavation permit shall be provided and displayed for each location. At a minimum, materials to be used for all crossings shall meet the following requirements.

9.1 Water Main: Pipe used for this purpose shall be as previously specified in this Section of these specifications. Fittings for use in the right-of-way shall be of the joint type as shown and as detailed on the plans. All fittings shall meet the requirements as previously stated in this Section of these specifications.

9.2 Pipe Encasement: All water main for use at the crossing locations shall be placed in or through an encasement tube consisting of over-sized steel pipe. Materials to be used for this purpose shall consist of new steel pipe in not less than ten (10) foot lengths. The materials used for the encasement tube construction shall have a minimum yield strength of 35,000 psi. All joint ends shall be cut at 90 degrees to the longitudinal axis of the pipe. Each end shall be beveled and joints shall be butt welded around the entire perimeter of the pipe. The encasement tube shall have a minimum wall thickness of 0.250 inches.

Encasement spacers shall be used between the water main and the encasement tube in accordance with applicable sections of these specifications.

All encasement tube installation shall be in accordance with applicable Articles of these specifications. Concrete for thrust blocking where required, shall be in accordance with applicable Articles of these specifications.

9.3 Encasement Spacers: Casing spacers shall be projection type, totally non-metallic, constructed of preformed sections of high-density polyethylene. Spacers shall be ISO 9002 certified for strength and quality, and spaced along carrier pipe as shown in the approved plans. Spacers shall be manufactured by RACI, or approved equal.

ARTICLE 10 – FIRE HYDRANTS

Fire and flush hydrants permitted for use on all water system mains shall be the Mueller “Centurion” Model or approved equal unless otherwise specified on drawings. Each hydrant shall be of the traffic model type and manufactured to withstand a working pressure of 150 psi. in full compliance with the A.W.W.A. standard specifications C-502 of the latest revision. Two-way hydrants shall have two (2) hose nozzle connections. Three- way hydrants shall have two (2) hose connections and one (1) pumper nozzle; and shall only be used where specified on the plans. Three-way hydrants, where permitted, shall be the Mueller Model A-423 or approved equal. All hydrants shall have 5 ¼-inch valve openings for mechanical joint connection to minimum six (6) inch water main unless otherwise noted. All hydrants shall be “red” in color.

- 10.1 Auxiliary Valves: Fire hydrants are to be installed with auxiliary valves. Valves to be used for this purpose shall meet the requirements as stated in these specifications, and shall be sized as detailed on the approved plans. If the auxiliary valve is not directly connected to the main tee branch and hydrant, anchor couplings shall be used to secure the connection. Each valve shall be furnished with a valve box, lid and all joint accessories as required.
- 10.2 Blow-Off Hydrants: Blow-off hydrants shall be two (2) inch post type flushing hydrants. The hydrant shall be Eclipse No. 2 as manufactured by Kupferle Foundry, or Model A-411 as manufactured by the Mueller Company, with a two (2) inch mechanical joint inlet and a single, two and one half (2 ½) inch threaded outlet nozzle. Hydrant shall incorporate a dry barrel design to prevent freezing, and shall be “red” in color.

All fire hydrants, auxiliary valves and blow-off hydrants shall be furnished and installed in accordance with the plan details, the detail notations, and applicable Articles of these specifications.

ARTICLE 11 – POLYETHYLENE ENCASMENT FOR DUCTILE IRON PIPE

This Article covers materials for polyethylene encasement to be applied to underground installations of ductile iron pipe, fittings, valves, and other appurtenances.

Polyethylene film shall be manufactured of virgin polyethylene material conforming to the following requirements of A.S.T.M. Standard Specifications D-1248-78 for Polyethylene Plastics Molding and Extrusion Materials:

- 11.1 Raw material used to manufacture
polyethylene film: Type: 1
 Class: A (natural)
 or B (black) Grade:
 E-1
 Flow rate: 0.4 maximum
 Dielectric strength: Volume resistivity, minimum ohm-cm³=10¹⁵
- 11.2 Polyethylene film:
 Tensile strength: 1200 psi (8.3 Mpa)
 minimum Elongation: 300 percent
 minimum
 Dielectric strength: 800 V/mil. (31.5 um) thickness minimum
- 11.3 Thickness:
 Polyethylene film shall have a minimum thickness of 0.008-in. (8 mil. or 200 um). The minus tolerance on thickness shall not exceed 10 percent of the nominal thickness.
- 11.4: Tube size or sheet width:
 Tube size or sheet width for each pipe diameter shall be as listed below.

Nominal Pipe Diameter (in.)	Minimum Polyethylene Width in. (cm)	
	Flat Tube	Sheet
4	16 (41)	32 (82)
6	20 (51)	40 (102)
8	24 (61)	48 (122)
10	27 (69)	54 (137)
12	30 (76)	60 (152)
14	34 (86)	68 (172)
16	37 (94)	74 (188)
24	41 (104)	82 (208)

ARTICLE 12 – ¾-INCH AND 1-INCH RESIDENTIAL SERVICES

12.1 Service Saddles:

- Ford S70-XXX, sized for appropriate service.
- Mueller H-13XXX, sized for appropriate service.

12.2 Corp Stops:

- Ford F1000-X, sized for appropriate service.
- Mueller B-25008, sized for appropriate service.

12.3 Service Lines:

- Type K copper
- HDPE CTS SDR 9, 200psi
- Stiffeners for HDPE shall be Ford Series 50

12.4 Curb Stop/Box:

- Curb Stop: Ford Minneapolis pattern valve, B44-XXX-GSWM, sized for appropriate service.
- Curb Box: Ford EM2-XX-46

12.5 Meter Setter:

- Ford VBH72-12W-XX-XX, sized for appropriate service.

12.6 Meter Pit:

- 20" Diameter, 30" Tall, PVC, Old Castle Model 0020B

12.7 Pit Frame/Cover:

- 20" Diameter frame and cover with touch read

12.8 The District will provide the meters.

12.9 Locate wire, meeting these specifications, shall be installed with HDPE service lines, running from the main to the inside of the meter pit, and terminating just below the pit lid.

SECTION 2 – WATER DISTRIBUTION SYSTEM

INSTALLATION ARTICLE 1 - GENERAL

The work covered by this Section of the specifications, shall consist of furnishing all previously specified materials with all necessary equipment, machinery, tools, and labor, and performing all work required to install and/or construct the water system extensions or changes with all connections and appurtenances as required; in accordance with all directives or modifications and these specifications, all to be complete, in place, accepted and ready for use.

ARTICLE 2 – SITE AND WORK PREPARATION

Prior to starting the various water main route installations, connections, and/or changes as required, the Contractor shall notify the District a minimum of twenty-four (24) hours prior to the start of construction. After so doing, the Contractor shall clear the route of all trees, shrubs, and other objects or materials, which may directly interfere with the construction. All other utility companies or organizations shall be notified for location of their respective facilities prior to starting any work. All trees, shrubs, bushes, etc., which will not interfere with the construction shall be protected from damage. Work preparations shall include having all necessary material items, equipment, and an adequate labor force at the site in working condition, and completely instructed and prepared to perform the work to completion as required.

ARTICLE 3 - DRAINAGE

The Contractor shall control the grading in the vicinity of the pipe trenches so that the surface of the ground will be properly sloped to prevent water from running into the excavated areas. Any water or other liquid wastes which accumulate in the excavated areas shall be promptly removed.

ARTICLE 4 – TRENCH EXCAVATION

- 4.1: General: The Contractor shall perform all excavation necessary for or incidental to the proper installation and construction of the work shown and detailed on the drawings, or as described by the City. Excavation shall include the removal of trees, shrubs, paving, and undesirable materials. Excavation shall be done along the lines as indicated on the plans and shall be continuous without improper bends or kinks. Trenches shall be of sufficient width to provide a working space on each side of the materials being installed. During excavation, materials to be used for backfill shall be stock piled, in an orderly manner, a sufficient distance from the edge of the excavation to avoid overloading which might cause slides or cave-ins, and in such manner so as not to interfere with public travel whenever possible. The Contractor shall provide all barricades, lights, temporary crossing, warning signs, etc., that may be necessary to protect the public and the work from injury or damage.
- 4.2: Depth: Trenches for water main and appurtenances shall be excavated to a sufficient depth to obtain a minimum of forty-two (42) inches of cover over the top of the pipe, except as otherwise required to make taps and connections to existing mains. All excavation shall be made so as to provide a continuous bearing for the barrel of the pipe. Holes of sufficient size shall be excavated to permit ample room for making joints. The bottom of trenches shall be free from rocks, clods, debris, and all other unsuitable materials, and shall consist of properly shaped earth, or tamped granular material as specified in the previous Section of these specifications. The Contractor shall take care not to excavate below grade except to remove undesirable material, or as directed by the City.
- 4.3: Rock Excavation: Where rock is encountered in the trenching operation, the excavation shall be carried to a depth of four (4) inches below the pipe bottom depth assuming proper cover as specified under the preceding paragraph. Where solid rock is encountered and it is necessary to drill and blast same, the Contractor shall provide all suitable equipment and personnel for carrying out the operation in a safe and sensible manner. The Contractor shall have Insurance that includes specific coverage for this and directly or indirectly related items.

When solid rock is encountered, the Contractor shall not refill any trench until told to do so by the District. Excess materials resulting from the rock excavations shall be spread over or adjacent to the trench area where acceptable, or shall be picked up and removed from the site for disposal at a suitable location. It may also be necessary to place a thin layer of earth over the rock backfill areas. This may be hauled in from a stockpile location. This earth layer must be of sufficient depth to support the growth of vegetation. All loose rock and debris shall be thoroughly cleaned up and disposed of. The excavated areas shall be left in a neat, clean, acceptable condition.

ARTICLE 5 – HANDLING OF MATERIALS

All pipe, fittings, valves, and other accessories, shall be unloaded, stored re-handled, and installed by methods in such a manner as to ensure their final location in a sound and undamaged condition, conforming in all respects to specified requirements. Under no circumstances shall pipe, fittings, valves, or other accessories, be dropped to the ground, or otherwise subjected to possible damage from impact or shock. Such materials shall be loaded by lifting with machine or hoist, or by skidding. Pipe handled on skidways shall not be skidded or rolled against other pipe.

Under all circumstances, all materials for use shall be handled in a workman-like manner, using the necessary manpower and equipment to perform the task in accordance with the manufacturer's recommendations.

- 5:1 Protection of Materials, Coatings, and/or Linings: All materials shall be handled in such manner that neither the coatings or the linings are damaged. Hooks for insertion into the ends of the pipes, fittings, valves, and other accessories, shall have broad, well-padded contact surfaces, and shall be of such design and size that uniform support will be provided. Under most circumstances, damage to outside coatings are repairable, and the necessary

repairs shall be properly made prior to installation. Damage to interior linings is not considered repairable, and therefore, the damaged items shall be replaced at the Contractor's expense.

- 5:2: Handling Materials Into Trench: Proper equipment, tools, facilities, and methods satisfactory to the District, shall be provided and used by the Contractor for the safe handling, of all materials. Fittings, valves, and other accessories shall be carefully lowered into the trench or excavation, piece by piece to protect coatings and linings. Under no circumstances shall any materials be dropped or dumped into the trench.

ARTICLE 6 – PIPE LAYING

Laying of the pipe shall commence immediately after the excavation is started, and the Contractor shall use every possible means to keep the completed pipe installation closely behind the trenching. The District may stop the trenching if it appears that the trench is open too far in advance of the pipe laying operation. The Contractor may lay pipe in the best manner adapted to securing speed and good results.

- 6:1 Pipe Joints: The Contractor shall have the necessary equipment and tools available for making the joints for the specific materials being used. In accordance with applicable items under the previous Section of these specifications, acceptable joints for the various pipeline and fitting materials are listed as follows:

Cast or Ductile Iron Pipe: Ring or fluid-tite joint with mechanical joint for fittings, valves, and adapters.

P.V.C. Pipe: Ring-tite joint with necessary transition gaskets for connection to mechanical joint fittings, valves, and adapters.

A. Pipe Joint Adapters: The Contractor shall provide the necessary adapters for all connection changes from ring-tite, slip, or mechanical joint to flanged joint as and where required.

All pipe spigot ends shall be visibly marked to fully "make-up" the joint. With exception of field cut pipe, all "make-up" marks shall be placed on the pipe at the factory. Field cut pipe shall be marked for full joint depth prior to insertion.

- 6:2: Pipe Cutting: Cutting of pipe for closure pieces with installation of valves or fittings, or for any other reason, shall be done in a neat and workman-like manner without damage to the pipe or linings. The cutting operation shall leave a smooth cut end at right angles to the longitudinal axis of the pipe. The exterior surface of the cut end shall be beveled, and the interior surface shall be reamed or filed free of all rough edges and protrusions. All pipe cutting shall be done by saw or mechanical pipe cutters of an approved type. Upon completion of the cutting and trimming operation, the pipe end or ends shall be marked for "make-up" depth. Prior to insertion, the pipe shall be thoroughly cleaned of all foreign materials, including filing and cutting debris.

- 6:3: Pipe Alignment: Pipelines intended to be straight shall be laid straight. Deflections from a straight line shall not exceed the manufacturer's recommendations for joint deflections. Pipe shall be deflected at the joints only. Pipe barrel shall not be deflected. Should the planned or specified alignment require deflections in excess of the maximum recommended for the type of pipe being installed, when using a standard pipe length within the limits of available space, then either shorter pipe sections, or additional bends shall be installed. Under no circumstances shall PVC pipe be deflected except at the joint. PVC pipe shall not be placed under strain.

- 6:4: Thrust Blocking: All mechanical or push-on (ring-tite) joint water main and connection installations, shall be thrust blocked for all bends of 22 ½ degree or more. All bends, tees, crosses, valves, tapping sleeve, and fire hydrant locations shall be thrust blocked in accordance with District requirements. Bearing areas are determined on the basis of bearing against solid undisturbed earth. Concrete to be used for this purpose shall be designed for compressive strength as described in the previous Section of these specifications. All joint and fitting bolts shall remain accessible. Forming for thrust blocks to

obtain the necessary bearing area shall be provided as required. All accessible form materials shall be removed from the trench prior to backfill.

6:5: Existing Utilities: Existing utilities shall be protected during the construction period. Where necessary, the existing utility shall be removed or temporarily relocated, and replaced upon completion of that phase of the work creating this requirement. Under all circumstances, the utility involved and the parties being affected by the disrupted service shall be notified in advance of the proposed operation. All changes and work shall be subject to the approval and acceptance of the utility involved and the District.

6:6: Quality: Damaged or unsound pipe, fittings, and accessories of whatever nature shall be rejected and removed from the work. All joints shall be made as previously specified. Each piece of pipe and all fittings, valves, etc., shall be checked and cleared of debris prior to being put in place. All gaskets shall be checked and cleaned of oil, grease, dirt, etc., before being inserted. All bolted joints shall be rechecked for operation and bolt tightness prior to installation. All open ends of pipe, fittings, etc., shall be carefully plugged or sealed at the end of each day's work to prevent entrance of animals, water, and other foreign matter. All excavation shall be made to neat line and grade.

All personnel involved in any way with the work must be made aware of the fact that the work shall result in a first-class, professional job.

ARTICLE 7 – POLYETHYLENE ENCASEMENT INSTALLATION

The Contractor shall furnish all materials and install the polyethylene encasement as specified in the previous of Section of these specifications. The polyethylene encasement shall prevent contact between the pipe and the surrounding backfill and bedding material but is not intended to be a completely airtight and watertight enclosure. Overlaps shall be secured by the use of adhesive tape, plastic string, or any other material capable of holding the polyethylene encasement in place until backfilling operations are completed.

This Article includes three different methods of installation of polyethylene encasement on pipe. Methods A and B are for use with polyethylene tubes and method C is for use with polyethylene sheets.

7.1: Method A – One length of polyethylene tube for each length of pipe: The Contractor shall cut the polyethylene tube to a length of approximately two (2) foot longer than that of the pipe section. The tube shall then be placed around the pipe, centered to provide one (1) foot of overlap on each adjacent pipe section, and bunched accordion-fashion lengthwise until it clears the pipe ends.

The pipe shall be lowered into the trench and the joint made up with the preceding section of pipe. A shallow bell hole shall be made at joints to facilitate installation of the polyethylene tube.

After assembling the pipe joint, the bunched polyethylene shall be pulled from the preceding length of pipe, slipped over the end of the new length of pipe, and secured in place. The end of the polyethylene from the new pipe section shall be placed over the end of the first wrap until it overlaps the joint at the preceding length of pipe. The overlap shall next be secured in place by taking up slack width to make a snug, but not tight, fit along the barrel of the pipe and securing the fold at quarter points.

All rips, punctures, or other damage to the polyethylene shall be repaired with adhesive tape or with a short length of polyethylene tube cut open, wrapped around the pipe, and secured in place. Proceed with installation of the next section of pipe in the same manner.

7.2: Method B – Separate pieces of polyethylene tube for barrel of pipe and for joints: The Contractor shall cut the polyethylene tube to a length of approximately one (1) foot longer than that of the pipe, centered to provide six (6) inches of bare pipe at each end. Make polyethylene snug, but not tight; secure ends as described for Method A.

Prior to making up a joint, a three (3) foot length of polyethylene tube shall be placed over the end of the preceding pipe section, bunched accordion-fashion lengthwise. After

completion of the joint, the three (3) foot length of polyethylene shall be pulled over the joint, overlapping the polyethylene previously installed on each adjacent section of pipe by at least one (1) foot, made snug and secure at each end as described for Method A.

All rips, punctures, or other damage to the polyethylene shall be repaired as described in Method A. Proceed with installation of the next section of pipe in the same manner.

7.3: Method C – Flat polyethylene sheet encasement: Contractor shall cut polyethylene sheet to a length of approximately two (2) foot longer than that of the pipe section. The cut length shall be centered to provide a one (1) foot overlap on each adjacent pipe section, bunching it until it clears the pipe ends. The polyethylene shall be wrapped around the pipe so that it circumferentially overlaps the top quadrant of the pipe. The cut edge of the polyethylene shall be secured at intervals of approximately three (3) foot.

The wrapped pipe shall be placed into the trench and the pipe joint made up with the preceding section of pipe. A shallow bell hole shall be made at the joints to facilitate installation of the polyethylene. After completion of the joint, the overlap shall be described for Method A.

All rips, punctures, or other damage to the polyethylene shall be repaired as described for Method A. Proceed with installation of the next section of pipe in the same manner.

Bends, reducers, offsets, and other pipe-shaped appurtenances shall be covered with polyethylene in the same manner as the pipe. When valves, tees, crosses, and other odd-shaped pieces cannot be wrapped practically in a tube, they shall be wrapped with a flat sheet or split length of polyethylene tube by passing the sheet under the appurtenance and bring it up around the body. Seams shall be made by bringing the edges together, folding over twice, and taping down. Width and overlaps at joints shall be handled as described for Method A. Polyethylene shall be taped securely in place at valve stem and other penetrations,

Where encountered, the Contractor shall provide openings for branches, service taps, blow-offs, air valves, and similar appurtenances by making an X-shaped cut in the polyethylene and temporarily folding back the film. After the appurtenance is installed, the slack shall be securely taped at the appurtenance and the cut repaired, as well as any other damaged areas in the polyethylene, with tape.

Where polyethylene-wrapped pipe joins an adjacent pipe that is not wrapped, the Contractor shall extend the polyethylene wrap to cover the adjacent pipe for a distance of at least two (2) foot. The end shall be secured with circumferential turns of tape.

The Contractor shall use the same backfill material as that specified for pipe without polyethylene wrapping, exercising care to prevent damage to the polyethylene wrapping when replacing backfill. Backfill material shall be free from cinders, refuse, boulders, rocks, stones, or other materials that could damage the polyethylene.

ARTICLE 8 – WATER MAIN TRACER TAPE INSTALLATION

The Contractor shall furnish all materials and install the water main tracer tape as specified in the previous Section of these specifications. The three (3) inch wide detectable tape shall be installed directly above the water main locations as the trench backfill progresses, to permit an earth cover of 12 to 18 inches over the tape. The tape material shall be installed in accordance with the manufacturer's recommendations. The tape is to be placed in a manner such that trench backfill settlement will not place an excessive tensile stress on the material.

ARTICLE 9 – WATER MAIN LOCATOR WIRE INSTALLATION

The Contractor shall furnish all materials and install the water main and service locator wire as specified under the previous Section of these specifications. The No. 12 insulated wire shall be placed on top of the water main and secured with tape at 8-foot intervals. The wire shall be brought up along the outside of a valve box and brought through a hole drilled in the side of the box, 6- inches below finish grade. The wire shall be spliced at these locations using a standard plastic or rubberized wire

connector. This will permit placing a power source on the wire for both directions in order to use same for locating the water main. Intermediate splices are not allowed. The wire shall be laid slack in the trench so same will not be subject tensile stress as the trench is being backfilled. A sufficient length of wire shall be coiled in meter pit to bring wire to grade.

Prior to final acceptance by Owner, Contractor shall demonstrate that the locator wire works to the satisfaction of the Owner and/or his representative.

ARTICLE 10 – VALVE INSTALLATION

Prior to installation, all valves shall be checked for bolt tightness and operation. All foreign matter, dirt, and debris, shall be removed from inside the valve body. The valve gate and guide shall be cleaned free of grease and dirt. After thoroughly cleaning and checking the valve for operation, the valve gate shall be closed, and the valve shall be installed in place. Following placement and connection to both sides of the valve, excavation for the valve bearing thrust block shall be made. The thrust block shall then be poured of concrete, in accordance with the previous Section of these specifications. The valve holding clamps, No. 4 reinforcing bars, shall then be placed over the valve with embedment in the concrete thrust block.

Following initial set of the concrete, the valve box as specified under the previous Section of these specifications shall be place over the valve body. The valve box shall be set plumb and earth shall be thoroughly tamped around the box to maintain the plumb position. The top of the valve box shall be adjusted for height to the level of the adjacent pavement if in a paved area, or shall be adjusted to stand four (4) inches above ground level, if located in an unpaved area. The lid or cover shall then be placed on the valve box. The valve box may require vertical adjustment from time to time as trench settling occurs. It is intended that upon final project completion, all valve boxes shall be left in a vertical plumb, usable position.

ARTICLE 11 – WORK ADJACENT TO-AND/OR CROSSING STATE OR COUNTY HIGHWAYS

11.1: General: All work to be performed within the right-of-way limits of the State and/or County Highways shall be performed in strict accordance with the Highway Department requirements. The Contractor shall obtain the necessary permits for all work prior to starting any construction. All permits must be displayed as required. The Contractor shall comply with all requirements such as; signals, flagmen, and watchmen; performance of work in such a manner so as not to interfere with traffic, highway entrances, highway maintenance, highway drainage, etc., and methods of placing materials, backfill compaction, and all such other requirements, which may differ from or may be in addition to those specified for work other than that within the highway right-of-way limits.

11:2 Highway Crossings: Highway crossings shall be constructed in accordance with all permit requirements. The Contractor will be held responsible for any and all expense incurred by the Highway Department in protecting the highway while construction is in progress, or as a result of said construction. The Contractor will also be held responsible for all damages to the highway due to operations during construction of the crossings including replacement of damaged pavement. Encasement shall extend from ditch line to ditch line, toe of slope to toe of slope.

A. Boring or Jacking: The crossing shall be machine bored with simultaneous installation of the encasement. Boring without the concurrent installation of the encasement tube will not be permitted. All joints of the encasement tube shall be welded as specified and the encasement tube shall extend to the required dimensions.

B. Open Trench Encasement: Water main encasement may be place in open trench where allowed or permitted. Encasement shall be installed to grade as shown on the plan profile sections. It is recommended that the cut installation be coordinated with the road construction to rough sub-grade. The entire encasement length shall be excavated to subgrade. The encasement pipe shall then be placed over 4 to 6 inches of crushed stone. Following placement, the entire trench shall be backfilled with minus crushed stone compacted in 6-to-8-inch lifts to the road sub-grade level or to the top of the trench.

C. Backfill: Following completion of the machine bored crossing, all bore pit or other

required excavation shall be suitably backfilled to grade. All debris, of whatever nature, shall be picked up and removed from the site. After clean-up, the disturbed area shall be smooth to grade, seeded, and covered with straw. The entire work area shall be left in an orderly and acceptable condition.

ARTICLE 12 – TESTING WATER LINES

All newly laid water lines shall be tested prior to flushing and sterilization. Trenches may be backfilled as the pipe and accessories are installed, or where practicable and at the option of the Contractor. Trenches over the joint locations may be left open for visual inspection during tests. Prior to making tests, all air shall be expelled from the lines. If hydrants or blow-offs are not available, suitable taps shall be provided by the Contractor for this purpose at or near the end points of the installation.

- 12.1 Hydrostatic Tests: A two (2) hour test shall be made on each segment of the water lines between end points at a test pressure of at least 50% in excess of normal maximum operating pressure, not to exceed 200 psi. The test pressure shall be determined by the District and suitable gauges for checking same shall be supplied and connected by the Contractor. A gate valve or pressure relief valves shall be supplied and connected by the Contractor. A gate valve or pressure relief fitting shall be placed at each end of the segment being tested unless otherwise directed. Allowable pressure drop during the two (2) hour test shall be limited to 3% of the test pressure.

Any leaks evident at the surface shall be uncovered, repaired, and/or replaced. All leaking joints shall be tightened, or remade, or replaced, and re-tested. All pipe, fittings, valves, or other accessories found defective under this test shall be removed and replaced at the Contractors expense.

- 12.2 Leakage Test: In the event that the pressure test indicates leakage, a leakage test shall be conducted as follows:

The Contractor shall furnish the gauge and measuring device for the leakage test, as well as the pump, pipe, connections and all other necessary apparatus, and shall furnish all necessary labor to conduct the test. The duration of each leakage test shall be one hour, and during the test, the piping shall be subjected to a hydrostatic pressure of 1.5 times the working pressure or rated pressure of the pipe, whichever of is greater. No pipe installation will be accepted until the leakage is less than ten (10) gallons per mile of pipe per inch diameter per 24 hours. Should any tests of pipe laid disclose leakage greater than that specified, the Contractor shall, at his own expense, locate and repair the defective joints until the leakage is within the specified allowance.

ARTICLE 13 – FLUSHING AND STERILIZING WATER LINES

After an acceptable hydrostatic test, the lines shall again be flushed. After flushing the lines, the pressure valves shall be closed, and enough water drained from segment to permit replacement of a chlorine solution. The chlorine solution shall consist of a powdered chlorine compound such as H.T.H. (calcium hypochlorite 65% available chlorine) thoroughly mixed with water. The chlorine solution shall be poured into the upstream test connection point. The amount of the chlorine compound to be used shall be determined by the City if the Contractor so desires. The chlorine solution shall yield 50 p.p.m. available chlorine. After pumping the required amount of solution into the water line segment with a positive displacement type pump, the connection shall be plugged, and the pressure valve opened. Water shall be flushed through the line until chlorine odor is detected at the opposite end of the installation. At this time, the pressure valve shall be closed and the segment shall be allowed to stand for a period of 24 hours.

Following the 24-hour period, a chlorine residual level of a minimum of 10 p.p.m. must remain in the segment. If an acceptable residual level is determined, the pressure valve shall again be opened and the segment flushed until all traces of chlorine over and above normal line levels have been eliminated.

Should a leak occur during the sterilization procedure, it will be repaired and the sterilization and flushing will be repeated.

Upon successful completion of the testing and sterilization of each water main segment, and prior to

placing same in service, the Contractor shall collect and submit two (2) separate standard bacteriological samples, taken a minimum of 24 hours apart, for analysis to a State of Missouri certified laboratory. Upon receipt of satisfactory test results, the water main segment may be placed in permanent service.

ARTICLE 14 – TRENCH BACKFILL

After placing the piping in the trench, the Contractor shall backfill under and around the pipe simultaneously filling and tamping on both sides with sufficient earth to firmly hold the pipe in position. Extreme care must be exercised with the backfill operations to ensure that no sizable stones or rocks come into contact with the pipe surfaces. After carefully placing and tamping the initial backfill in place to at least six (6) inches over the top of the pipe barrel, the remaining materials may be pushed into the trench. No boulders, broken pavement, or large pieces of blasted rock shall be used in the trench backfill. Any trench improperly bedded or backfilled shall be excavated, examined, and replaced at the Contractor's expense. All non-usable materials shall be picked up and removed from the site to an acceptable disposal location. Upon completion of the initial backfill, the backfill surface shall be either "jetted" with water or neatly mounded to allow for settlement. As the work progresses and settlement occurs, the trenching surface shall continue to be graded and shaped so as to secure a final condition where no further settlement shall occur.

In areas where pavement or permanent surfacing is removed and is to be replaced, the entire backfill shall be made using minus crushed stone in accordance with the previous Section of these specifications. Same shall be placed in six (6) inch layers and compacted to maximum density.

Initial clean-up, in accordance with this Section of these specifications shall occur as the trench backfill operation proceeds. Before final acceptance of the work is made, the Contractor shall travel the lines with the City, and any settlement or unsightly areas shall be repaired or corrected as directed. Upon acceptance, the Contractor shall proceed with the final clean-up, grading, and seeding operation, in accordance with this Section of these specifications.

ARTICLE 15 – FIRE HYDRANT AND AUXILIARY VALVE INSTALLATION

The fire hydrants, valves, and all connection items shall be furnished and installed by the Contractor. All materials used for this purpose shall be as specified under the previous Section of these specifications. The installation shall include all; excavation as required, installation of the water main tee fitting, auxiliary valve, connection pipe, hydrant, gravel fill, thrust or kick block, backfill, and surface replacement as required. The fire hydrants shall be installed to the proper "bury" depth, to stand in an exactly "plumb" position. Hydrant extension pieces may be used to adjust to proper grade as required. Clean gravel fill as specified and detailed, shall be placed to the proper depth and dimension to provide the necessary "weep" volume for water contained in the hydrant thrust or kick block, to assure that cement paste does not plug or block the hydrant weep hole or the gravel fill under and around the weep hole.

The earth backfill shall be hand tamped around the hydrant base and barrel to assure the plumb position. The hydrants may be braced or wired in place until sufficient settlement has occurred to retain the plumb position. Upon completion, all bracing and debris shall be removed from the site. Each site shall then be thoroughly cleaned-up and restored equal to or better than its original condition. All installation sites shall be left in a neat, clean, acceptable condition.

ARTICLE 16 – SURFACE WATER CROSSINGS

16.1 Above-water crossings. The pipe shall be adequately supported and anchored, protected from damage and freezing and accessible for repair or replacement.

16.2 Water crossings.

a. Flowing streams.

A minimum cover of four feet shall be provided over the pipe. When crossing water courses are greater than 15 feet in width, the following shall be provided.

1. The pipe shall be of special construction, having flexible watertight joints. Steel or ductile iron ball-joint river pipe shall be used for open cut crossings. Restrained

joint pipe may be used for open cut crossings, provided it is encased in a welded steel casing. Restrained joint or fusion weld pipe shall be used for bored crossings.

2. Valves shall be provided at both ends of water crossings so that the section can be isolated for testing or repair; the valves shall be easily accessible and should not be subject to flooding; and the valve closest to the supply source shall be in an accessible location.
 3. Permanent taps shall be provided on each side of the valve within the manhole to allow insertion of a small meter to determine leakage and for sampling purposes.
 4. The stream crossing pipe or casing shall extend at least 15 feet beyond the upper edge of the stream channel on each side of the stream.
- b. Intermittent flowing streams.
1. Restrained joint pipe shall be used for all stream crossings;
 2. The pipe shall extend at least 15 feet beyond the upper edge of the stream channel on each side of the stream.

ARTICLE 17 – SEPARATION OF WATER MAINS, SANITARY SEWERS AND COMBINED SEWERS

- 17.1 Parallel installation (Horizontal Separation): Water mains shall be laid at least ten feet horizontally from any existing or proposed sewer. The distance shall be measured edge to edge. In cases where it is not practical to maintain a ten-foot separation, the department may allow deviation on a case-by-case basis, if supported by data from the design engineer. Such deviation may allow installation of the water main closer to a sewer, provided that the water main is laid in a separate trench or on an undisturbed earth shelf located on one side of the sewer and in either case, at such an elevation that the bottom of the water main is at least 18 inches above the top of the sewer. In areas where the recommended separations cannot be obtained, either the waterline or the sewer line shall be constructed of mechanical joint pipe or cased in a continuous casing.
- 17.2 Crossings (Vertical Separation): Water mains crossing sewers shall be laid to provide a minimum vertical clear distance of 18 inches between the outside of the water main and the outside of the sewer. This shall be the case where the water main is either above or below the sewer. At crossings, the full length of water pipe shall be located so both joints will be as far from the sewer as possible but in no case less than ten feet. Special structural support for the water and sewer pipes may be required. In areas where the recommended separations cannot be obtained either the waterline or the sewer line shall be constructed of mechanical joint pipe or cased in a continuous casing that extends no less than ten feet on both sides of the crossing.
- 17.3 Force mains: There shall be at least a ten-foot horizontal separation between water mains and sanitary sewer force mains and they shall be in separate trenches. In areas where these separations cannot be obtained, either the waterline or the sewer line shall be cased in a continuous casing.
- 17.4 Sewer manholes: No waterline shall be located closer than ten feet to any part of a sanitary or combined sewer manhole.
- 17.5 Disposal facilities: No waterline shall be located closer than 25 feet to any on-site wastewater disposal facility, agricultural waste disposal facility, or landfill.

ARTICLE 18 – INITIAL CLEAN UP, GRADING, AND REPLACEMENT

The Contractor shall provide the necessary labor and equipment to permit initial clean-up as the water main is being installed. Immediately following trench backfill, all areas disturbed by excavation shall be graded to conform to the adjacent ground levels. Earth shall be neatly mounded over the trench location. All debris, of whatever nature, due to the water main and service installation, shall be picked up and disposed of. All walks, driveways, roads, streets, etc., shall be replaced to original condition.

ARTICLE 19 – FINAL CLEAN-UP, FINISH GRADING, SEEDING AND STRAW

Following completion of the various routes and initial trench settlement, the Contractor shall go over the routes and clean-up all remaining debris. Following completion of the final clean-up, all areas in any way disturbed by the installation, shall be graded to conform to the adjacent ground areas. After final grading, the graded areas shall be sodded or seeded and covered with straw. In areas of rock excavation, it may be necessary to place a four-inch layer of earth over the exposed areas to form a seed bed for vegetation. The earth shall be applied as part of the final grading operation.

Upon completion of the final grading and seeding, the Contractor shall locate and paint the tops of all valve boxes the color "blue", and other accessories having covers, so that they are plainly visible for use.

All service boxes for valves, future connection items, etc., be firmly in placed in a plumb position, ready and usable for the intended service. Following final completion of all items, the Contractor and District shall again go over the various routes to determine final acceptance.

ARTICLE 20 - GUARANTEE

The Contractor shall guarantee all materials and workmanship in any way involved with this project for a period of one year from the date of final acceptance. Date of final acceptance is hereby defined as the date on which Board of Directors accepts the new water mains.

END OF SECTION 02510

SECTION 02530 - SANITARY SEWER COLLECTION SYSTEM MATERIALS**PART 1 - GENERAL**

Materials for use at any location in the Sanitary Sewer system (extensions or existing) shall meet the requirements as set forth in the following Articles under this Section, or as noted and/or detailed on the project plans.

PART 2 – PIPE, PIPE JOINTS AND FITTINGS**2.1 GRAVITY SEWER**

A. Rigid Plastic Pipe, Joints and Fittings: Pipe for use under this heading shall be of the bell and spigot type. All pipe and materials shall be made from P.V.C. components in accordance with A.S.T.M. specification D1784 for rigid polyvinyl chloride compounds. The pipe bell shall be an integral part of the pipe barrel. The spigot end of each pipe length shall be beveled to permit making up the joint. All pipe spigot ends shall be marked to show full make-up joint depth. All pipe shall meet or exceed the strength requirements when tested in accordance with A.S.T.M. specification D3034.

1. Pipe Joint: All pipe shall be joined by means of a rubber ring slip joint. Cement weld or glued joints will not be permitted. The slip joint may be formed by either a bell joint or a double ring coupling. The bell joint where used, shall be an integral and homogenous part of the pipe formed by extrusion, with a ring groove for seating the rubber ring gasket. The rubber ring gasket shall be partially split or perforated to permit expansion and contraction with respective increased or decreased pressure in the main. The double ring coupling shall be extruded from pipe materials as previously specified. The coupling interior shall be machined for two square-bottom gaskets and a center tapered stop. The double ring coupling shall be used with plain end pipe on which all ends are tapered to permit pushing the pipe into the coupling. The rubber ring gasket to be used with this coupling shall have a squared seating edge for placement in the coupling grooves. The rubber ring gasket shall also be partially split or perforated to permit expansion and contraction with main pressure changes.
2. Pipe Fittings: Lateral service line connected to the sewer main shall be made with wye type fittings inserted in the sewer main piping. Service laterals shall be installed as shown on the plans, or as directed. Each service lateral or wye shall terminate with a rubber faced expander plug to fully seal the open pipe end until same is required for service. Pipe fitting materials shall be the same as that specified for the piping materials. All fitting joints shall be sealed using rubber ring gaskets as previously specified.

All gravity sanitary sewer main and lateral service lines shall be SDR 35 and shall be supplied in 13 feet (minimum) lengths.

B. Ductile Iron Pipe, Joints and Fittings: Pipe for use under this heading shall be Class 50. This material shall meet the following minimum physical strength requirements of; 60,000 psi. tensile, 42,000 psi. yield, and ten (10) percent maximum elongation. Each piece of pipe shall have the; weight, thickness, class manufacturer's mark, the year of manufacture, and the letters DI or word "DUCTILE" clearly stamped on the pipe. The pipe materials and construction shall be in accordance with all the requirements of ANSI Standard A21.51 (A.W.W.A. C-151-65). The pipe may be furnished with mechanical, push on, or flange joint ends as detailed on the plans or as required.

1. Mechanical Joint Pipe and Fittings: Pipe and fittings of this joint type shall be furnished complete with all glands, gaskets, tee head bolts, hex nuts, etc., all properly sized and manufactured for the required pipe and fitting sizes. All fittings and bends shall be constructed of cast or ductile iron. Materials for this service shall consist of durable, solid, cast or ductile iron meeting the minimum physical requirements of 18,000 psi. tensile strength and 40,000 psi. modulus of rupture. Fittings and bend items shall be designed and tested to permit a minimum working pressure of 250 psi. prior to being shipped from the factory. All mechanical joint fittings, bends, and joint accessory materials shall conform to ANSI Standard A21.10 and A 21.1.1.
2. Slip Joint Pipe and Fittings: Slip joint pipe shall be made of ductile iron as previously specified. The plain end of the pipe shall be tapered to permit easy assembly. The pipe joint gasket shall meet all applicable requirements of ANSI Standard A21.10 with joints in accordance with Section

11-2.3 of U.S.A. Standard A 21.1.1. Fittings and bends for use with slip joint piping shall be mechanical joint as previously specified.

3. Flanged Pipe and Fittings: Pipe for use with flanged ends shall be ductile iron as previously specified. Threads for the screwed-on flanges shall be designed in accordance with U.S.A. Standard B 2.1. Flanges for use shall be faced and drilled in accordance with U.S.A. Standard B 16.1, 125 lb. All joint and joint materials, shall be designed and tested for a minimum working pressure of 250 psi. Flanged branch fittings and bends shall meet or exceed the pipe and joint materials requirements. The flange joint bolt circle and drilled holes shall match those of U.S.A. Standard B 16.1, 125 lb. All pipe and fittings shall be furnished with the properly sized; bolts, nuts, and best quality, 1/8-inch thick rubber gaskets. The interior surface of all pipe and fittings shall be coated with an approved epoxy lining, factory applied.

2.2 FORCE MAINS

A. PVC Force Mains

1. Pipe: Force mains shall be PVC Class 200. Pipe shall conform to AST D2241 and shall be pressure rated at 200 psi at 73° F with a standard dimension ratio of SDR 21. PVC pipe must bear the seal of approval of the National Sanitation Foundation. Net laying lengths must be 20 feet. Joints shall be integral bell push-on joints with single rubber gasket, making a pressure tight seal. Said pipe shall be in accordance with ANSI/ASTM D2241-78 or the latest revision thereof.
2. Fittings for PVC Pipe: Fittings for pipe sizes 2" and larger shall be flanged and/or iron fittings meeting the requirements of ANSI/AWWA C111/A 21.11. Fittings shall include appropriate transition gaskets.

For pipe sizes greater than 4", mechanical joint ductile iron fittings for PVC pipe shall be used and shall meet the requirements of ANSI/AWWA C111/A 21.11. Fittings shall include appropriate transition gaskets.

3. Pipe and Fitting Compound: PVC compounds shall be white in color for improved exposure resistance and shall comply with ASTM D-1784, Rigid Poly (Vinyl Chloride) Compounds with physical properties and chemical resistance of cell classifications for pipe of 12454-B, 12454-C, or 14333-D and cell classifications for fittings for 12454-B, 12454-C, or 13343-C. Different cell classifications having one or more superior properties and clean rework material generated by the manufacturers own production shall be acceptable.
4. Joints: Joints of both pipe and fittings shall comply with ASTM D-3139, Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals. Qualification test of the joint design shall result in no leakage under various laboratory test conditions of joint alignment at 2<< times rated pressure and at 22" mercury vacuum.
5. Gaskets: Gaskets shall be molded from a high grade, properly vulcanized, elastomeric compound consisting of either a basic natural or synthetic rubber. Gaskets shall be marked to show pipe size and type.

NOTE: Specifications for Elastomeric Seals for Thermoplastic Pipes are being developed by ASTM. Until they are published, the compound for elastomeric seal rubber gaskets shall generally comply with modified physical requirements of ASTM Standard Specifications: D-1869, Rubber Rings for Asbestos Cement Pipe; C361, Reinforced Concrete Low-Head Pressure Pipe; and AWWA Standard C III for Rubber Gasket Joints for Cast-Iron Pressure Pipe and Fittings.

6. Air/Vacuum Release Valves: Air/Vacuum Release Valves shall be Valmatic Model 801A or approved equal with steel floats, Buna-N seating and cast-iron housing. Air/Vacuum valves shall be located as depicted in the construction drawings and installed as detailed in the construction drawings.
7. Gate Valves: All gate valves shall be non-rising stem, cast-iron body and wedge, bronze trim and stem, resilient seat gate valves conforming to AWWA C509, unless otherwise indicated. The disc shall have a resilient rubber seat ring mounted securely with stainless steel, screws. All internal

parts shall be epoxy coated. The valve stem seal shall be double "O"-ring and shall contain an anti-friction washer. The valve shall be as supplied by Mueller, Clow, American or approved equal.

8. Restrained Joint PVC Pipe

- Restrained joint PVC pipe shall meet the performance requirements of ASTM D2241. The PVC compound shall meet cell classification 12454 per ASTM D1784. All joints shall meet the requirements of ASTM D3139. O-rings shall meet the requirements of ASTM F477 "Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.)
- Restrained joint PVC shall be installed using a "permanent" joint system. Joint system shall provide a noncorrosive restrained joint by using machined grooves on the pipe and in the coupling which, when aligned allow a spline to be inserted locking the pipe and coupling together. Provide an o-ring in the coupling to create a hydraulic seal. The SDR designation and the pressure class designation shall be as shown on the approved plans.

9. Mechanical Joint Restraints

- Restraint devices for nominal pipe sizes 3 inch through 36 inch shall consist of multiple gripping wedges incorporated into a follower gland meeting the applicable requirements of ANSI/AWWA C110-A221.10.
- The devices shall have a working pressure rating equal to that found in the most current product brochure. Ratings are for water pressure and must include a minimum safety factor of 2:1 in all sizes.
- Gland bod, wedges and wedge actuating components shall be cast from grade 65-45-12 ductile iron material in accordance with ASTM A536.
- Three (3) test bars shall be incrementally poured per production shift as per Underwriter's Laboratory (U.L.) specifications and ASTM A536. Testing for tensile, yield and elongation shall be done in accordance with ASTM E8.
- Chemical and nodularity tests shall be performed as recommended by the Ductile Iron Society, on a per ladle basis.

B. Ductile Iron Force Mains:

1. Ductile Iron Pipe, Joints and Fittings: Pipe for use under this heading shall be Class 50. This material shall meet the following minimum physical strength requirements of; 60,000 psi. tensile, 42,000 psi. yield, and ten (10) percent maximum elongation. Each piece of pipe shall have the; weight, thickness, class manufacturer's mark, the year of manufacture, and the letters DI or word "DUCTILE" clearly stamped on the pipe. The pipe materials and construction shall be in accordance with all the requirements of ANSI Standard A21.51 (A.W.W.A. C-151-65). The pipe may be furnished with mechanical, push on, or flange joint ends as detailed on the plans or as required. Ductile iron piping shall be used for the discharge piping in the wet well, valve vault, and meter vault and shall transition to PVC force main piping as shown on the plans and matching the specifications in this section.

- Mechanical Joint Pipe and Fittings: Pipe and fittings of this joint type shall be furnished complete with all glands, gaskets, tee head bolts, hex nuts, etc., all properly sized and manufactured for the required pipe and fitting sizes. All fittings and bends shall be constructed of cast or ductile iron. Materials for this service shall consist of durable, solid, cast or ductile iron meeting the minimum physical requirements of 18,000 psi. tensile strength and 40,000 psi. modulus of rupture. Fittings and bend items shall be designed and tested to permit a minimum working pressure of 250 psi. prior to being shipped from the factory. All mechanical joint fittings, bends, and joint accessory materials shall conform to ANSI Standard A21.10 and A 21.1.1.
- Flanged Pipe and Fittings: Pipe for use with flanged ends shall be ductile iron as previously specified. Threads for the screwed-on flanges shall be designed in accordance with U.S.A. Standard B 2.1. Flanges for use shall be faced and drilled in accordance with U.S.A. Standard B 16.1, 125 lb. All joint and joint materials, shall be designed and tested for a minimum working pressure of 250 psi. Flanged branch fittings and bends shall meet or exceed the pipe and joint materials requirements. The flange joint bolt circle and drilled holes shall match those of U.S.A. Standard B 16.1, 125 lb. All pipe and fittings shall be furnished with the

properly sized; bolts, nuts, and best quality, 1/8-inch thick rubber gaskets. The interior surface of all pipe and fittings shall be coated with an approved epoxy lining, factory applied.

PART 3 - MANHOLES

3.1 MANHOLES

- A. Pre-Cast Manholes: Pre-cast manhole straight sections with eccentric top or cone sections may be used for manhole construction. Bottom sections, with properly located inlet and invert openings sized for sewer main as required, may be used. As will be noted from the plant profile segments, most manholes are designed for two tenths (0.2) foot of fall across the manhole. All manhole sections shall be fitted with, or provided with rubber coated manhole steps. Concrete for all pre-cast manhole sections shall be designed of ingredients that will produce a minimum 3,500 psi. compressive strength at 28 days. All sections shall be fully reinforced with welded wire fabric.
- B. Manhole Frames and Covers: Shall be of the type and duty as shown on the manhole plans. Iron castings shall conform to the latest revisions of ASTM and specification A-48, Class 20. All castings for use shall be true to pattern in form and dimensions, free from faults, sponginess, cracks, blowholes, and other defects. The bearing surfaces, between frames and covers, shall be machined, fitted together, and match marked, to prevent rocking.

PART 4 – PIPE BEDDING

- 4.1 Materials to be used for this purpose shall consist of fine, clean, durable particles of crushed stone. Crushed stone used for this purpose shall consist of materials passing a 1-inch sieve to dust.

PART 5 – LIFT STATIONS

5.1 WET WELL MOUNTED LIFT STATIONS

NOT USED

5.2 WET WELLS AND VAULTS

Wet wells and vaults shall be precast concrete designed to produce on minimum 3,500 psi compressive strength at 28 days. All sections shall be fully reinforced with welded wire fabric. All wet wells and vaults shall be fitted with a hatch for access. Precast wet well interior shall be coated with an approved epoxy coating prior to or after placement. Wet wells and vaults shall be of diameter and depth as shown on the plans. All appurtenances depicted on the plans shall be provided and installed to render the lift station completely functional.

The base of the wet well shall be grouted with non-shrink, non-metallic, non-corrosive cement based grout conforming to ASTM C1107.

All pipe openings through the wet well walls shall be sealed with a resilient connector in accordance with ASTM C923. The connector shall provide a flexible and watertight seal between the pipe and wall opening.

The wet well shall contain stainless steel guide rails for the installation and removal of the pumps. There shall be provided stainless steel lifting chains and floats for control of the pumps as called for in Section 16200 and as recommended by the pump manufacturer. Floats shall be provided for the control of the pumps and alarms.

The wet well shall have a 4" minimum diameter Type 304 stainless steel air vent extending through the top slab with a 180 degree turn. All vents shall have a charcoal filter at the end of the vent pipe. The filter shall be such that the filter material may be replaced without replacing the vent filter piping.

Wet wells shall contain a form of fall protection around the access hatch meeting OSHA standards and as depicted on the construction drawings.

Structures shall be cleaned per specifications listed in Section 02411 – Selective Structure Demolition.

The interior of the wet well shall be epoxy seal coated per the following:

- a. Any voids resulting from pre-casting or placement shall be patched with TNEMEC Series 218 MortarClad or approved equal.
- b. The entire interior shall then be coated with TNEMEC Series 434 Perma-Shield H2S or approved equal.
- c. The Interior shall then receive a topcoat of TNEMEC Series 435 Perma-Glaze or approved equal.

The exterior of the vaults shall be coated with dampproofing as described in Section 07115.

5.3 BASIN AND VAULTS ACCESS COVER

Aluminum basin access covers shall be provided with each basin assembly and sized according to the plans. Each cover shall have a hinged access opening properly sized for installation and removal of the wastewater pump, check valve assemblies, gate valves, and access to magnetic flow meter. The access cover shall have a minimum of two (2) hinges, and shall be constructed of non-skid, tread-plate aluminum with a minimum thickness of ¼-inch, capable of withstanding a live load of 300 LBS P.S.F. Doors shall open to 90° and automatically lock with stainless steel hold open arms with aluminum release handles. Doors shall close flush with the frame and rest on a built-in neoprene cushion/gasket. Lifting handle, hinges, and all fastening hardware shall be stainless steel. Unit shall lock with a stainless steel slam lock with removable key. Access covers shall be bolted to the basin with stainless steel cap screws, or embedded into the concrete with a continuous anchor system.

The wet well access hatch shall have an integral nut rail. The upper guide rail brackets and lifting chain hooks shall be mounted to the nut rail. Model and type of access cover shall be of type depicted on the plans.

5.4 STORAGE

Storage shall be provided in RCP pipe as depicted on the construction plans. Pipe shall be Class 2 o-ring type RCP pipe. The inside and outside shall be coated with commercial grade water proofing sealer, SS1H slow setting emulsion. Joints shall be sealed using Fernco flexible coupling, Mac brand wrap.

5.5 MAGNETIC FLOW METER

Reference Section 16112 – Instrumentation for type of flow meter to be installed.

The electrodes shall be type-super smooth, polished with self-cleaning finish and non-stick shape. They shall be constructed of 316L stainless steel equivalent. The meter body shall include 316 stainless grounding rings. The cable connection ports shall be ¾" NPT male and rated for submersion.

Schedule 80 PVC conduits shall be used for all wiring from the meter vault to the signal converter enclosure.

Flow meter shall be supplied in a vault as specified above on the discharge line beyond the valve vault. All power and signal wiring shall be per manufacturer's requirements. Flow meter readout display shall be provided in control panel.

PART 6 – PUMPS AND MOTORS

- 6.1 The Contractor shall furnish duplex pumping station containing Homa AMS434-190 Vortex Pumps as depicted in the construction drawings. The motor shall be 1750 RPM connected for operation on a 460 volt, 60 Hz, three-phase service, horsepower rating and number of pumps shall be in accordance with the schedule on the plans. The motor shall be an integral part of the pumping unit. The pump discharge size shall be 4" or larger.

The pumps shall be capable of delivering 100 gpm against a rated total dynamic head of 52.48 feet. The pumps shall also be capable of operating at negative total dynamic heads without overloading the motors. Under no conditions shall inline piping or valving be allowed to create a false apparent head.

The vortex unit shall be capable of passing 3" solid material normally found in domestic and commercial sewage such as sanitary napkins, disposable diapers, cloth diapers, wash rags, wood, plastic, etc. The discharge shall be capable of freely passing through a 3" piping system including check and gate valves.

The common pump and motor shaft shall be 420 stainless steel supported by a heavy duty lower single row and an upper sealed single row ball bearing. The cutting elements and impeller shall be designed to keep the overhung load distance to a minimum. All fasteners shall be 304 stainless steel.

Each pump shall be equipped with two seals. The lower seal (pump side) shall be of the mechanical type with silicone carbide faces. The upper seal shall be a lip type seal mounted at a slight angle to the shaft.

The seals shall be separated by an oil chamber. An electronic probe shall be provided in the oil chamber to detect the leakage of water into the chamber. A solid-state device mounted in the pump control panel or in a separate enclosure shall send a low voltage, low amperage signal to the probe. If water enters the oil chamber the probe shall activate a warning light in the control panel.

The motor shall be of the submersible type.

The motor shall be airfilled and shall have Class "F" insulation. Bimetallic thermal switches shall be imbedded in each phase of the winding to sense high temperature. The rating of the switch shall be 140 C 5 C. The control current shall be connected through the bimetallic switches so that the motor is shut down should a high temperature condition exist. The switches shall be self-resetting when the motor cools.

The equipment specified shall be the product of a company experienced in the design and manufacture of grinder pumps. The company shall submit detailed installation and user instructions for its product; submit evidence of an established service support program including complete parts and service manuals; and be responsible for maintaining a continuing inventory of grinder pump replacement parts. Vortex pumps shall be as manufactured by Homa Pumps or approved equal.

The manufacturer shall offer a limited warranty guarantying its product to be free from defects in materials and factory workmanship for a period of two years from date of installation or twenty-seven (27) months from date of shipment, whichever occurs first, provided the product is properly installed, serviced, and operated under normal conditions and according to the manufacturer's instructions. Repair or parts replacement required as a result of such defect will be made free of charge during this period upon return of the defective parts or equipment to the manufacturer or its nearest authorized service center.

PART 7 – CONNECTION TO PRESENT SYSTEM

7.1 MATERIALS

- A. Materials to be used for connections to the present system shall be in accordance with the preceding Articles as applicable, under this Section of these specifications. Installation and testing of all items shall be in strict accordance with the following Section of these specifications. Under all circumstances, extreme care must be exercised when connecting to the present system. Foreign materials of whatever nature, must not be permitted to enter the system.
- B. The Contractor shall notify the City prior to connection so that proper notification to those affected may be provided. Where system segment shut-down is required, the actual shut-down is not to be done until all connection materials, equipment, and personnel are at the site, and the existing system point of connection has been exposed, thoroughly cleaned, and prepared for immediate installation of the connection materials. All personnel shall be thoroughly instructed as to the procedure to be followed and ready for work. All connections are then to be made in an efficient manner requiring the least amount of time and maximum amount of care.
- C. Existing manholes shall be core bored or provided with a smooth cut for connection of new mains or services. The pipe to base connection shall be made using a rubber gasket around the pipe barrel with sufficient flap to act as a water stop when sealed in the socket or hole filler grout. An asphaltic-fibre cement shall be used over the joint connection around the full pipe diameter, after the filler grout has hardened. Concrete for additional support of the connecting sewer main, shall be placed under the piping adjacent to the manhole base.

PART 8 – HIGHWAY CROSSING MATERIALS

8.1 SEWER MAIN

Pipe to be used for this purpose, unless otherwise shown on the plan and/or details, shall be as specified under Article 2 of the specifications. Fittings for use in the right-of-ways shall be of the joint type as shown and as detailed on the plans. All fittings shall meeting the requirements as stated under Article 2 of the specifications.

8.2 PIPE ENCASEMENT

- A. All sewer main larger than two (2) inches in diameter shall be placed in or through an encasement tube consisting of over-sized steel pipe or, in the case of force main, restrained-joint PVC pipe. The encasement tube inside diameter shall be as shown on the plans. Materials to be used for steel encasement tube shall consist of new steel pipe in not less than ten (10) foot lengths. The materials used for the encasement tube construction shall have minimum yield strength of 35,000 psi. All joint ends shall be cut at 90 degrees to the longitudinal axis of the pipe. Each end shall be beveled and joints shall be butt welded around the entire perimeter of the pipe. The encasement tube shall have a minimum wall thickness of 0.250 inches.
- B. Encasement Spacers: Casing spacers shall be projection type, totally non-metallic, constructed of preformed sections of high-density polyethylene. Spacers shall be ISO 9002 certified for strength and quality, and spaced along carrier pipe as shown in the approved plans. Spacers shall be manufactured by RACI, or approved equal.

PART 9 – CONCRETE FOR PIPE ENCASEMENT AND/OR SUPPORT

Concrete to be used for pipe encasement and support shall consist of ingredients designed to produce a mixture having a 3,500 psi., compressive strength at 28 days curing time. The mix shall be as “dry” as possible using only sufficient water to permit mixing and placement. Excessive water will not be permitted. Cement for use shall be the “high early” type to provide initial set as soon as possible. Concrete may be placed and covered with earth fill to prevent freezing during periods of cold weather. However, frozen ingredients will not be permitted for use. All concrete used and placed for this purpose shall be given at least three (3) days curing time before being placed under stress.

PART 10 – POLYETHYLENE ENCASEMENT FOR DUCTILE IRON PIPE.

This Article covers materials for polyethylene encasement to be applied to underground installations of ductile iron pipe, fittings, valves, and other appurtenances.

Polyethylene film shall be manufactured of virgin polyethylene material conforming to the following requirements of A.S.T.M. Standard Specifications D-1248-78 for Polyethylene Plastics Molding and Extrusion Materials:

10.1 Raw material used to manufacture polyethylene film:

Type: 1
 Class: A (natural) or B (black)
 Grade: E-1
 Flow rate: 0.4 maximum
 Dielectric strength: Volume resistivity, minimum $\text{ohm-cm}^3=10^{15}$

10.2 Polyethylene film:

Tensile strength: 1200 psi (8.3 Mpa) minimum
 Elongation: 300 percent minimum
 Dielectric strength: 800 V/mil. (31.5 um) thickness minimum

10.3 Thickness:

Polyethylene film shall have a minimum thickness of 0.008-in. (8 mil. or 200 um). The minus tolerance on thickness shall not exceed 10 percent of the nominal thickness.

10.4 Tube size or sheet width:

Tube size or sheet width for each pipe diameter shall be as listed below.

Minimum Polyethylene Width

Nominal Pipe Diameter (in.)	Flat Tube	in. (cm)	Sheet
4	16 (41)		32 (82)
6	20 (51)		40 (102)
8	24 (61)		48 (122)
10	27 (69)		54 (137)
12	30 (76)		60 (152)
14	34 (86)		68 (172)
16	37 (94)		74 (188)
24	41 (104)		82 (208)

PART 11 – SANITARY FORCE MAIN LOCATOR WIRE

Force main locator wire shall be installed with all force main, fittings, and valve installation. The material to be installed for this purpose shall consist of standard electric service wire, a single No. 12 U.L. approved copper wire of the solid type with insulation for 600 volts. Insulated wire for this service shall be provided in standard rolls of not less than five hundred (500) foot lengths.

11.1 Splices: Splices shall only be allowed where accessible. Buried splices will not be allowed.

11.2 Wire Contact: In order to make use of the wire for force main location purposes, a splice point shall be placed adjacent to a valve box location. The wire shall be brought to the ground surface at these locations so a power source can be connected. The wire shall run outside up alongside the valve box, then through a hole into the valve box just below ground level. The splice connector shall be left exposed at the top of the valve box at the wire contact locations. Wire contact points shall be provided at no more than 500-foot intervals, or where approved by the Engineer, on a case-by-case basis.

Force main locator wire installation shall be in accordance with applicable Articles of these specifications.

SANITARY SEWER COLLECTION SYSTEM INSTALLATION

PART 1 – GENERAL

- 1.1 Underground pipe construction shall be in accordance with the recommended practice as outlined by the pipe manufacturer.
- 1.2 All excavations shall be made to such depths and widths as will give ample room for building all structures, sewers, and appurtenances as detailed on the approved plans.
- 1.3 Clearing and grubbing the site of work, excavation of earth or other materials, sheeting and bracing, pumping and drainage, backfilling, rough grading, and cleaning up shall all be done as specified. In addition, all work maintaining or replacing existing fences, roadways, drives, lawns or structures disturbed by the work, safety precautions and other miscellaneous general work not specified under specific items is to be included in the work done under this section.

PART 2 - SITE AND WORK PREPARATION

- 2.1 Prior to starting the various installations, connections, and/or changes as required the contractor shall notify the City a minimum of twenty-four (24) hours prior to the start of construction. After so doing, the Contractor shall clear the route of all trees, shrubs, and other objects or materials which may directly interfere with the construction. All other utility companies or organizations shall be notified for location of their respective facilities prior to starting any work. All trees, shrubs, bushes, etc., which will not interfere with the construction shall be protected from damage. Work preparations shall include having all necessary material items, equipment, and an adequate labor force at the site in working condition, and completely instructed and prepared to perform the work to completion as required.

PAR 3 - DRAINAGE

- 3.1 The Contractor shall control the grading in the vicinity of the pipe trenches so that the surface of the ground will be properly sloped to prevent water from running into the excavated areas. Any water or other liquid wastes which accumulate in the excavated areas shall be promptly removed.

PART 4 - TRENCH EXCAVATION

- 4.1 Contractor shall perform all excavation necessary for or incidental to the proper installation and construction of the work shown and detailed on the drawings, or as directed by the Engineer. Excavation shall include the removal of trees, shrubs, paving, and undesirable materials. Excavation shall be done along the lines as staked, and indicated on the plans and shall be continuous without improper bends or kinks. Trenches shall be of sufficient width to provide a working space on each side of the materials being installed. During excavation, materials to be used for backfill shall be stock piled, in an orderly manner, a sufficient distance from the edge of the excavation to avoid overloading which might cause slides of cave-ins, and in such manner so as not to interfere with public travel whenever possible. The contractor shall provide all barricades, lights, temporary crossing, warning signs, etc., that may be necessary to protect the public and the work from injury or damage.
- 4.2 Trenches for sewer main and appurtenances shall be excavated to a sufficient depth to obtain a minimum of thirty-six (36) inches of cover over the top of the pipe, except as otherwise required to make taps and connections to existing mains. All excavation shall be made so as to provide a continuous bearing for the barrel of the pipe. Holes of sufficient size shall be excavated to permit ample room for making joints. The bottom of trenches shall be free from rocks, clods, debris, and all other unsuitable materials, and shall consist of properly shaped earth, or tamped granular material as specified in the previous Section of the specifications. The Contractor shall take care not to excavate below grade except to remove undesirable material, or as directed by the Engineer.
- 4.3 Where rock is encountered in the trenching operation, the excavation shall be carried to a depth of four (4) inches below the pipe bottom depth assuming proper cover as specified under the preceding paragraph. Solid rock is hereby defined as such material which cannot be excavated by an excavator with an operating weight of at least 52,000 pounds and a flywheel horsepower of at least 155 horsepower. Where solid rock is encountered and it is necessary to drill and blast same, the Contractor shall provide all suitable equipment and personnel for carrying out the operation in a safe and sensible manner. The Contractor's Insurance shall include specific coverage for this and directly or indirectly related items.

- 4.4 When encountered, the Contractor shall strip from the solid rock areas all overlying earth in sections and shall then notify the Engineer for inspection and measurement. The Engineer may then take levels on the surface of the rock and adjacent ground level, or he may at his discretion, defer the measurement until after excavation is completed. In any event, the Contractor shall not refill any trench where rock is encountered until told to do so by the Engineer or his agent. The rock volume, using lengths and depths as measured in the field, shall be determined on the basis of using a foot trench width as depicted on the construction drawings. The Contractor will not be allowed payment for any rock claimed unless same has been measured as herein provided.'
- 4.5 Excess materials resulting from the rock excavations shall be spread over or adjacent to the trench area where acceptable, or shall be picked up and removed from the site for disposal at a suitable location. It may also be necessary to place a thin layer of earth over the rock backfill areas. This may be hauled in from a stockpile location. This earth layer must be of sufficient depth to support the growth of vegetation. All loose rock and debris shall be thoroughly cleaned up and disposed of. The excavated areas shall be left in a neat, clean, acceptable condition.

PART 5 - HANDLING OF MATERIALS

- 5.1 All pipe, fittings, valves, manholes and other accessories, shall be unloaded, stored rehandled, and installed by methods and in such a manner as to insure their final location in a sound and undamaged condition, conforming in all respects to specified requirements. Under no circumstances shall pipe, fittings, valves, manholes, or other accessories, be dropped to the ground, or otherwise subjected to possible damage from impact or shock. Such materials shall be loaded by lifting with machine or hoist, or by skidding,. Pipe handled on skidways shall not be skidded or rolled against other pipe. When pipe line materials at the site of the work, each piece shall be unloaded opposite, or as close as possible to the point of installation in order to avoid unnecessary rehandling.
- 5.2 Under all circumstances, all materials for use shall be handled in a workman-like manner, using the necessary manpower and equipment to perform the task in accordance with the manufacturer's recommendations.
- A. Protection of Materials, Coatings, and/or Linings: All materials shall be handled in such manner that neither the coatings or the linings will be damaged. Hooks for insertion into the ends of the pipes, fittings, valves, manholes, and other accessories, shall have broad, well-padded contact surfaces, and shall be of such design and size that uniform support will be provided. Under most circumstances, damage to outside coatings are repairable, and the necessary repairs shall be properly made prior to installation. Damage to interior linings are not considered repairable, and therefore, the damaged item shall be replaced at the Contractors expense.
- B. Handling Materials Into Trench: Proper equipment, tools, facilities, and methods satisfactory to the Engineer, shall be provided and used by the Contractor for the safe handling of all materials. Fittings, valves, and other accessories shall be carefully lowered into the trench or excavation, piece to piece to protect coatings and linings. Under no circumstances shall any materials be dropped or dumped into the trench.

PART 6 - PIPE LAYING AND TRENCH BACKFILL

6.1 GENERAL

- A. Installation shall start at the downstream end of the project and shall proceed upstream. All pipe spigot ends shall face downstream and bell ends shall face upstream. Laying of the pipe shall commence immediately after the excavation is started, and the Contractor shall use every possible means to keep the completed pipe installation closely behind the trenching. The Engineer may stop the trenching when in his opinion, the trench is open too far in advance of the pipe laying operation. The Contractor may lay pipe in the best manner adapted to securing speed and good results.

6.2 PIPE JOINTS

- A. The Contractor shall have the necessary equipment and tools available for making the joints for the specific materials being used. In accordance with applicable items under the previous Section of these specifications, acceptable joints for the various pipe line and fitting materials are listed as follows:

1. Cast or Ductile Iron Pipe: Ring or fluid title joint with mechanical joint for fittings, valves, and adapters.

2. P.V.C. Pipe: Ring title joint with necessary transition gaskets for connection to mechanical joint fittings, valves, and adapters.
 - a. Pipe Joint Adapters: The Contractor shall provide the necessary adapters for all connection changes from ring-title, slip, or mechanical joint to flanged joint as and where required.

All pipe spigot ends shall be visibly marked to fully "make-up" the joint. With exception of field cut pipe, all "make-up" marks shall be placed on the pipe at the factory. Field cut pipe shall be marked for full joint depth prior to insertion.

3. Installation: Mechanical joint restraint shall require conventional tools and installation procedures per AWWA C600, while retaining full mechanical joint deflection during assembly.
 - a. Proper actuation of the gripping wedges shall be ensured with torque limiting twist off nuts.

6.3 PIPE CUTTING

- A. Cutting of pipe for closure pieces with installation of valves or fittings, or for any other reason, shall be done in a neat and workman-like manner without damage to the pipe or linings. The cutting operation shall leave a smooth cut end at right angles to the longitudinal axis of the pipe. The exterior surface of the cut end shall be beveled, and the interior surface shall be reamed or filed free of all rough edges and protrusions. All pipe cutting shall be done by saw or mechanical pipe cutters of an approved type. Upon completion of the cutting and trimming operation, the pipe end or ends shall be marked for "make-up" depth. Prior to insertion, the pipe shall be thoroughly cleaned of all foreign materials, including filing and cutting debris.

6.4 PIPE ALIGNMENT

- A. Pipe lines intended to be straight shall be laid straight. Deflections from a straight line shall not exceed the manufacturer's recommendations for joint deflections. Should the planned or specified alignment require deflections in excess of the maximum recommended for the type of pipe being installed, when using a standard pipe length within the limits of available space, then either shorter pipe sections, or additional bends shall be installed.

6.5 EXISTING UTILITIES

- A. Existing utilities shall be protected during the construction period. Where necessary, the existing utility shall be removed or temporarily relocated, and replaced upon completion of that phase of the work creating this requirement. Under all circumstances, the utility involved and the parties being affected by the disrupted service shall be notified in advance of the proposed operation. All changes and work shall be subject to the approval and acceptance of the utility involved and the Engineer.

6.6 QUALITY

- A. Damaged or unsound pipe, fittings, and accessories of whatever nature shall be rejected and removed from the work. All joints shall be made as previously specified. Each piece of pipe and all fittings, valves, etc., shall be checked and cleared of debris prior to being put in place. All gaskets shall be rechecked for operation and bolt tightness prior to installation. All open ends of pipe, fittings, etc., shall be carefully plugged or sealed at the end of each days work to prevent entrance of animals, water, and other foreign matter. All excavation shall be made to neat line and grade.

All personnel involved in any way with the work must be made aware of the fact that the work shall result in a first-class, professional job.

6.7 SANITARY FORCE MAIN TRACER TAPE INSTALLATION

The Contractor shall furnish all materials and install the force main tracer tape as specified in the previous Section of these specifications. The three (3) inch wide detectable tape shall be installed directly above the force main locations as the trench backfill progresses, to permit an earth cover of 12 to 18 inches over the tape. The tape material shall be installed in accordance with the manufacturer's recommendations. The tape is to be placed in a manner such that trench backfill settlement will not place an excessive tensile stress on the material.

6.8 SANITARY FORCE MAIN LOCATOR WIRE INSTALLATION

The Contractor shall furnish all materials and install the force main locator wire as specified under the previous Section of these specifications. The No. 12 insulated wire shall be placed under the force main at the bottom of the trench or wrapped around the force main. The wire shall be brought up alongside of a valve box. The wire shall be spliced at these locations using a standard plastic or rubberized wire connector. This will permit placing a power source on the wire for both directions in order to use same for locating the force main. The wire shall be wired to the valve box or post to retain its location. At no point will buried splices be allowed. The wire shall be loosely knotted at each splice location to prevent direct stress on the connection. The wire shall be laid slack in the trench so same will not be subject tensile stress as the trench is being backfilled.

Prior to final acceptance by Owner, Contractor shall demonstrate that the locator wire works to the satisfaction of the Owner and/or his representative.

6.9 TRENCH BACKFILL

- A. After placing the piping in the trench, the Contractor shall backfill under and around the pipe simultaneously filling and tamping on both sides with sufficient earth to firmly hold the pipe in position. Extreme care must be exercised with the backfill operations to ensure that no sizable stones or rocks come into contact with the pipe surfaces. After carefully placing and tamping the initial backfill in place to at least six (6) inches over the top of the pipe barrel, the remaining materials may be pushed into the trench. No boulders, broken pavement, or large pieces of blasted rock shall be used in the trench backfill. Any trench improperly bedded or backfilled shall be excavated, examined, and replaced at the Contractor's expense. All non-usable materials shall be picked up and removed from the site to an acceptable disposal location. Upon completion of the initial backfill, the backfill surface shall be neatly mounded to allow for settlement. As the work progresses and settlement occurs, the trenching surface shall continue to be graded and shaped so as to secure a final condition where no further settlement shall occur.
- B. In areas where pavement or permanent surfacing is removed and is to be replaced, the entire backfill shall be made using fine crushed stone placed in six (6) inch layers and compacted to a maximum density.
- C. Initial clean-up, in accordance with Article 14 shall occur as the trench backfill operation proceeds. Before final acceptance of the work is made, the Contractor shall travel the lines with the Engineer, and any settlement or unsightly areas shall be repaired or corrected as directed. Upon acceptance, the Contractor shall proceed with the final clean-up, grading, and seeding operation, in accordance with Article 15 this Section of the specifications.

PART 7 – SERVICE LINE WYE INSTALLATION

The Contractor shall furnish all materials and install service connection fittings and service lines as required.

- A. Sewer Main Service Line Connection Fittings: Fittings for service line connection to the sanitary sewer main shall be placed where indicated in the field by the Engineer. All service connection fittings shall be wye or double wye fittings in accordance with Article 2 of Section III of the specifications. All service connection fitting joints shall be watertight and of a quality equal to that of the sanitary main being used.
- B. Sewer Lateral Service Line: The Contractor shall furnish all materials and install sewer lateral service lines from connection to the sewer main wye fitting as shown on the plans.

All service lines and wye installed for future connections shall terminate with a rubber faced threaded compression type expanded plug. All service line and fittings shall be in accordance with Article 2 of Section III of the specifications.

PART 8 – MANHOLE INSTALLATION

8.1 BASE

- A. Pre-cast manhole base sections shall be set on the prepared sub-grade in proper alignment for connection to the inlet and discharge connections. In the event fill under the base section is required to achieve the

proper grade, it shall be made using a 1 inch minus crushed stone fill, fully compacted to sub-grade. Earth fill under pre-cast base sections will not be permitted.

1. Pipe Connections: Sewer main connections to the manhole base shall be made prior to placement of the manhole barrel sections. The pipe to base connection shall be made using a rubber gasket around the pipe barrel with sufficient flap to act as a water stop when sealed in the socket or hole filler grout. An asphaltic-fibre cement shall be used over the joint connection around the full pipe diameter, after the filler grout has hardened. Concrete for additional support of the connecting sewer main, shall be placed under the piping adjacent to the manhole base.

8.2 BARREL

- A. The manhole barrel shall be set on the pre-cast base. The barrel shall be constructed of pre-cast sections as previously specified.

1. Pre-Cast Sections: The barrel to base joint shall be sealed using the rubber ring provided for this purpose when placing same over a pre-cast base section. The remaining seam shall be sealed using an asphaltic-fibre cement on the interior and exterior joint locations. All remaining barrel joints and top or cone to barrel joint connection, shall be sealed using the rubber gasket and asphaltic-fibre cement application.

The entire exterior of the manhole shall be coated with asphaltic-fibre cement to achieve a water-tight seal.

An eccentric pre-cast top or cone section shall be placed over the manhole barrel sections. The top to barrel joint seal shall be made as previously specified for pre-cast section joints. All manhole steps shall be in alignment with the vertical wall of the manhole. The top of the cone section shall provide a 24-inch diameter circular opening.

8.3 MANHOLE COMPLETION

- A. Upon completion of the manhole barrel construction, all debris shall be removed from the excavated area and disposed of. Following clean up; the excavated area shall be backfilled with clean earth. Care must be exercised to maintain the manhole barrel joints in a scaled condition. The backfill may be carefully jetted with water to achieve initial settlement. Following initial settlement, the top of the manhole cover frame shall then be set in place using the frame lugs to center the frame over the opening. It is intended that the frame to top of cone seal shall be watertight. The manhole cover shall then be put in place. Following placement of the manhole frame and cover, the backfill operation shall proceed to the top of the manhole frame and cover.

All backfill operations shall be in accordance with the applicable Articles of the specifications. All manhole construction, frame and cover, etc., shall be in accordance with the plan details and notations.

PART 9 – LIFT Station Installation

9.1 WET WELL

The lift station wet well shall be installed as per Part 8 of the section.

9.2 LIFT STATION

The lift station shall be installed in accordance with the approved plans and as shown on the profile section.

PART 10 – PUMP STATION INSTALLATION

The pump station described under Part 9 of this Section of these specifications shall be constructed at a location established by the Engineer which, in general, will be as shown on the plans. The pump station shall be constructed in accordance with the plan detail and as shown on the profile section.

A cast iron guide rail base shall be mounted on the floor of the pump station. The pump shall be guided onto the cast iron discharge base by guide rails supported at the top by an upper guide bracket and at the bottom by the discharge base. The pump base shall be equipped with a straightening vane which properly aligns the pump on the discharge base just prior to final seating. When the pump is in position, the weight of the pump shall compress the gasket and

seal the connection. The area under the pump shall be free and clear of any additional support or guide pipes to insure free entrance of solids to the impeller.

A fully ported 4" gate valve along with a 4" swing check valve with external indicator arm shall also be installed in the discharge line of each pump.

A NEMA 4X junction box, fully gasketed, shall be provided. All control elements shall be housed in a NEMA 3R door-in-door enclosure. The enclosure shall be fully gasketed and shall have a drip cap. The enclosure shall be suitable for wall or free-standing bracket mounting. Pumping units serving a single user shall have a basin mounted control panel. Pumping units serving two or more users shall have bracket mounted control panels with dedicated electric service complete with lockable disconnect, meter base, service wire, conduit, etc.

A combination manual motor starter and disconnect switch shall be provided for each pump. The unit shall have instantaneous trip magnetic overcurrent protection. The unit shall have adjustable thermal trips.

The control circuit shall be 110 volts. The control circuit shall be connected through the heat sensing switches in the pump and shall disconnect the control circuit in case of a high temperature condition in the grinder pump motor.

A HP rated contactor for each pump shall be provided. Definite purpose contactors will not be acceptable. Single phase controls to have start and run capacitors and start relays mounted in control cabinet. A seal failure warning light shall be mounted on the dead front door.

On duplex stations, an alternator relay shall be supplied to alternate pumps on each successive cycle. A lag float switch shall be used to start both pumps if inflow is greater than on pump can handle and shall also start the second pump in case operating pump fails.

A terminal strip with box type connectors shall be supplied to make all power and control connections for the pump. All terminals shall be marked for easy identification. A ground terminal strip shall also be provided.

A high level alarm light shall be mounted on the top of the control cabinet. The light shall be enclosed in a red polycarbonate enclosure. The light shall be activated by the high level alarm float installed in the pump station as shown on the drawings.

PART 11 – WORK ADJACENT TO AND/OR CROSSING STATE OF COUNTY HIGHWAYS

11.1 GENERAL

- A. All work to be performed within the right-of-way limits of the State and/or County Highways shall be performed in strict accordance with the Highway Department requirements. The Contractor shall obtain the necessary permits for all work prior to starting any construction. All permits must be displayed as required. The Contractor shall comply with all requirements such as; signals, flagmen, and watchmen; performance of work in such a manner so as not to interfere with traffic, highway entrances, highway maintenance, highway drainage, etc., and methods of placing materials, backfill compaction, and all such other requirements, which may differ from or may be in addition to those specified for work other than that within the highway right-of-way limits.

11.2 HIGHWAY CROSSINGS

- A. Highway crossings shall be constructed in accordance with all permit requirements. The Contractor will be held responsible for any and all expense incurred by the Highway Department in protecting the highway while construction is in progress, or as a result of said construction. The contractor will also be held responsible for all damages to the highway due to operations during construction of the crossings, including replacement of damaged pavement. Encasement shall extend from ditch line to ditch line, toe of slope to toe of slope, or as depicted on the Construction Plans.
 1. All bores to comply with Section 734 of MODOT specifications.
 2. Backfill: Following completion of the machine bored crossing, all bore pit or other required excavation shall be suitably backfilled to grade. All debris, of whatever nature, shall be picked up and removed from the site. After clean-up, the disturbed area shall be smoothed to grade, seeded, and covered with straw. The entire work area shall be left in an orderly and acceptable condition.

PART 12 – TESTING OF GRAVITY SEWERS

The extent of testing shall be at the discretion of the owner and engineer and paid for by the contractor.

12.1 GENERAL

After construction and backfilling are completed and before any services are connected the sewers, the completed lines shall be tested for leaks, and visually checked for straightness of line and cracked pipe. If any deficiencies in line or grade are found which will be detrimental to the proper functioning of the sewer, the deficiencies shall be corrected. Any damaged or cracked pipe shall be excavated and re-laid in a manner satisfactory to the Owner. Any section of sewer, which is found to be leaking in excess of the allowable quantity, shall be repaired.

12.2 ACCEPTANCE TESTS

- A. Each reach of sewer shall meet the requirements of the following shall be repaired to the satisfaction of the Owner.
 1. Upon completion of the sewers, acceptance tests will be conducted by the Contractor in the presence of the Engineer to determine the acceptability of the sewers. The testing schedule shall be submitted to the Engineer by the Contractor prior to testing. The Contractor shall furnish suitable test equipment, materials and manpower to conduct the test.
 2. All completed pipe sewers shall be subject to an exfiltration test. The sewer pipe shall sustain a maximum limit of 100 gallons per inch of diameter per day per mile. The exfiltration test shall cover a period of at least four continuous and connective hours. For purposes of determining maximum allowable leakage, manholes shall be considered a section of 48-inch pipe.
 3. No ground water in an amount greater than that allowed and specified herein for the exfiltration test shall be permitted.
 4. Any completed pipe sewers not conforming to the tests herein specified or conforming to all requirements of the specifications, plans and profiles, or subject to any irregularity of construction shall be removed and replaced.
 5. The Contractor shall cooperate fully with the Engineer for the inspection and testing of the completed work.
 6. Stoppers and/or plugs for the various sizes of pipe shall be furnished by the Contractor for use in the tests and personnel shall be made available by the Contractor for aid in conducting the tests herein specified.
 7. As an alternate to the exfiltration test, a low-pressure air test may be conducted after backfilling and before replacing pavement. The equipment shall be provided and tests shall be conducted by the Contractor in the presence of the Engineer.
 8. The Contractor may desire to make an air test prior to backfill for his own purpose, but "Acceptance Test" shall be conducted after backfill.
 9. All wyes, tees or ends of lateral or service stubs shall be suitably capped to withstand the internal pressure during testing. Such caps shall be easily removable for future connections or extensions.
 10. After each manhole-to-manhole section of line has been backfilled and cleaned, the ends shall be plugged with pneumatic plugs. These plugs shall be designed such that they will hold against line test pressure without requiring blocking or bracing. All pneumatic plugs shall pass a qualifying test in the presence of the Engineer before actual line testing as follows: One length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs being tested. Air shall be introduced into the pipe until the pipe pressure reaches 15 psi. The pneumatic plugs shall hold against this pressure without bracing and movement of the plugs.

11. Air for inflation of the triple connection pneumatic plug shall be supplied through a factory-equipped control panel. There shall be three hose connections from the control panel to the triple connection pneumatic plug. One hose shall be used only for inflation of the pneumatic plug. The second hose shall be used for continuously reading the air pressure rise in the sealed line.
12. There shall be a 3 1/2" diameter, 0-30 psig gauge mounted on the control panel for reading the internal pressure of the line being tested. Calibrations from the 0-10 psig range shall be in tenths of pounds (not ounces) and this 0-10 portion shall cover 90% of the completed dial range.
13. Low pressure air shall be introduced into the sealed line until the internal air pressure reaches 4.0 psig greater than the average back pressure of any ground water pressures that may be over the pipe. At least two minutes shall be allowed for the air pressure to stabilize. After the stabilization period, the third hose shall be quickly disconnected from the control panel.
14. The portion of line being tested shall be accepted if the portion under test does not lose air at a rate greater than 0.0015 cfm per square foot of internal pipe surface when tested at an average pressure of 3.0 psig greater than any back pressure exerted by ground water that may be over the pipe at the time of the test.
15. The above requirement shall be accomplished by performing the test as follows. The time required in minutes for the pressure to decrease from 3.5 to 2.5 psig (greater than the average back pressure of any ground water that may be over the pipe) shall not be less than the time shown for the given diameters in the following table (See Table 3 this Section):

TABLE 3

PIPE DIAMETER INCHES	MINIMUM TIME MN: SEC	LENGTH FOR MINIMUM TIME FEET	TIME FOR LONGER LENGTHS SECONDS
4	3:46	597	3.380 L
6	5:40	398	0.654 L
8	7:34	298	1.520 L
10	9:25	239	2.374 L
12	11:20	189	3.418 L
15	14:10	159	5.342 L
18	17:00	133	7.692 L
21	19:50	114	10.470 L
24	22:40	99	13.574 L
27	25:30	88	17.306 L
30	28:20	80	21.366 L
33	31:10	72	25.852 L
36	34:00	66	30.768

16. In areas where ground water is known to exist, the Contractor shall install a 1/2" diameter capped pipe nipple, approximately 10 inches long, through the manhole wall on top of on one of the sewer lines entering the manhole. This shall be done at the time the sewer line is installed. Immediately prior to the performance of the line acceptance test, the ground water level shall be determined by removing the pipe cap, blowing air through the pipe nipple into the ground so as to clear it, and then connecting a clear plastic tube to the pipe nipple. The hose shall be held vertically and a measurement of the height in feet of water shall be taken after the water stops rising in this plastic tube. The height in feet shall be divided by 2.3 to establish the pounds of pressure that will be added to readings.
17. If the installation fails to meet this requirement, the Contractor shall determine at his own expense the source of the leakage. He shall repair or replace all defective materials and/or workmanship. The use of sewer scaling materials and methods shall not be used or accepted.
18. There shall be no substitute for good construction. The replacement of any pipes, pipe or fraction thereof shall require the end connections to be made with factory manufactured pieces having flexible gasketed joints to fit intended use. The use of half bell pipe and/or concrete collar will not be acceptable. Test shall be repeated as often as necessary until the installation meets the requirements of the acceptance test.

19. Pipe Deflection: Each segment of P.V.C. sewer main shall be tested for deflection. The test shall consist of pulling a mandrel through each segment of P.V.C. pipe. The mandrel shall be an object having a cross-section, or same shall be a ball, having a diameter equal to 95% of the nominal pipe inside diameter. A steel cable of adequate known length and strength characteristics, shall be used to pull the mandrel through the piping. In the event of a failure, the failure location shall be found by measurement and the piping shall be repaired or replaced as required. After failure correction, the segment shall be re-tested. This process shall be repeated as often as necessary.

It is recommended that the test for deflection precede the test for infiltration and exfiltration. The Contractor shall furnish all equipment as required to perform all testing as specified. All tests shall be conducted in the presence of the Engineer.

20. After completion of aforementioned testing, each manhole shall be subjected to any exfiltration test. The manhole to be tested shall be isolated from the sewer lines by installing pneumatic plugs in the sewer lines using the same procedure as for air testing, except that the plugs shall be installed in such a manner that there is a clear distance of at least 18" between the inside face of the manhole and the face of the plug. The manhole shall be tested by one of the two methods discussed below.

12.3 WATER TEST

The manhole shall then be filled completely with water. Depth of water shall be at least 3' above ground water. A liquid level measurement shall be made and recorded after initial filling and 15 and 30 minutes thereafter. The test is acceptable when the water loss observed is less than 0.1 gallon/foot diameter/foot head/hour. Addition of water during the testing shall not be allowed.

12.4 VACUUM TEST

All lift holes and any pipes entering the manhole are to be plugged. A vacuum will be drawn and the vacuum drop over a specified time period is used to determine the acceptability of the manhole. The values recorded are applicable only to the manhole being tested and at the time of testing.

The test results will be greatly affected by the preparation of the manhole. All lift holes shall be plugged completely. All pipes entering the manhole shall be temporarily plugged, taking care to securely brace the pipes and plugs to prevent them from being drawn into the manhole.

A. Procedure

1. The test head shall be placed at the top of the manhole in accordance with the manufacturer's recommendations.
2. A vacuum of 10 in. of mercury shall be drawn on the manhole, the valve on the vacuum line of the test head closed, and the vacuum pump shut off. The time shall be measured for the vacuum to drop to 9 in. of mercury.
3. The manhole shall pass if the time for the vacuum reading to drop from 10 in. of mercury to 9 in. of mercury meets or exceeds the values indicated in Table 1.
4. If the manhole fails the initial test, necessary repairs shall be made by an approved method. The manhole shall then be retested until a satisfactory test is obtained.

Minimum Test Times for Various Manhole Diameters – Vacuum Test – Table 1

Depth (ft)	Diameter (Inches)								
	30	33	36	42	48	54	60	66	72
	Times (Seconds)								
8	11	12	14	17	20	23	26	29	33
10	14	15	18	21	25	29	33	36	41
12	17	18	21	25	30	35	39	43	49
14	20	21	25	30	35	41	48	51	57
18	22	24	30	34	40	45	52	58	67
18	25	27	32	35	45	52	58	65	73
20	28	30	35	42	50	53	65	72	81
22	31	33	39	45	55	54	72	79	89
24	33	36	42	51	59	64	78	87	97
26	38	39	46	55	64	75	85	94	105
28	39	42	49	59	69	81	91	101	113
30	42	45	53	63	74	87	98	108	121

21. All sewer pipes shall be flushed to remove any debris, sand or grit from the completed sewers prior to being placed in service. The Contractor shall flush and pump or remove all water from the flushing process.
22. Each section of the sewer line between manholes is required to be straight and uniformly graded. Each section will be lamped in the presence of the Engineer.

PART 13 – TESTING OF FORCE MAINS

13.1 General

- A. Sufficient backfill shall be placed prior to fillings with water and filed testing to prevent lifting of the pipe. When local conditions require that the trenches be backfilled immediately after the pipe has been laid, the testing may be carried out after backfilling has been completed.
- B. At least seven (7) days shall elapse after the last concrete thrust blocking has been cast with normal (Type 1) Portland cement. This elapsed time may be reduced to three (3) days with the use of high-early strength (Type 111) Portland cement.

13.2 Procedure

- A. The following procedure is based on the assumption that the pressure and leakage test will be performed at the same time. Separate tests may be made if approved by the Owner. If separate tests are made, the pressure test shall be made first, the duration of the pressure test may be reduced to one (1) hour and the test pressure for the leakage test may be reduced to the maximum working pressure that will occur on that last portion of the line. Each section of the pipeline shall be slowly filled with water and all air expelled by means of taps at high points. The specified test pressure shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Owner. The test pressure shall be maintained by additional pumpage if necessary for the specified time during which all exposed pipe, fittings, valves, and hydrants shall be carefully examined. All effective elements shall be repaired or removed and replaced and the test repeated until all visible leakage has been stopped and the allowable leakage requirements have been met.

13.3 HYDROSTATIC TESTS

- A. A two (2) hour test shall be made on each segment of the water lines between end points at a test pressure of at least 50% in excess of normal maximum operating pressure, not to exceed 200 psi. The test pressure shall be determined by the City and suitable gauges for checking same shall be supplied and connected by the Contractor. A gate valve or pressure relief valves shall be supplied and connected by the Contractor. A gate valve or pressure relief fitting shall be placed at each end of the segment being tested unless otherwise directed. Allowable pressure drop during the two (2) hour test shall be limited to 3% of the test pressure.

- B. Any leaks evident at the surface shall be uncovered, repaired, and/or replaced. All leaking joints shall be tightened, or remade, or replaced, and re-tested. All pipe, fittings, valves, or other accessories found defective under this test shall be removed and replaced at the Contractors expense.

13.4 ALLOWABLE LEAKAGE

- A. The Contractor shall furnish the gauges and measuring device for the leakage test, pump, pipe, connections and all other necessary apparatus, and shall furnish the necessary assistance to conduct the test. The duration of each leakage test shall be two (2) hours and during the test the main shall be subjected to the pressure required above or as specified in the purchaser's addendum to this standard. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe or any valved section thereof to maintain the specified leakage test pressure after the pipe has been filled with water and the air in the pipeline has been expelled. No installation will be accepted if the leakage is greater than that determined by the formula:

$$\frac{L}{7,400} = ND\sqrt{P} \quad P + 50 \text{ psi}$$

L is the allowable leakage in gallons per hour; N is the number of joints in the length of pipeline tested; D is the nominal diameter of the pipe in inches; and P is the average test pressure during the leakage test in pounds per square inch gauge.

PART 14 – INITIAL CLEAN UP, GRADING, AND REPLACEMENT

The Contractor shall provide the necessary labor and equipment to permit initial clean up as the sewer main is being installed. Immediately following trench backfill, all areas disturbed by excavation shall be graded to conform to the adjacent ground levels. Earth shall be neatly mounded over the trench location. All debris, of whatever nature, due to the sewer main and service installation, shall be picked up and disposed of. All walks, driveways, roads, streets, etc., shall be replaced to original condition.

PART 15 – FINAL CLEAN UP, FINISH GRADING, SEEDING, AND STRAW

Following completion of the various routes and initial trench settlement, the Contractor shall go over the routes and clean-up all remaining debris. Following completion of the final clean up, all areas in any way disturbed by the installation shall be graded to conform to the adjacent ground areas. After final grading, the graded areas shall be seeded and covered with straw. In areas of rock excavation, it will be necessary to place a four inch layer of earth over the exposed areas to form a seed bed for vegetation. The earth shall be applied as part of the final grading operation.

PART 16 – GUARANTEE

The Contractor shall guarantee all materials and workmanship in any way involved with this project for a period of one year from the date of final acceptance. Date of final acceptance is hereby defined as being the date on which the Board of Directors accepts the improvements.

END OF SECTION 02530

SECTION 02630 – STORM DRAINAGE**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes
 - 1. Storm sewer drainage piping, fittings, and accessories.
 - 2. Storm drainage structures.

1.2 SUBMITTALS

- A. Product Data: Provide data on pipe materials, pipe fittings, and accessories. Provide shop drawings for precast inlets and catch basins
- B. Manufacturer's Certificate: Certify that products meet or exceed specified local requirements.
- C. Project Record Documents:
 - 1. Accurately record actual locations of pipe runs, connections, catch basins, cleanouts, and invert elevations.
 - 2. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.

PART 2 - PRODUCTS**2.1 PIPE AND FITTINGS**

- A. Reinforced Concrete Pipe (RCP): ASTM C76, Class III unless noted otherwise on Drawings, installed with flexible plastic, bitumen gaskets at joints.
 - 1. Gaskets: AASHTO M198, Type B or ASTM C443, installed in accordance with manufacturer's recommendations.
 - 2. Flared End Sections: ASTM C76, or for sections with toe wall, AASHTO H170.
- B. All High Density Polyethylene pipe (HDPE) shall conform to the following requirements:
 - 1. AASHTO M252 Type S and M294 Type S, smooth interior and annular exterior. Pipe shall be installed in accordance with pipe manufacture's installation guidelines. Pipe shall meet all City of Union Requirements.
 - 2. Joint and Fittings. Pipe joints and fittings shall conform to ASTM D3212, AASHTO M252 or AASHTO M294, or be approved by the engineer. All joints and fittings to be water tight.

HDPE pipe shall not be used under paved areas.

2.2 DRAINAGE STRUCTURES

- A. Catch Basins, Inlets, and Junction Boxes: Provide in accordance with details shown on Drawings and ASTM C-478.
- B. Lids and Frame: Provide in accordance with details shown on Drawings.
 - 1. Acceptable Manufacturers:
 - a. Neenah Foundry.
 - b. East Jordan Iron Works.
 - c. Bass & Hays Foundry.
- C. Cement Mortar used for paving inverts, filling lift holes, joints, patching and anchoring castings shall consist of one part Portland cement, type I, ASTM C150, 1/4 part hydrated lime, ASTM C206 and 2-1/2 parts clean, well-graded sand and water free of suspended matter, alkali, and containing no industrial or domestic waste.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that trench cut and excavation is ready to receive work and excavations, dimensions, and elevations are as indicated on Drawings.

3.2 PREPARATION

- A. Hand trim excavations to required elevations. Correct over-excavation with bedding material.
- B. Remove large stones or other hard matter that could damage piping or impede consistent backfilling or compaction.
- C. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by licensed land surveyor and replaced, as necessary, by same.

3.3 INSTALLATION - PIPE

- A. The pipe shall be inspected for defects and cracks before being lowered into the trench, piece by piece. Any defective, damaged or unsound pipe or any pipe that has had its grade disturbed after laying shall be taken up and replaced. Open ends shall be protected with a stopper to prevent earth or other material from entering the pipe during construction. The interior of the pipe shall be free from dirt, excess water and other foreign materials as the pipe laying progresses and left clean at the completion of the installation.
- B. Excavate pipe trench and place bedding material in accordance with Section 02300.
- C. Install pipe in accordance with manufacturer's written recommendations.
- D. Reinforced Concrete Pipe: Pipe shall be installed in accordance with pipe manufacturer's installation Guidelines for Culvert Storm Drainage Applications.
- E. Installation shall commence at the lowest point for each segment of the route.
- F. Lay pipe to the required line and slope gradients with the necessary fittings, inlets, risers, structures, and other appurtenances placed at the required location as noted on Drawings.
- G. Do not displace or damage pipe when compacting.
- H. No pipe shall be laid in water or when trench conditions are unsuitable for such work.
- I. Joints:
 - 1. Joints shall be constructed as described herein and in accordance with manufacturer's installation instructions for soiltight joints.
 - 2. For RCP, the joint surface shall be cleaned and washed with water, if necessary, before the joints are made. For tongue and groove joints in smaller sizes, make joints butting the inside of the bell with a cement mortar before joining. The inside joint shall be wiped clean of excess mortar by brush or a squeegee drawn through the pipe as the laying operations progress. In the larger diameters, which permit the entry of a man, annular space between pipe sections shall be completely filled with mortar and finished off smooth with the inside surface of the pipe.
- J. All installation shall be in compliance with ASTM C1479.

3.4 INSTALLATION – CATCH BASINS, INLETS, AND JUNCTION BOXES

- A. Drainage structures shall be constructed in accordance with details shown on drawings.
- B. Precast Sections:
 - 1. Precast section with bases shall be installed in accordance with Section 02300 or as shown on drawings.
 - 2. Pipe shall be properly aligned with connections to structures as shown on the drawings.
- C. Invert channels shall be smooth and accurately shaped to a semicircular bottom conforming to the inside of the adjacent sewer section. Invert channels and structure bottoms shall be shaped with cement mortar. Changes in size and grade of invert shall be made gradually and evenly. Changes in direction of the sewer entering branch or branches shall have a true curve of as large a radius as the manhole will permit.
- D. Frames and Covers:
 - 1. Frames and covers shall be set to the proper elevation. The frames shall be firmly embedded in mortar approximately 1 inch thick and aligned to fit the top section of the structure.
 - 2. Bricks set in mortar used to adjust the frame to finished grade shall be limited to no more than four courses.
 - 3. Adjustment rings used to make adjustments in grade shall be made with the initial ring embedded in mortar and the exterior of the rings parged with mortar not less than 1/2 inch thick. No adjustment made in this manner shall exceed 8 inches.

3.5 INSPECTION AND TESTING

- A. General:
 - 1. Storm sewer systems and culverts, upon completion or at such time as directed, shall be cleaned, inspected and tested. The system or culvert shall have a true grade and line. Actual elevations shall be within 0.08 feet of the elevations given on the drawings.
 - 2. After completion of the Work, or any part thereof, the job shall be tested to determine that it has been installed in accordance with the drawings and specifications. In general, the Work shall prove to be in good condition, installed in accordance with the drawings and specifications and ready for use.
- B. Cleaning and Testing: Visibly inspect and remove all debris and obstructions from storm pipe. Test for infiltration and exfiltration by hydrostatic testing per ASTM C969. Manholes and pipe shall conform to ASTM C969 leakage criteria.
- C. Alignment Test: After backfill has been placed and compacted to a depth not less than one foot above top of pipe, a visual inspection shall be made by flashing a light between manholes. Any displacement or misalignment of invert shall be corrected.

END OF SECTION 02630

SECTION 02700 - ROAD AND DRIVEWAY CROSSINGS**1. GENERAL**

Any and all road and driveway areas that are disturbed as a result of construction shall be restored to an "as good or better" condition as existed prior to being disturbed. All road repairs shall also meet Franklin County Highway Department specifications.

2. AGGREGATE SURFACE COURSE

- A. The aggregate surface course shall be constructed to the grade and cross-section as shown on the Plans. The Contractor shall shape the rock road surface. Any additional granular material needed to shape the area disturbed shall be provided by the Contractor as necessary.
- B. The aggregate surface course shall be constructed in accordance with Section 304 of the "Missouri Standard Specifications for Highway Construction" - Latest Edition and all other sections referred to in said Section 304.

3. CONCRETE PAVEMENT REPAIRS

- A. Concrete pavement shall be constructed to match existing grades, with a minimum thickness of 6 inches. Concrete pavement construction shall be in accordance with Sections 502 and 609 of the "Missouri Standard Specifications for Highway Construction" - Latest Edition and all other sections referred to in Section 609.
- B. Concrete used shall be Class "B" concrete in accordance with Section 501 of the "Missouri Standard Specifications for Highway Construction" - Latest Edition and all other sections referred to in Section 501.
- C. The Contractor shall provide suitable protection for the concrete pavement during curing.
- D. The Contractor shall coordinate concrete pavement construction with the adjacent landowners to minimize access limitations.

4. ASPHALT SURFACE COURSE.

- A. A prime coat of MC-30 liquid asphalt shall be applied to the aggregate course surface in accordance with Section 408 of the "Missouri Standard Specifications for Highway Construction" - Latest Edition and all other sections referred to in said Section 408. The prime coat shall be applied at a rate of 0.4 gallons per square yard. Prime coat only needed when asphalt depth is less than 3".
- B. Asphaltic concrete pavement construction shall conform to Section 403 of the "Missouri Standard Specifications for Highway Construction" - Latest Edition and all other sections referred to in said Section 403. Asphaltic concrete pavement shall be 4" compacted thickness minimum, MoDOT Type BP-2 asphalt.

END OF SECTION 02700

SECTION 02715 – ENTRANCE AND GRAVEL AREA**PART 1 - GENERAL****1.1 SUMMARY**

- A. Entrance and gravel area surfaces shall consist of furnishing and placing chat, gravel, or crushed stone surfacing in the quantity shown on the contract or as directed by the engineer.

1.2 QUALITY ASSURANCE

- A. An Independent Testing Laboratory (ITL) approved by Owner and paid for by Contractor, will be retained to perform construction testing of in-place granular base course and granular surface for compliance with requirements for thickness. Base course tolerances shall be verified by the Contractor by rod and level readings on not more than 25-foot centers to be not more than 0.05-feet above design elevation which will allow for thickness as shown on Construction Drawings.

1.3 SUBMITTALS

- A. Submit materials certificate to the independent testing laboratory that is signed by materials producer and Contractor, certifying that materials comply with, or exceed, requirements specified herein or on the Construction Drawings.

1.4 WEATHER LIMITATIONS

- A. Do not place aggregate when base surface temperature is less than 40 degrees F, nor when air temperature is below 45 degrees F. Do not place aggregate when surface is wet or frozen. Do not place aggregate when weather conditions are unfavorable otherwise.

PART 2 - PRODUCTS**2.1 GRANULAR BASE COURSE**

- A. Granular base course to be 2-inch minus crushed stone. Granular base course to be 4 inches thick. Granular base course shall be compacted to 98% of its standard proctor maximum dry density. Observation of the placement of the granular base course and field density testing should be performed by a qualified technician to verify the compaction requirements are met in the field.

2.2 GRANULAR SURFACE

- A. Granular surface to be 1-inch minus crushed stone. Granular surface to be 4 inches thick. Granular surface shall be compacted to 98% of its standard proctor maximum dry density. Observation of the placement of the granular surface and field density testing should be performed by a qualified technician to verify the compaction requirements are met in the field.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Contractor shall verify to the Owner in writing that the subgrade has been inspected, tested, and gradients and elevations are correct, dry, and properly prepared in accordance with Section 02300.

3.2 CONSTRUCTION

- A. Perform base course construction in a manner that will drain the surface properly and prevent runoff from adjacent areas from draining onto base course construction.
- B. Material shall be spread to a uniform thickness over the subgrade and shaped as shown on the Plans until the surface is free from ruts and waves. The surface shall be compacted under traffic. Maintenance of the surface shall continue until final project acceptance is made.
- C. Construct to thickness indicated on Construction Drawings.

3.3 FIELD QUALITY CONTROL

- A. Field testing specified below will be performed by the Contractor's Independent Testing Laboratory.
- B. Field testing, frequency, and methods may vary as determined by and between the Owner and the Owner's Testing Laboratory.
- C. The independent testing laboratory will prepare reports that indicate test location, elevation data, and test results. Owner and Contractor shall be provided with copies of the reports within 96 hours of the time the test was performed. In the event that the test results show failure to meet any of the Specifications; Owner and Contractor will be notified immediately by the independent testing laboratory.
- D. The Contractor shall certify in writing to the Owner that base course placement is in accordance with specification requirements prior to subsequent work thereon.
- E. The Contractor shall pay for retesting due to failures at no additional expense to Owner. Contractor shall provide free access to the site for testing activities.

END OF SECTION

SECTION 02751 – PORTLAND CEMENT CONCRETE PAVEMENT1. GENERAL

- A. This Section includes the installation of concrete pavement. Concrete pavement shall be as specified in the 2023 version of the "Missouri Standard Specifications For Highway Construction".

2. SUMMARY

- A. The extent of Portland Cement Concrete paving is shown on drawings.
- B. Concrete and related materials are specified herein.

3. SUBMITTALS

- A. Provide samples, manufacturer's product data, test reports, and materials' certifications as required in referenced sections for concrete and joint fillers and sealers.

4. FORMS

- A. Forms. Steel, 2 inch dimensional wood or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects.
1. Use flexible spring steel forms or laminated boards to form radius bends as required.
 2. Form material for the face of the curb shall not have any horizontal joints closer than 7 inches from the top of the curb.
 3. Provide stakes and bracing materials as required to hold forms securely in place.
 4. Tops of forms shall not depart from grade line more than 1/8 inch when checked with a 10-foot straightedge. Alignment of straight sections shall not vary more than 1/8 inch in 10 feet.
- B. Coat forms with a nonstaining form release agent that will not discolor or deface surface of concrete.

5. CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type I.
1. Use one brand of cement throughout project, unless otherwise acceptable to Engineer.
 2. Normal Weight Aggregates: ASTM C 33, and as herein specified. Provide aggregates from a single source. Do not use fine or coarse aggregates containing spall-causing or other deleterious substances. Aggregates shall be "Meramec Sand and Gravel."
 3. Lightweight Aggregates: ASTM C 330.
- B. Water: Potable.
- C. Pozzolanic Admixtures: Pozzolanic admixtures or fly ash may not be used or substituted for other elements in the concrete mix.

- D. Air-Entraining Admixtures: Air-entraining admixtures shall meet the requirements of ASTM C 260 and shall be added to the mixer in the amount necessary to produce the specified air content. The air-entrainment agent and the water reducer admixture shall be compatible.
- E. Water-Reducing Admixtures: Only if approved by the Engineer; water-reducing, set-controlling admixtures shall meet the requirements of ASTM C 494, Type A, water-reducing or Type D, water-reducing and retarding admixtures, and shall be added at the mixer separately from air-entraining admixtures in accordance with the manufacturer's printed instructions.
- F. Grout: The grout mixture can be any commercially made product for highway patching made of an epoxy base. The grout shall be compatible with concrete and steel and capable of binding the dowel with the concrete. The matrix may be extended with hard durable aggregate following the manufacturer's recommendations. The grout shall be discarded after 45 minutes and shall not be retempered. The minimum strength shall be equal to the strength of the concrete pavement. Samples of the grout shall be submitted to the Engineer before grouting begins. Grout shall have a minimum strength of 4,000 psi in 28 days.
- G. Liquid-Membrane Forming and Sealing Curing Compound: Comply with ASTM C 309, Type I, Class A unless otherwise specified by the Engineer. Moisture loss no more than 0.055 gr./sq. cm. when applied at 150 sq. ft./gal. Only white-pigmented compound may be used.
- H. Joint Fillers: All expansion joints shall be "non-gassing."
 - 1. Exposed curb and gutter joints shall be sealed with Crafcro "Asphalt Rubber Plus" or approved equal. Comply with ASTM 1190.
 - 2. Expansion joint filler shall be 1/2-inch thick, preformed and nongassing. It shall be Homex Plus expansion joint material or approved equal.

6. CONCRETE PAVEMENT

A. CONCRETE MIX, DESIGN, AND TESTING

- 1. Design mix to produce normal-weight concrete consisting of Portland cement, aggregate, water-reducing or set retarding admixture, air-entraining admixture, and water to produce the following properties:
 - a) Compressive Strength: 4,000 psi, minimum at 28 days, unless otherwise indicated.
 - b) Air Content: 6 percent \pm 1-1/2 percent.

B. SURFACE PREPARATION

- 1. Remove loose material from compacted subbase surface immediately before placing concrete.
- 2. Proof-roll prepared subbase surface to check for unstable areas and need for additional compaction. In areas too small or confined to proof-roll, method shall be approved by the Engineer. Do not begin paving work until such conditions have been corrected and are ready to receive paving.
- 3. Aggregate Base
 - a) Top surface of the compacted aggregate base course shall be finished by blading or with automated equipment specially designed for the purpose and rolled with a steel-wheeled roller. Addition of thin layers of fine materials to the top of the base course to meet the grade will not be acceptable.
 - b) Surfaces of the completed aggregate base shall not deviate more than 1/2 inch when tested with a 10 foot straightedge. The completed compacted thickness of any course shall be within plus 3/4 inch and minus 1/2 inch of indicated thickness, and the average thickness shall not be less than the design thickness indicated.

C. FORM CONSTRUCTION

1. Set forms to required grades and lines, braced and secured.
2. Clean forms after each use and coat with form release agent as required to ensure separation from concrete without damage.

D. CONCRETE PLACEMENT

1. Do not place concrete until subbase and forms have been checked for line and grade. Moisten subbase if required to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
2. Place concrete by methods that prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with vibrator. Keep vibrator away from joint assemblies, or side forms. Consolidate with care to prevent dislocation of reinforcing, dowels, and joint devices. Use only square-faced shovels for hand spreading and consolidation.
3. Mixing and concreting operations shall be discontinued when a descending ambient temperature away from artificial heat reaches 40 degrees Fahrenheit and not resumed until an ascending ambient temperature away from artificial heat reaches 35 degrees Fahrenheit. Concrete shall not be placed on subgrade with a temperature less than 35 degrees Fahrenheit. Concrete temperature shall not drop below 65 degrees Fahrenheit for a period of no less than 6 days after placement. Concrete exposed to melting snow during daytime and freezing during nighttime shall be protected from freezing until strength of at least 3500-psi has been attained.
4. If approval has been granted for the Contractor to place the concrete while the ambient temperature is at or lower than 40 degrees Fahrenheit, the Contractor shall take precautionary measures to prevent damage by freezing, such as heating mixing water, heating aggregates, or applying heat directly to the contents of the mixer. Aggregates shall not be heated higher than 150 degrees Fahrenheit, and the temperature of the aggregates and mixing water combined shall be not higher than 100 degrees Fahrenheit, when the cement is added. Unless otherwise authorized, the temperature of the mixed concrete when heating is employed shall not be less than 50 degrees Fahrenheit and not more than 80 degrees Fahrenheit at the time of placement. Cement or fine aggregate containing lumps or crusts of hardened material or frost shall not be used. Concrete shall not be placed upon a frozen subgrade.
5. Use bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
6. Deposit and spread concrete in a continuous operation between transverse joints as far as possible. If interrupted for more than ½ hour, place a construction joint.
7. When adjacent pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained sufficient strength to carry loads without injury.

E. JOINTS

1. All joints shall conform to these specifications and the drawings.
 - a) At locations where adjacent longitudinal concrete pavement is designated for replacement, a "Type G" longitudinal construction joint per MoDOT Standard Plans shall be installed. The dowel shall be centered exactly over the joint.
 - b) Transverse contraction joints in pavement shall conform to "TYPE G" transverse construction joints per MoDOT Standard Plans. The dowel shall be centered exactly over the joint.
 - c) All joints shall be placed at right angles to or radial to the centerline of the pavement unless directed otherwise.

2. Sawed Joints

- a) Premolded strips shall not be used in place of saw cutting joints. All joints shall be sawed according to the following:
- b) Transverse contraction joints in the pavement shall be sawed at fifteen foot (15') intervals, or as directed by the Engineer, with the joint groove cut to the dimensions shown on the drawings. When the groove for poured type transverse joints is cut prior to removal of the forms, the groove shall be cut as close as is practical to the pavement edge; and the resulting crescent-shaped plug in the groove immediately adjacent to the form will be acceptable. Sawing of joints shall commence as soon as the concrete has hardened sufficiently to permit sawing without excessive raveling. All joints shall be sawed before shrinkage cracking takes place. In general, all joints shall be sawed in sequence.

3. Structures

- a) Manhole castings within pavement limits shall be boxed as directed by the Engineer in the field and surrounded by 1/2" white closed cell poly foam.
- b) All catch basins shall be separated from the pavement by 3/4 inch premolded expansion joint material extending completely through the curb and pavement slab. Catch basin sills shall be separated from the pavement by 3/4 inch premolded expansion joint material extending completely through the pavement.
- c) When a transverse joint falls within five feet of or contacts a drainage or utility structure, the joint shall be moved to either side to permit the joint to fall in the center of round structures or at the corner of rectangular structures and the joint spacing adjusted accordingly, or shall be placed as directed by the Engineer in the field.
- d) Expansion Joints
- e) Expansion joints shall be installed between the new pavement and any existing driveways.
- f) Expansion joints shall be placed between any building or structure when new pavement is placed adjacent to that building or structure unless directed otherwise.
- g) All expansion joint material shall be 8" tall and designed such that the top portion of the material can be removed after the concrete has set to leave a 1/2" channel that is ready to be sealed. It is the responsibility of the Contractor to remove and properly dispose of the excess material produced due to the formation of this 1/2" channel. The expansion joint material shall be approved by the Engineer prior to construction beginning.

F. CONCRETE FINISHING

1. After striking-off and consolidating concrete, smooth surface by screeding and floating. Use hand methods only where mechanical floating is not possible. Adjust floating to compact surface and produce uniform texture. See plans for description of finished surfaces unless otherwise specified.
2. After floating, test surface for trueness with a 10-foot straightedge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide a continuous smooth finish.
3. Work gutters and back top edge of curb with an edging tool, and round to 1/2-inch radius, unless otherwise indicated. Eliminate tool marks on concrete surface.
4. After completion of floating and when excess moisture or surface sheen has disappeared, complete troweling and finish surface as follows:
 - a) Broom finish by drawing a fine-hair broom across concrete surface perpendicular to line of traffic. Repeat operation if required to provide a fine line texture acceptable to Engineer.
 - b) After form removal, clean ends of joints and point-up any minor honeycombed areas. Remove and replace areas or sections with major defects, as directed by Engineer.

G. CURING

1. Protect and cure finished concrete paving using white pigmented membrane-forming curing and sealing compound applied at a minimum of one gallon per 150 square feet or approved moist-curing methods. Apply per manufacturer's recommendations.
2. Protect pavement from rain by an approved means during the curing process.

H. REPAIRS AND PROTECTIONS

1. Repair or replace broken or defective concrete, as directed by the Engineer.
2. Drill test cores where directed by the Engineer when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with Portland cement concrete bonded to pavement with epoxy adhesive.
3. Protect concrete from damage until acceptance of work.
4. Sweep concrete pavement and wash free of stains, discolorations, dirt, and other foreign material just before final inspection.

END OF SECTION 02751

SECTION 02765 - PAVEMENT MARKINGS**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes:
1. Painting and marking of pavements, curbs, guard posts, and light pole bases.

1.2 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.
- B. American Association of State Highway and Transportation (AASHTO):
1. AASHTO M247 - Glass Beads Used in Traffic Paints
 2. AASHTO M248 - Ready-Mixed White and Yellow Traffic Paints
- C. ASTM International (ASTM):
1. ASTM D4414 - Standard Practice for Measurement of Wet Film Thickness by Notched Gauges.
- D. Federal Specifications (FS):
1. FS A-A-2886 - Paint, Traffic, Solvent Based (supersedes FS TT-P-85 and FS TT-P-115, Type I)
 2. FS TT-B-1325 - Beads (Glass Spheres) Retro-Reflective
 3. FS TT-P-1952 - Paint, Traffic And Airfield Marking, Waterborne

1.3 PROJECT CONDITIONS

- A. Maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize flagmen, barricades, warning signs, and warning lights as required.

PART 2 - PRODUCTS**2.1 MATERIALS**

- A. Paint shall be waterborne or solvent borne, colors as shown or specified herein. Pavement marking paints shall comply with applicable state and local laws enacted to ensure compliance with Federal Clean Air Standards. Paint materials shall conform to the restrictions of the local Air Pollution Control District.
- B. Waterborne Paint: Paints shall conform to FS TT-P-1952.
- C. Solvent Borne Paint: Paint shall conform to FS A-A-2886 or AASHTO M248. Paint shall be non-bleeding, quick-drying, and alkyd petroleum base paint suitable for traffic-bearing surface and be mixed in accordance with manufacturer's instructions before application for colors White, Yellow, Blue, and Red.
- D. Glass Beads: AASHTO M 247, Type 1 or FS TT-B-1325, Type 1, Gradation A.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine the work area and correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

3.2 PREPARATION

- A. Sweep and clean surface to eliminate loose material and dust.
- B. Where existing pavement markings are indicated on Construction Drawings to be removed or would interfere with adhesion of new paint, a motorized abrasive device shall be used to remove the markings. Equipment employed

shall not damage existing paving or create surfaces hazardous to vehicle or pedestrian traffic. Within public rights-of-way, appropriate governing authority shall approve method of marking removal.

- C. New pavement surfaces shall be allowed to cure for not less than 30 days before application of marking materials.

3.3 APPLICATION

- A. Apply two coats of same color of paint as specified below, at manufacturer's recommended rate, without addition of thinner, with maximum of 100 square feet per gallon or as required to provide a minimum wet film thickness of 15 mils and dry film thickness of 7 ½ mils per coat. Paint shall be applied for a total dry film thickness of 15 mils. Apply with mechanical equipment to produce uniform straight edges. At sidewalk curbs and crosswalks, use straight-edge to ensure uniform, clean, and straight stripe.
- B. Install pavement markings according to manufacturer's recommended procedures for the specified material.
- C. Following items shall be painted with colors noted below:
 - 1. Pedestrian Crosswalks: White
 - 2. Exterior Sidewalk Curbs and Guard posts: Yellow
 - 3. Exterior Light Pole Bases: Yellow
 - 4. Fire Lanes: Red or per local code
 - 5. Lane Striping where separating traffic moving in opposite directions: Yellow
 - 6. Lane Striping where separating traffic moving in the same direction: White
 - 7. ADA Symbols: Blue or per local code
 - 8. ADA parking space markings as shown on the drawings.
 - 9. Parking Stall Striping: Yellow, unless otherwise noted on Construction Drawings
- D. Apply glass beads at pedestrian crosswalk striping and at lane striping and arrows at driveways connecting to public streets. Broadcast glass beads uniformly into wet markings at a rate of 6 lb/gal.

3.4 FIELD QUALITY CONTROL

- A. Field quality control shall be the responsibility of the Contractor in accordance with Section 01452. Field quality control testing and inspection shall be at the discretion of the Contractor as necessary to assure compliance with Contract requirements.

3.5 CLEANING

- A. Waste materials shall be removed at the end of each workday. Upon completion of the work, all containers and debris shall be removed from the site. Paint spots upon adjacent surfaces shall be carefully removed by approved procedures that will not damage the surfaces and the entire job left clean and acceptable.

END OF SECTION 02765

SECTION 02770 - CURBS AND SIDEWALKS**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes:
 - 1. Portland cement concrete curbs, gutters, and sidewalks except sidewalks adjacent to building.
- B. Related Requirements:
 - 1. Section 02300 - Earthwork: Preparation of subgrades.

1.2 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.
- B. American Concrete Institute (ACI):
 - 1. ACI 305R - Hot Weather Concreting
 - 2. ACI 306R - Cold Weather Concreting
 - 3. ACI 306.1 - Cold Weather Concreting.
 - 4. ACI 308 - Curing Concrete
- C. ASTM International (ASTM):
 - 1. ASTM A185 - Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
 - 2. ASTM A615 - Deformed and Plain Billet-Steel for Concrete Reinforcement.
 - 3. ASTM C31 - Making and Curing Concrete Test Specimens in the Field.
 - 4. ASTM C39 - Comprehensive Strength of Cylindrical Concrete Specimens.
 - 5. ASTM C42 - Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
 - 6. ASTM C94 - Ready-Mixed Concrete.
 - 7. ASTM C138 - Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete.
 - 8. ASTM C143 - Slump of Hydraulic Cement Concrete.
 - 9. ASTM C231 - Air-Content of Freshly Mixed Concrete by the Pressure Method.
 - 10. ASTM C172 - Sampling Freshly Mixed Concrete.
 - 11. ASTM C173 - Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
 - 12. ASTM C260 - Air-Entraining Admixtures for Concrete.
 - 13. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.
 - 14. ASTM C618 - Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture in Portland Cement Concrete.
 - 15. ASTM C989 - Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.
 - 16. ASTM C1064 - Temperature of Freshly Mixed Portland Concrete Cement.
 - 17. ASTM C1218 - Water-Soluble Chloride in Mortar and Concrete.
 - 18. ASTM D98 - Calcium Chloride.
 - 19. ASTM D994 - Preformed Expansion Joint Filler for Concrete (Bituminous).
 - 20. ASTM D1190 - Concrete Joint Sealer, Hot Poured, Elastic Type.
 - 21. ASTM D1751 - Performed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
 - 22. ASTM D2628 - Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements.
- D. Federal Specifications (FS):
 - 1. FS HH-F-341 - Fillers, Expansion Joint: Bituminous (Asphalt & Tar)
- E. State Highway Department Standard Specifications

1.3 SUBMITTALS

- A. Mix Design:
 - 1. Fill out and submit attached Concrete Mix Design Submittal Form.
 - 2. Submit three copies of each proposed mix.
 - 3. Submit separate mix design for concrete to be placed by pumping in addition to the mix design for concrete to be placed directly from the truck chute.

4. Submit mix design to the Civil Engineering Consultant of Record, the Owner's Construction Testing Laboratory, and the Owner's Assigned Concrete Sub-Consultant.
5. Include applicable information shown on the Mix Design Submittal Form and the following:
 - a. Proportions of cementitious materials, fine and coarse aggregate, and water.
 - b. Water-cementitious material ratio, 28-day compressive design strength, slump, and air content.
 - c. Type of cement, fly ash, slag and aggregate.
 - d. Aggregate gradation.
 - e. Type and dosage of admixtures.
 - f. Special requirements for pumping.
 - g. Range of ambient temperature and humidity for which design is valid.
 - h. Special characteristics of mix which require precautions in mixing, placing, or finishing techniques to achieve finished product specified.
 - i. Materials and methods for curing concrete.

B. Submit certified laboratory test data or manufacturer's certificates and data for the items listed below certifying that materials are in conformance requirements specified herein. Submit to the Engineering Consultant of Record and the Construction Testing Laboratory for review and approval and within 7 calendar days after receipt of Notice-to-Proceed.

1. Concrete mix design(s)
2. Type and source of Portland cement, fly ash, and slag
3. Aggregate gradations
4. Preformed expansion joint filler
5. Field molded/poured sealant
6. Dowel bars
7. Expansion sleeves
8. Tie bars
9. Reinforcing steel bars
10. Welded wire fabric
11. Air entraining admixtures
12. Water-reducing, set-retarding and set-accelerating admixtures (if used)

C. Test Reports: Submit field quality control test reports.

1.4 PROJECT CONDITIONS

A. Maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize temporary striping, flagmen, barricades, warning signs, and warning lights as required.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects. Use flexible spring steel forms or laminated boards to form radius bends as required. Forms shall be of depth equal to depth of curbing or sidewalk, and so designed as to permit secure fastening together at tops. Coat forms with nonstaining type of coating that will not discolor or deface surface of concrete.
- B. Welded Wire Mesh: Welded plain cold-drawn steel wire fabric, ASTM A185. Furnish in flat sheets.
- C. Reinforcing Steel: Deformed steel bars, ASTM A615, Grade 60.
- D. Portland Cement: Shall conform to ASTM C150, Type I.
- E. Fly Ash: ASTM C618, Class C or F. Use only one type and source throughout project.
- F. Slag: ASTM C989, Grade 100 or 120. Use only one type and source throughout project.
- G. Exterior Pavement Joint Materials
 1. Joint Back-up Material: Polyethylene foam, 100% closed cell.
 2. Sealant:
 - a. Dow 888, by Dow Corning.
 - b. 301 NS by Pecora.

- c. Spectrum 800 or 900 by Tremco.
- H. Aggregate: ASTM C33.
- I. Water: Clean and potable
- J. Dowel Bars: ASTM A615, grade 60, and plain steel bars.
- K. Air Entrainment: ASTM C260. .
 - 1. Air-Mix or AEA-92, by Euclid Chemical Corp.
 - 2. MB-VR MB-AE 90, or Micro-Air, by BASF.
 - 3. Daravair or Darex Series, by W.R. Grace.
 - 4. Equivalent approved products.
- L. Liquid Membrane Curing and Sealing Compound: ASTM C1315, Type I, Class A or B, 25% minimum solids content, clear non-yellowing with no styrene-butadiene.
 - 1. Water Based, VOC less than 350 g/l:
 - a. Super Aqua Cure, by Euclid Chemical Corp.
 - b. Kure 1315 by BASF.
 - 2. Solvent Based
 - a. Super Rez-Seal, by Euclid Chemical Corp.
 - b. Kure-N-Seal 30 by BASF.

2.2 CONCRETE MIXING

- A. Mix concrete and deliver in accordance with ASTM C94. Design mix shall produce normal weight concrete consisting of Portland cement, supplementary cementitious materials, aggregates, admixtures and water to produce the following:
 - 1. Compressive Strength: 3,500 psi minimum at 28 days unless otherwise indicated on the Drawings.
 - 2. Slump Range: 2"-4" for hand placed concrete, 1-1/4" to 3" for machine placed (slipform) concrete.
 - 3. Air Entrainment: 5 to 8 percent.
- B. Supplementary Cementitious Materials (SCM):
 - 1. Concrete mix shall contain SCM at the amounts specified unless other amounts are approved by the Civil Engineer. Either fly ash or ground granulated blast furnace slag (GGBFS) may be used for the SCM but shall not be used together to form a ternary mix. Use of fly ash or GGBFS in the concrete mix is mandatory.
 - 2. Fly Ash: Substitute fly ash for Portland cement at 15% of the total cementitious content.
 - a. If used to mitigate potential aggregate reactivity, only Type F fly ash may be used and shall have the following maximum properties: 1.5% available alkali and 8.0% CaO. When a maximum of 25% replacement is used, up to 10.0% CaO is permitted.
 - 3. Ground Granulated Blast Furnace Slag (GGBFS): Substitute GGBFS for Portland cement at 20% of the total cementitious content.
 - a. If required to mitigate potential sulfate exposure or aggregate reactivity, up to 50% substitution of Portland cement is allowed.
 - 4. Maintain air-entrainment at specified levels.
- C. Calcium chloride:
 - 1. Calcium chloride (Type L) may be used in solution form as part of the mixing water to accelerate concrete setting and early-strength development.
 - a. Amount of calcium chloride added shall not be more than necessary to produce the desired results and shall not exceed 2% by weight of cement.
 - b. The dosage range for the calcium chloride for the entire project shall not vary by more than 1%. Range is defined as the difference between the maximum and minimum dosages of calcium chloride for the entire project.
 - c. Calcium chloride shall not be used in the following applications unless approved by the Civil Engineer:
 - 1) concrete containing embedded dissimilar metals or aluminum
 - 2) slabs supported on permanent galvanized steel forms
 - 3) concrete exposed to deicing chemicals
 - 4) prestressed or post-tension concrete
 - 5) concrete containing aggregates with potentially deleterious reactivity and concrete exposed to soil
 - 6) concrete exposed to soil or water containing sulfates.
 - 2. Use calcium chloride in accordance with manufacturer's recommendation.
 - 3. Chloride-ion Concentration:

- a. Maximum water-soluble chloride-ion concentrations in hardened concrete at ages from 28 to 42 days contributed from the ingredients including water, aggregates, cementitious material, and admixtures shall not exceed the following limits unless approved by the Civil Engineer:

Type of Member	Maximum water-soluble chloride ion (Cl-) content in concrete (percent by weight of cement)
Prestressed concrete	0.06
Reinforced concrete exposed to chloride in service	0.15
Reinforced concrete that will be dry or protected from moisture in service	1.00
Other reinforced concrete construction	0.30

4. When using calcium chloride or other admixtures containing chlorides, measure water-soluble chloride-ion content (percent by weight of cementitious materials) per ASTM C1218. Sample shall be from concrete representing the submitted mix design and maximum chloride dosage anticipated for the project.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Begin paving work only after unsuitable areas have been corrected and are ready to receive paving.
- B. Remove loose material from compacted base material surface to produce firm, smooth surface immediately before placing concrete.

3.2 INSTALLATION

- A. Form Construction
1. Set forms to required grades and lines, rigidly braced and secured.
 2. Install sufficient quantity of forms to allow continuance of work and so that forms remain in place minimum of 24 hours after concrete placement.
 3. Check completed formwork for grade and alignment to following tolerances:
 - a. Top of forms not more than 1/8-inch in 10'-0".
 - b. Vertical face on longitudinal axis, not more than 1/4-inch in 10'-0".
 4. Clean forms after each use and coat with form release agent as often as required to ensure separation from concrete without damage.
- B. Reinforcement: Fasten reinforcing bars or welded wire fabric (if required) accurately and securely in place with suitable supports and ties. Remove from reinforcement all dirt, oil, loose mill scale, rust, and other substances that will prevent proper bonding of the concrete to the reinforcement.
- C. Concrete Placement
1. Concrete shall be mixed and placed when the air temperature in the shade and away from artificial heat is a minimum of 35 degrees F and rising. Hot and cold weather concreting shall be in accordance with ACI 305R (hot weather) and 306.1 and 306R (cold weather). Do not place concrete until base material and forms have been checked for line and grade. Moisten base material if required to provide uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until set at required finish elevation and alignment.
 2. Place concrete using methods that prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Consolidate with care to prevent dislocation of reinforcing, dowels, and joint devices.
 3. Deposit and spread concrete in continuous operation between transverse joints, as far as possible. If interrupted for more than 1/2 hour, place construction joint. Automatic machine may be used for curb and gutter placement. Machine placement shall be at required cross section, line, grade, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete as specified herein.
- D. Joint Construction
1. Contraction Joints: Construct concrete curb or combination concrete curb and gutter, where specified on Construction Drawings, in uniform sections of length specified on Construction Drawings. Form joints between sections either by steel templates, 1/8-inch in thickness, of length equal to width of curb and gutter, and with depth which will penetrate at least 2-inches below surface of curb and gutter; or with 3/4-inch thick performed expansion joint filler cut to exact cross section of curb and gutter; or by sawing to depth of at least 2-inches while con-

crete is between 4 and 24 hours old. If steel templates are used, they shall be left in place until concrete has set enough to hold its shape, but shall be removed while forms are still in place.

2. Longitudinal Construction Joints: Tie concrete curb or combination concrete curb and gutter, where specified on Construction Drawings, to concrete pavement with 1/2-inch round deformed reinforcement bars of length and spacing shown on Construction Drawings.
3. Transverse Expansion Joints: Concrete curb, combination concrete curb and gutter, or concrete sidewalk shall have filler cut to exact cross section of curb, gutter, or sidewalk. Joints shall be similar to type of expansion joint used in adjacent pavement.

E. Joint Fillers: Extend joint fillers full-width and depth of joint, and not less than 1/2-inch or more than 1-inch below finished surface where joint sealer is indicated. Furnish joint fillers in 1-piece lengths for full width being placed, wherever possible. Where more than 1 length is required, lace or clip joint filler sections together.

F. Joint Sealants: Install in accordance with manufacturer's recommendations.

3.3 CONCRETE FINISHING

A. After striking off and consolidating concrete, smooth surface by screeding and floating. Adjust floating to compact surface and produce uniform texture. After floating, test surface for trueness with 10'-0" straightedge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide continuous smooth finish.

B. Work edges of sidewalks, gutters, back top edge of curb, and formed joints with edging tool, rounding edge to 1/2-inch radius. Eliminate tool marks on concrete surface. After completion of floating and trowelling, when excess moisture or surface sheen has disappeared, complete surface finishing, as follows:

1. Curbs, gutters, and sidewalks: Broom finish by drawing fine-hair broom across surface perpendicular to flow of traffic. Repeat operation as necessary to produce fine line texture.

C. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point up minor honeycombed areas. Remove and replace areas or sections with major defects as directed Owner.

D. Check surface areas at intervals necessary to eliminate ponding areas. Remove and replace unacceptable work as directed by Owner.

3.4 CURING AND PROTECTION

A. Protect and cure finished concrete paving using with curing compound or with acceptable moist-curing methods in accordance with "water-curing" section of ACI 308. Cure for a period not less than 7 days.

B. Use solvent based curing compound when compound is applied below 40 F.

3.5 BACKFILL

A. After concrete has set sufficiently, spaces on either side of concrete curb, combination concrete curb and gutter, or concrete sidewalk shall be refilled to required elevation with suitable material compacted in accordance with Section 02300.

3.6 CLEANING AND PROTECTION

A. Sweep concrete pavement and wash free of stains, discolorations, dirt, and other foreign material just prior to final inspection.

B. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials.

3.7 FIELD QUALITY CONTROL

- A. Field quality control shall be the responsibility of the Contractor in accordance with Section 01452. Field quality control testing and inspection shall be at the discretion of the Contractor as necessary to assure compliance with Contract requirements.

END OF SECTION 02770

SECTION 02822 - CHAIN LINK FENCES AND GATES**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes
1. Chain link fences and gates associated with sitework.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM)
1. ASTM A 392 - Zinc-Coated Steel Chain-Link Fence Fabric
 2. ASTM C 94 - Ready-Mixed Concrete
- B. Chain Link Fence Manufacturers Institute (CLFMI) latest edition Product Manual

1.3 SUBMITTALS

- A. Project Record Documents: Accurately record actual locations of property perimeter posts relative to property lines and easements.

1.4 QUALITY ASSURANCE

- A. Chain link fabric, posts, and components, and installation shall conform to the requirements of the CLFMI Product Manual unless otherwise shown or specified.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this Section with minimum 3 years documented experience.

PART 2 - PRODUCTS**2.1 MATERIALS**

- A. Steel Posts: Type I or II or roll formed "C" Section steel conforming to CLFMI and as specified hereinafter.
- B. Fabric: No. 9 gage (0.148 nominal) galvanized steel wire in 2 inch mesh; ASTM A 392, top and bottom selvages twisted and barbed, height as shown. Furnish 1-piece fabric widths.
- C. End, Corner, and Pull Posts: Galvanized steel, minimum sizes and weights as follows:
1. Up to 6'-0" Fabric height: 2.375-inch OD pipe, 3.65-pounds per linear foot, or 3.5-inch x 3.5-inch roll formed section, 4.85-pounds per linear foot.
 2. Over 6'-0" Fabric Height: 2.875-inch OD pipe, 5.79-pounds per linear foot, Or 3.5-inch x 3.5 inch roll-formed section, 4.85-pounds per linear foot.
- D. Line Posts: Galvanized steel, minimum sizes and weights as follows:
1. Up to 6'-0" Fabric Height: 1.90-inch OD steel pipe, 2.70-ounds per linear foot or 1.875-inch x 1.625-inch "C"-section, 2.28 -pounds per linear foot.
 2. 6'-0" to 8'-0" Fabric Height: 2.375-inch OD steel pipe, 3.65-pounds per linear foot or 2.25-inch x 1.875-inch H-section, 2.64 pounds per linear foot.

- E. Gate Posts: Galvanized steel posts for supporting single gate leaf or 1 leaf of double gate installation, for nominal gate widths as follows:
 - 1. Up to 6'-0": 2.875-inch OD pipe, 5.79-pounds per linear foot, or 3.5-inch x 3.5-inch roll-formed section, 4.85-pounds per linear foot.
 - 2. 6'-0" to 13'-0": 4.00 inch OD pipe, 9.11-pounds per linear foot.
- F. Top Rail: 1.66-inch OD pipe, 2.27-pounds per linear foot or 1.625-inch x 1.25-inch roll-formed sections, 1.35-pounds per linear foot; galvanized steel.
 - 1. Manufacturer's longest lengths.
 - 2. Couplings: Expansion type, approximately 6 inches long.
 - 3. Attaching Devices: Provide means for attaching top rail securely to each gate, corner, pull and end post.
- G. Sleeves: Galvanized steel pipe not less than 6-inches long with inside diameter not less than ½ inch greater than outside diameter of pipe. Provide steel plate closure welded to bottom of sleeve of width and length not less than 1 inch greater than outside diameter of sleeve.
- H. Tension Wire: 7 gage galvanized steel conforming to CLFMI, Marcellled, located at bottom of fabric.
- I. Wire Ties: 11 gage galvanized steel.
- J. Barbed Wire: Three (3) strands of four-point, 12.5 gauge, galvanized barbed wire located above chain link fence on post top angled hangers.
- K. Post Brace Assembly: Manufacturer's standard adjustable brace at end of gate posts and at both sides of corner and pull posts, with horizontal brace located at mid-height of fabric. Use same material as top rail for brace, and truss to line posts with 0.375-inch diameter rod and adjustable tightener.
- L. Post Tops: Galvanized steel, weather tight closure cap with angled three-strand barbed wire hangers each tubular post. Furnish caps with openings to permit passage of top rail.
- M. Stretcher Bars: Galvanized steel, 1 piece lengths equal to full height of fabric, with minimum cross-section of 3/16-inch x 3/4-inch. Provide one stretch bar for each gate and end post, and two for each corner and pull post.
- N. Stretch Bar Bands: Manufacturer's standard
- O. Gate Cross-bracing: 3/8-inch diameter galvanized steel adjustable length truss rods.
- P. Cast-In-Place Concrete: ASTM C94, mix design as follows:
 - 1. Design mix to produce normal weight concrete consisting of Portland cement, aggregate, water-reducing admixture, air-entraining admixture, and water to produce following:
 - a. Compressive Strength: 2,500 psi, minimum at 28 days, unless otherwise indicated on Construction Drawings.
 - b. Slump Range: 1-3 inches at time of placement
 - c. Air Entrainment: 5 to 8 percent
- Q. Water: Clean
- R. Swinging Gate Hardware:
 - 1. Hinges: Size and material to suit gate size, non-lift-off type, offset to permit full 180-degree gate opening. Provide a pair of 1 1/2-inch hinges for each leaf over 6'-0" nominal height.
 - 2. Latch: Forked type or plunger-bar type to permit operation from either side of gate, with padlock eye as integral part of latch.
- S. Double Gates Hardware: Provide gate stops for double gates, consisting of mushroom type of flush plate with anchors set in concrete, to engage center drop rod or plunger bar. Include locking device and padlock eye as integral part of latch, using 1 padlock for locking both gate leaves.

- T. Non-shrink, non-metallic grout: pre-mixed factory-packaged, non-corrosive, non-staining, non-gascoes, exterior grout complying with ASTM C1107

2.2 GATE FABRICATION

- A. Fabricate swing gate perimeter frames of 1.90-inch OD pipe, galvanized steel. Provide horizontal and vertical members to ensure proper gate operation and attachment of fabric, hardware, and accessories. Space frame members maximum of 8'-0" apart.
- B. Assemble gate frames by welding or special fittings and rivets, for rigid connections. Install same fabric as for fence with stretcher bars at vertical edges. Install diagonal cross-bracing on gates as required ensuring rigid frame without sag or twist. Bars may be used at top and bottom edges. Attach stretchers to gate frame at 15 inches o.c. maximum.
- C. Attach hardware to provide security against removal or breakage.

2.3 FINISH

- A. Fabric Finish: Galvanized, ASTM A 392, Class I, with not less than 1.2 ounces of zinc per square foot of surface area.
- B. Framing: Galvanized steel, ASTM A 120 or A 123, with not less than 1.8 ounces of zinc per square foot of surface area.
- C. Hardware and Accessories: Galvanized, ASTM A 153 with zinc weights in accordance with Table I.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install chain link fence in accordance with CLFMI Product Manual unless otherwise specified herein.
- B. Comply with recommended procedures and instructions of fencing manufacturer. Provide secure, aligned installation with line posts spaced at 10'-0" o.c. maximum.
- C. Methods for Setting Posts:
 - 1. Grade-Set Posts:
 - a. Drill or hand excavate to a depth approximately 3 inches lower than post bottom. Set post bottom not less than 36 inches below finish grade.
 - b. Excavate each post hole to 12 inch diameter, or not less than four times diameter of post.
 - c. Place concrete around posts and vibrate or tamp for consolidation. Check each post for vertical and top alignment, and hold in position during placement and finishing operations. Extend concrete footing 2-inches above grade and trowel crown to shed water.
 - d. Post shall be set plumb within 1/4" in 10 feet.
 - 2. Sleeve Set Posts: Anchor posts by means of pipe sleeves preset and anchored into concrete. After posts have been inserted into sleeves, fill annular space between post and sleeve solid with nonshrink, non-metallic grout, mixed and placed to comply with grout manufacturer's directions.
- D. Top Rails: Run rail continuously, bending to form radius for curved runs. Provide expansion couplings as recommended by manufacturer.
- E. Center Rails: Provide center rails where indicated. Install in 1 piece between posts and flush with post on fabric side, using special offset fittings where necessary.
- F. Brace Assemblies: Install braces so posts are plumb when diagonal rods are under proper tension.
- G. Tension Wire: Install tension wires through post cap loops before stretching fabric and tie to each post cap with not less than 6 gauge galvanized wire. Fasten fabric to tension wire using 11 gauge galvanized steel hog rings spaced 24-inches o.c.

- H. Fabric: Leave approximately 2 inches between finish grade and bottom selvage. Pull fabric taut and tie to posts, rails, and tension wires. Install fabric on security side of fence, and anchor to framework so that fabric remains in tension after pulling force is released.
- I. Barbed Wire: Attach barbed wire to post top hangers. Pull taut and tie to post top hangers. Install barbed wire on security side of fence and anchor to framework so wire remains in tension after pulling force is released.
- J. Stretcher Bars: Secure at end, corner, pull, and gateposts by threading through or clamping to fabric at 4 inches o.c. and secure to posts with metal bands spaced at 15 inches o.c.
- K. Tie Wires:
 - 1. Use U-shaped wire, conforming to diameter of pipe to which attached, clasping pipe and fabric firmly when ends twisted at least 2 full turns. Bend ends of wire to minimize hazard to persons or clothing.
 - 2. Tie fabric to line posts with wire ties spaced 12 inches o.c. Tie fabric to rails and braces with wire ties spaced 24 inches o.c. Tie fabric to tension wires with hog rings spaced 24-inches o.c.
 - 3. Manufacturer's standard procedure will be accepted if of equal strength and durability.
- L. Fasteners: Install nuts for tension bands and hardware bolts on side of fence opposite fabric side. Peen ends of bolts or score threads to prevent removal of nuts.
- M. Gates: Install gates plumb, level, and secure for full opening without interference. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubrication.
- N. Repair coatings damaged in the field with methods and techniques as recommended by the manufacturer.

END OF SECTION

SECTION 02920 - FINISH GRADING AND SEEDING**PART 1 GENERAL****1.1 SUMMARY**

- A. Section Includes: Seeding.

1.2 DEFINITIONS

- A. Finish Grade: Elevation of finished surface of planting soil.
- B. Manufactured Soil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- C. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.
- D. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill immediately beneath planting soil.
- E. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Certification of grass seed.
 - 1. Certification of each seed mixture for turf grass sod.
- C. Product certificates.
- D. Planting Schedule: Indicating anticipated planting dates for each type of planting.

1.4 QUALITY ASSURANCE

- A. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when planting is in progress.
 - 1. Report suitability of topsoil for lawn growth. State-recommended quantities of nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory topsoil.

1.5 MAINTENANCE SERVICE

- A. Initial Lawn Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until acceptable lawn is established, but for not less than the following periods:
 - 1. Seeded Lawns: 60 days from date of Substantial Completion.
 - a. When initial maintenance period has not elapsed before end of planting season, or if lawn is not fully established, continue maintenance during next planting season.

PART 2 PRODUCTS**2.1 SEED**

- A. Grass Seed: Fresh, clean, dry, new-crop seed complying with United States Department of Agriculture Rules and Regulations under the Federal Seed Act. for purity and germination tolerances.

- B. Seed Species: State-certified seed of grass species, as follows:
 - 1. Proportioned by weight as follows:
 - a. 20% Adventure Fescue
 - b. 20% Jaguar IV Fescue
 - c. 20% Olympic Fescue
 - d. 20% Arid Fescue
 - e. 20% Regal Perennial

2.2 TOPSOIL

- A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of 4 percent organic material content; free of stones 1 inch or larger in any dimension and other extraneous materials harmful to plant growth.
- B. Topsoil Source: Reuse surface soil stockpiled on-site. Verify suitability of stockpiled surface soil to produce topsoil. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
- C. Supplement with imported or manufactured topsoil from off-site sources when quantities are insufficient.

2.3 INORGANIC SOIL AMENDMENTS

- A. Lime: ASTM C 602, agricultural limestone containing a minimum of 80 percent calcium carbonate equivalent and as follows:
 - 1. Class: T, with a minimum of 99 percent passing through No. 8 sieve and a minimum of 75 percent passing through No. 60 sieve.
- B. Perlite: Horticultural perlite, soil amendment grade.
- C. Agricultural Gypsum: Finely ground, containing a minimum of 90 percent calcium sulfate.
- D. Sand: Clean, washed, natural or manufactured, free of toxic materials.

2.4 ORGANIC SOIL AMENDMENTS

- A. Peat: Sphagnum peat moss, partially decomposed, finely divided or granular texture, with a pH range of 3.4 to 4.8.
- B. Peat: Finely divided or granular texture, with a pH range of 6 to 7.5, containing partially decomposed moss peat, native peat, or reed-sedge peat and having a water-absorbing capacity of 1100 to 2000 percent.

2.5 FERTILIZER

- A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
- B. Composition: 1 lb/1000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
- C. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
- D. Composition: 12 percent nitrogen, 12 percent phosphoric acid, and 10 percent potash, by weight.

2.6 MULCHES

- A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

PART 3 - EXECUTION**3.1 LAWN PREPARATION**

- A. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 4 inches. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
- B. Thoroughly blend planting soil mix off-site before spreading or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil mix.
- C. Spread planting soil mix to a depth of 4 inches but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
- D. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.
- E. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- F. Before planting, restore areas if eroded or otherwise disturbed after finish grading.

3.2 SEEDING

- A. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
- B. Sow seed at a total rate of 7 to 8 lb./1000 square feet or 350 lb./acre.
- C. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.
- D. Protect seeded areas by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre to form a continuous blanket 1-1/2 inches in loose depth over seeded areas. Spread by hand, blower, or other suitable equipment.
- E. Anchor straw mulch by crimping into soil with suitable mechanical equipment.

3.3 LAWN MAINTENANCE

- A. Maintain and establish lawn by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth lawn. Provide materials and installation the same as those used in the original installation.
- B. Mow lawn as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings.

3.4 SATISFACTORY LAWNS

- A. Satisfactory Seeded Lawn: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any and bare spots not exceeding 5 by 5 inches.
- B. Use specified materials to reestablish lawns that do not comply with requirements and continue maintenance until lawns are satisfactory.

END OF SECTION 02920

SECTION 03410 - PLANT-PRECAST STRUCTURAL CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes precast structural concrete.

1.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design precast structural concrete, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Precast structural concrete units and connections shall withstand design loads indicated within limits and under conditions indicated.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each precast concrete mixture.
- C. Shop Drawings: Include member locations, plans, elevations, dimensions, shapes and sections, openings, support conditions, and types of reinforcement, including special reinforcement. Detail fabrication and installation of precast structural concrete units.
- D. Delegated-Design Submittal: For precast structural concrete indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- E. Qualification Data: For Installer fabricator testing agency.
- F. Welding certificates.
- G. Material certificates.
- H. Material test reports.
- I. Source quality-control reports.
- J. Field quality-control and special inspection reports.

1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm that assumes responsibility for engineering precast structural concrete units to comply with performance requirements. Responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
 - 1. Participates in PCI's Plant Certification program at time of bidding and is designated a PCI-certified plant as follows:
 - a. Group C, Category C1 - Precast Concrete Products (no prestressed reinforcement.)

- B. Design Standards: Comply with ACI 318 (ACI 318M) and design recommendations in PCI MNL 120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of precast structural concrete units indicated.
- C. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 116, "Manual for Quality Control for Plants and Production of Structural Precast Concrete Products."
- D. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D.1.1M, "Structural Welding Code - Steel."
- E. Preinstallation Conference: Conduct conference at Project site.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Support units during shipment on nonstaining shock-absorbing material in same position as during storage.
- B. Store units with adequate bracing and protect units to prevent contact with soil, to prevent staining, and to prevent cracking, distortion, warping or other physical damage.
- C. Lift and support units only at designated points shown on Shop Drawings.

1.6 COORDINATION

- A. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction before starting that Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

PART 2 - PRODUCTS

2.1 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- B. Steel Bar Mats: ASTM A 184/A 184M, fabricated from ASTM A 615/A 615M, Grade 60, deformed bars, assembled with clips.
- C. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.
- D. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.
- E. Supports: Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 116.

2.2 PRESTRESSING TENDONS

- A. Strand: ASTM A 416/A 416M, Grade 270, uncoated, 7-wire, low-relaxation strand.

2.3 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type I or Type III, gray, unless otherwise indicated.
- B. Supplementary Cementitious Materials:
 - 1. Fly Ash: ASTM C 618, Class C or F, with maximum loss on ignition of 3 percent.
 - 2. Metakaolin Admixture: ASTM C 618, Class N.
 - 3. Silica Fume Admixture: ASTM C 1240, with optional chemical and physical requirement.
 - 4. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- C. Normal-Weight Aggregates: Except as modified by PCI MNL 116, ASTM C 33, with coarse aggregates complying with Class 5S, Class 5M, Class 4S, Class 4M. Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.
- D. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.
- E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture.
- F. Waterproofing Admixture: See Section 03050.
 - A. All precast concrete manholes and diversion box will require waterproofing admixture.

2.4 STEEL CONNECTION MATERIALS

- A. Carbon-Steel Shapes and Plates: ASTM A 36/A 36M.
- B. Carbon-Steel-Headed Studs: ASTM A 108, AISI 1018 through AISI 1020, cold finished, AWS D1.1/D1.1M, Type A or B, with arc shields and with minimum mechanical properties of PCI MNL 116.
- C. High-Strength, Low-Alloy Structural Steel: ASTM A 572/A 572M.
- D. Carbon-Steel Structural Tubing: ASTM A 500, Grade B.
- E. Deformed-Steel Wire or Bar Anchors: ASTM A 496 or ASTM A 706/A 706M.
- F. Carbon-Steel Bolts and Studs: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); carbon-steel, hex-head bolts and studs; carbon-steel nuts, ASTM A 563 (ASTM A 563M); and flat, unhardened steel washers, ASTM F 844.
- G. Shop-Primed Finish: Prepare surfaces of nongalvanized-steel items, except those surfaces to be embedded in concrete, and shop apply rust-inhibitive primer.

2.5 BEARING PADS

- A. Provide bearing pads for precast structural concrete units as recommended by precast fabricator for application.

2.6 GROUT MATERIALS

- A. Sand-Cement Grout: Portland cement, ASTM C 150, Type I, and clean, natural sand, ASTM C 144 or ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

- B. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107, Grade A for drypack and Grades B and C for flowable grout and of consistency suitable for application within a 30-minute working time.

2.7 CONCRETE MIXTURES

- A. Prepare design mixtures for each type of precast concrete required.
 - 1. Limit use of fly ash to 10 percent replacement of portland cement by weight and granulated blast-furnace slag to 10 percent of portland cement by weight; metakaolin and silica fume to 10 percent of portland cement by weight.
- B. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at precast structural concrete fabricator's option.
- C. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 318 or PCI MNL 116 when tested according to ASTM C 1218/C 1218M.
- D. Normal-Weight Concrete Mixtures: Proportion by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:
 - 1. Compressive Strength (28 Days): 5000 psi minimum for Diversion Box.
 - 2. Compressive Strength (28 Days): 3500 psi minimum for Manholes.
 - 3. Maximum Water-Cementitious Materials Ratio: 0.45.
- E. Water Absorption: 6 percent by weight or 14 percent by volume, tested according to PCI MNL 116.
- F. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 116.
- G. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.
- H. Concrete Mix Adjustments: Concrete mix design adjustments may be proposed if characteristics of materials, Project conditions, weather, test results, or other circumstances warrant.

2.8 FABRICATION

- A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.
 - 1. Weld-headed studs and deformed bar anchors used for anchorage according to AWS D1.1/D1.1M and AWS C5.4, "Recommended Practices for Stud Welding."
- B. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing precast structural concrete units to supporting and adjacent construction.
- C. Cast-in reglets, slots, holes, and other accessories in precast structural concrete units as indicated on the Contract Drawings.
- D. Cast-in openings larger than 10 inches (250 mm) in any dimension. Do not drill or cut openings or prestressing strand without Architect's approval.

- E. Reinforcement: Comply with recommendations in PCI MNL 116 for fabricating, placing, and supporting reinforcement.
- F. Reinforce precast structural concrete units to resist handling, transportation, and erection stresses.
- G. Prestress tendons for precast structural concrete units by either pretensioning or post-tensioning methods. Comply with PCI MNL 116.
- H. Comply with requirements in PCI MNL 116 and in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.
- I. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in precast concrete units.
- J. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air on surfaces. Use equipment and procedures complying with PCI MNL 116.
- K. Comply with ACI 306.1 procedures for cold-weather concrete placement.
- L. Comply with PCI MNL 116 procedures for hot-weather concrete placement.
- M. Identify pickup points of precast structural concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each precast structural concrete unit on a surface that will not show in finished structure.
- N. Cure concrete, according to requirements in PCI MNL 116, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture. Cure units until compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final product.
- O. Discard and replace precast structural concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs meet requirements in PCI MNL 116 and meet Architect's approval.

2.9 FABRICATION TOLERANCES

- A. Fabricate precast structural concrete units straight and true to size and shape with exposed edges and corners precise and true so each finished unit complies with PCI MNL 116 product dimension tolerances.

2.10 COMMERCIAL FINISHES

- A. Standard Grade: Normal plant-run finish produced in molds that impart a smooth finish to concrete. Surface holes smaller than 1/2 inch caused by air bubbles, normal color variations, form joint marks, and minor chips and spalls are permitted. Fill air holes greater than 1/4 inch in width that occur more than once per 2 sq. in. Major or unsightly imperfections, honeycombs, or structural defects are not permitted. Limit joint offsets to 1/8 inch.

2.11 SOURCE QUALITY CONTROL

- A. Testing: Test and inspect precast structural concrete according to PCI MNL 116 requirements.
- B. Defective Units: Discard and replace precast structural concrete units that do not comply with requirements, including strength, manufacturing tolerances, and color and texture range. Chipped, spalled, or cracked units may be repaired, subject to Architect's approval. Architect reserves the right to reject precast units that do not match approved samples, sample panels, and mockups.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install clips, hangers, bearing pads, and other accessories required for connecting precast structural concrete units to supporting members and backup materials.
- B. Erect precast structural concrete level, plumb, and square within specified allowable tolerances. Provide temporary structural framing, supports, and bracing as required to maintain position, stability, and alignment of units until permanent connection.
 - 1. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
 - 2. Remove projecting lifting devices and grout fill voids within recessed lifting devices flush with surface of adjacent precast surfaces when recess is exposed.
 - 3. For hollow-core slab voids used as electrical raceways or mechanical ducts, align voids between units and tape butt joint at end of slabs.
- C. Connect precast structural concrete units in position by bolting, welding, grouting, or as otherwise indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and grouting are completed.
- D. Field cutting of precast units is not permitted without approval of the Architect.
- E. Fasteners: Do not use drilled or powder-actuated fasteners for attaching accessory items to precast, prestressed concrete units.
- F. Welding: Comply with applicable AWS D1.1/D1.1M and AWS D1.4 for welding, welding electrodes, appearance, quality of welds, and methods used in correcting welding work.
- G. At bolted connections, use lock washers, tack welding, or other approved means to prevent loosening of nuts after final adjustment.
- H. Grouting: Grout connections and joints and open spaces at keyways, connections, and joints where required or indicated on Shop Drawings. Retain grout in place until hard enough to support itself. Pack spaces with stiff grout material, tamping until voids are completely filled.

3.2 ERECTION TOLERANCES

- A. Erect precast structural concrete units level, plumb, square, true, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 135.
- B. Minimize variations between adjacent slab members by jacking, loading, or other method recommended by fabricator and approved by Architect.

3.3 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 - 1. Erection of precast structural concrete members.
 - 2. Welding.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- C. Field welds will be visually inspected and nondestructive tested according to ASTM E 165 or ASTM E 709. High-strength bolted connections will be subject to inspections.

- D. Testing agency will report test results promptly and in writing to Contractor and Engineer.
- E. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
- F. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- G. Prepare test and inspection reports.

3.4 REPAIRS

- A. Repair precast structural concrete units if permitted by Architect.
 - 1. Repairs may be permitted if structural adequacy, serviceability, durability, and appearance of units has not been impaired.
- B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 feet.
- C. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A 780.
- D. Wire brush, clean, and paint damaged prime-painted components with same type of shop primer.
- E. Remove and replace damaged precast structural concrete units that cannot be repaired or when repairs do not comply with requirements as determined by Architect.

3.5 CLEANING

- A. Clean mortar, plaster, fireproofing, weld slag, and other deleterious material from concrete surfaces and adjacent materials immediately.
- B. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.
 - 1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's written recommendations. Clean soiled precast concrete surfaces with detergent and water, using stiff fiber brushes and sponges, and rinse with clean water. Protect other work from staining or damage due to cleaning operations.
 - 2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

END OF SECTION 03410

SECTION 04000 – ASPHALT PAVEMENT**1. GENERAL**

- A. This Section includes: Construction of an asphaltic concrete pavement leveling course. The leveling and surface course shall be asphaltic concrete as specified in the latest version of the “Missouri Standard Specifications for Highway Construction.”

2. DESCRIPTION OF WORK

1. Extent of asphalt paving work is shown on drawings.

3. SUBMITTALS

1. Material Certificates: Provide copies of materials certificates signed by material producer and Contractor certifying that each material item complies with, or exceed, specified requirements.

4. SITE CONDITIONS

1. Weather Limitations: Apply tack coat when pavement and ambient temperature is above 45°F (7°C), and when temperature has not been below 35°F (1 C) for 12 hours immediately prior to application. Do not apply when pavement surface is wet or contains an excess of moisture.
2. Construct asphalt pavement when atmospheric temperature is above 45°F (7°C), and when base is dry.
3. Grade Control: Establish and maintain required lines and elevations.

5. MATERIALS

1. General: Use materials as specified in the Plans.
2. Coarse Aggregate: Sound, durable rock meeting the requirements of the Missouri Standard Specifications for Highway Construction.
3. Fine Aggregate: Fine, granular material meeting the requirements of the Missouri Standard Specifications for Highway Construction.
4. Mineral Filler: Rock or slag dust, hydraulic cement, or other inert material complying with the requirements of the Missouri Standard Specifications for Highway Construction.
5. Asphalt Binder shall be homogenous and free from water, and shall not, on heating, foam below the specified minimum flash point. It shall be prepared by refining crude petroleum by suitable methods. It shall conform to the requirements of the Missouri Standard Specifications for Highway Construction.
6. Tack Coat: Emulsified asphalt, AASHTO M 140 (ASTM D 997) or M 208 (D 2397); SS-1, SS-1H, CSS-1 or CSS-1H, diluted with one part water to one part emulsified asphalt.
7. Prime Coat: Cutback asphalt type, AASHTO M-82 (ASTM D2027) MC-30, MC-70 or MC-250.
8. Blotter Aggregate: Washed concrete sand.

6. ASPHALT AGGREGATE MIXTURE

1. Provide plant-mixed, hot-laid asphalt aggregate mixture complying with the Missouri Standard Specifications for Highway Construction.

7. SURFACE PREPARATION

1. The surface to be paved shall be cleaned by means necessary to achieve a "tackable" surface. Cleaning may be accomplished by, but not be limited to, sweeping or washing. A tack coat, as specified, shall be applied to ensure adhesion between layers.
2. Tack Coat: Apply to contact surfaces of previously constructed or prepared surfaces abutting or projecting into asphalt pavement. Distribute at rate of 0.05 to 0.15 gal. per sq. yd. of surface.
 1. Allow to dry until at proper condition to receive asphalt pavement.
 2. Exercise care in applying asphalt materials to avoid smearing of adjoining concrete surfaces. Remove and clean damaged surfaces.

8. PLACING MIX

1. General: Place asphalt pavement mixture on dry, prepared surface, spread and strike-off. Spread mixture at minimum temperature of 225°F (107°C). Place only when both air temperature and surface temperature are above 45°F. Place inaccessible and small areas by hand. Place each course to required grade, cross-section, and compacted thickness.
2. The mixture shall be spread only upon a clean and dry surface, and only when weather conditions are suitable.
3. Hot Joints: prior to the first pavement strip's temperature dropping below 200 degrees Fahrenheit, the second strip will be required to be laid alongside the first pavement strip. This will create a hot joint, the density on both sides of the joint will be compacted together to form a solid bond. The intent is to avoid cold longitudinal joints; this includes longitudinal and transverse butt joints.
4. Butt Joints: Saw cutting cold transverse butt joints will be required. All saw cuts will be incidental to the contract.

9. ROLLING

1. General: Begin rolling when mixture will bear roller weight without excessive displacement.
2. Compact mixture with hot hand tampers or vibrating plate compactors approved by the Engineer in areas inaccessible to rollers.
3. Breakdown Rolling: Accomplish breakdown or initial rolling using an eight ton to twelve ton three wheel roller or two wheel tandem roller or self propelled pneumatic roller immediately following rolling of joints and outside edge. Check surface after breakdown rolling, and repair displaced areas by loosening and filling, if required, with hot material.
4. Second Rolling: Follow breakdown rolling as soon as possible, while mixture is hot with a pneumatic tire oscillating-type roller developing at least 80 pounds per square inch contact pressure for all wheels. Continue second rolling until mixture has been thoroughly compacted.
5. Finish Rolling: Perform finish rolling while mixture is still warm enough for removal of roller marks with not less than a ten ton, two or three wheel tandem-type roller. Continue rolling until roller marks are eliminated and pavement has attained maximum density.
6. The Contractor shall complete all Rolling activities prior to the asphalt mixture cooling below 185 degrees Fahrenheit.
7. Patching: Remove and replace pavement areas mixed with foreign materials and defective areas. Cut-out such areas and fill with fresh, hot asphalt pavement mixture. Compact by rolling to maximum surface density and smoothness.
8. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
9. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

10. FIELD QUALITY CONTROL

1. General: Test in-place asphalt pavement courses for compliance with requirements for thickness and surface smoothness. Repair or remove and replace unacceptable pavement as directed by Engineer.

11. THICKNESS

1. In-place compacted thickness will not be acceptable if exceeding the following allowable variation from required thickness:
 - a. Surface Course: 3 1/2-inch nominal thickness, or as otherwise indicated on the plans, with a variance of no more than 1/4", plus or minus.'
 - b. Spot Wedge: 1" nominal thickness as needed, or as otherwise indicated on the plans.

12. SURFACE SMOOTHNESS

1. The surface of each layer shall be substantially free from waves or irregularities. The final surface shall not vary from a 10-foot straightedge, by more than 1/8 inch. At transverse construction joints, the surface shall not vary from the 10-foot straightedge by more than 1/8 inch. .
2. Check surface areas at intervals as directed by Engineer.

13. MEASUREMENT

- A. Tack and Prime Coat. No direct measurement of the tack or prime coat will be performed.
- B. Asphalt Pavement. The quantity measured shall be the number of sq. yds. of asphalt in place, compacted and approved by the Engineer.

14. PAYMENT

1. Payment shall be at the unit prices as herein indicated. These prices shall be full compensation for the execution of pay items indicated including all material, furnishing equipment, labor, tools and incidentals necessary to complete these items.
2. Tack and Prime. No direct payment for these items will be made and will be considered incidental and a subsidiary obligation of the Contractor covered under asphalt Pavement Mixture.
3. Asphalt Pavement (3 1/2-Inch nominal thickness)
Payment shall be at the unit price per sq. yds. of asphalt placed which shall be full compensation for furnishing and placing all materials.

END SECTION 04000

SECTION 07115 - BITUMINOUS DAMPPROOFING**PART 1 - GENERAL****1.1 SUMMARY**

- A. This Section includes the following:
 - 1. Cold-applied, cut-back asphalt dampproofing.
 - 2. Cold-applied, emulsified-asphalt dampproofing.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittal:
 - 1. Product Data for Credit EQ 4.2: For dampproofing, including printed statement of VOC content.

1.3 PROJECT CONDITIONS

- A. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has cured.

PART 2 - PRODUCTS**2.1 COLD-APPLIED, CUT-BACK ASPHALT DAMPPROOFING**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ChemMasters Corp.
 - 2. Degussa Building Systems; Sonneborn Brand Products.
 - 3. Gardner Gibson, Inc.
 - 4. Henry Company.
 - 5. Karnak Corporation.
 - 6. Koppers Inc.
 - 7. Malarkey Roofing Products.
 - 8. Meadows, W. R., Inc.
 - 9. Tamms Industries, Inc.
- C. Trowel Coats: ASTM D 4586, Type I, Class 1, fibered.
- D. Brush and Spray Coats: ASTM D 4479, Type I, fibered.
- E. VOC Content: 2.5 lb/gal. (300 g/L) or less.

2.2 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ChemMasters Corp.
 - 2. Degussa Building Systems; Sonneborn Brand Products.
 - 3. Gardner Gibson, Inc.
 - 4. Henry Company.
 - 5. Karnak Corporation.
 - 6. Koppers Inc.
 - 7. Malarkey Roofing Products.
 - 8. Meadows, W. R., Inc.
 - 9. Tamms Industries, Inc.
- C. Trowel Coats: ASTM D 1227, Type II, Class 1.
- D. Fibered Brush and Spray Coats: ASTM D 1227, Type II, Class 1.
- E. Brush and Spray Coats: ASTM D 1227, Type III, Class 1.
- F. VOC Content: 0.25 lb/gal. or less].

2.3 MISCELLANEOUS MATERIALS

- A. Cut-Back Asphalt Primer: ASTM D 41.
- B. Emulsified-Asphalt Primer: ASTM D 1227, Type III, Class 1, except diluted with water as recommended by manufacturer.
- C. Asphalt-Coated Glass Fabric: ASTM D 1668, Type I.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of projections and substances detrimental to work; fill voids, seal joints, and apply bond breakers if any, as recommended by prime material manufacturer.

3.2 APPLICATION, GENERAL

- A. Comply with manufacturer's written recommendations unless more stringent requirements are indicated or required by Project conditions to ensure satisfactory performance of dampproofing.
- B. Apply dampproofing all concrete structures surfaces in contact with soil or rock.

3.3 COLD-APPLIED, CUT-BACK ASPHALT DAMPPROOFING

- A. On Concrete Structure Walls: Apply 2 brush or spray coats at not less than 1.25 gal./100 sq. ft. (0.5 L/sq. m) for first coat and 1 gal./100 sq. ft. (0.4 L/sq. m) for second coat, or 1 trowel coat at not less than 4 gal./100 sq. ft. (1.6 L/sq. m).

3.4 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

- A. On Concrete Foundations Structure Walls: Apply 2 brush or spray coats at not less than 1.5 gal./100 sq. ft. (0.6 L/sq. m) for first coat and 1 gal./100 sq. ft. (0.4 L/sq. m) for second coat, 1 fibered brush or spray coat at not less than 3 gal./100 sq. ft. (1.2 L/sq. m), or 1 trowel coat at not less than 4 gal./100 sq. ft. (1.6 L/sq. m).

END OF SECTION 07115

APPENDIX A

CHAPTER 700 UTILITIES
TABLE OF CONTENTS

CHAPTER 700.....5

ARTICLE I Administration5

Section 700.010. Appointment Of Superintendent.5

Section 700.020. Responsibilities Of the Superintendent.5

Section 700.030. Employee Authority.5

Section 700.040. Complaints Regarding Employees.....5

ARTICLE II Utilities Generally5

Section 700.050. Definitions.....5

Section 700.060. Extension Policies Established.7

Section 700.070. Sale Of Public Utilities.7

Section 700.080 Access To Premises.....7

Section 700.090. Resale Of Utility Services Prohibited.7

Section 700.100. Injuring Or Misusing Utility System.....7

Section 700.110. Area Of Service.8

Section 700.120. Specifications For Making Excavations.8

Section 700.130, Meters, User's Responsibility.8

ARTICLE III BILLING, ALL UTILITIES8

Section 700.140. Written Application For Utility Service; Normal Business Hours.....8

Section 700.150. Services, To Whom Provided.....9

Section 700.155. Water And Sewer Services Deemed Furnished To Both Occupant And Owner Of Premises.....9

Section 700.150. Deposits.10

Section 700.160. Utility Meters; Monthly Readings.10

Section 700.170. Special utility services.....11

Section 700.180. Denial of utility service.....11

Section 700.190. Notice When Customer Is Terminating Utility Service.11

Section 700.200. Bills Shall Be Due As Follows.....11

Section 700.210. Delinquent Payments.11

Section 700.220 Water Rates To Be Charged.....12

Section 700.230 Wastewater/Treatment Works/Sewer Rates To Be Charged.....	13
ARTICLE IV STREET LIGHTING	15
Section 700.240. Board May Contract For Street Lighting.....	15
Section 700.250. Additions To System.	15
ARTICLE V WATER AND WATER METERS.....	16
Section 700.260. Location Of Meters.	16
Section 700.262. Additional Grounds For Disconnection.....	16
Section 700.264. Connection Fee, Water.	17
ARTICLE VI. SEWERS AND SEWAGE DISPOSAL	17
Section 700.300. Definitions.....	17
Section 700.310. Enforcement; violations.....	19
Section 700.320. Objectionable waste.	19
Section 700.330. Unauthorized sewage disposal.....	19
Section 700.340. Connection required.	20
Section 700.350. Expense and liability incident to installation.	20
Section 700.360. Separate building sewer required.....	20
Section 700.370. Use of old building sewers.	20
Section 700.380. Construction methods and materials.....	20
Section 700.390. Lifts.....	20
Section 700.400. Connection to public sewer.....	20
Section 700.410. Excavations.	21
Section 700.420. Prohibited sanitary sewer discharges; storm sewers.....	21
Section 700.425 Interceptors.	21
Section 700.430. Waters and wastes specifically prohibited.	22
Section 700.440. Waters and wastes subject to review by Village.....	22
Section 700.450. Substances Village may prohibit.....	22
Section 700.460. Actions Village may take with reference to certain wastes.....	24
Section 700.480. Preliminary treatment facilities.	24
Section 700.490. Control manhole.....	24
Section 700.500. Measurements, tests and analyses.....	24

Section 700.510. Special agreements.....	25
Section 700.520. Private Systems.	25
ARTICLE VII Lead Ban Policy.....	25
Section 700.530. Purpose.....	25
Section 700.540. Application.....	25
Section 700.550. Policy.....	25
Section 700.560. Definitions.....	26
Section 700.570. Exemptions.	26
Section 700.580. Lead Banned From Drinking Water Plumbing.....	27
ARTICLE VIII Protection Of Drinking Water	27
Section 700.590. Statement Of Intent.	27
Section 700.600. Definitions.....	27
Section 700.610. Required Separation Distances.	27
Section 700.620. Prohibited Uses Within Protection Field.....	28
Section 700.630. Contaminants And Remediation.....	29
Section 700.640. Enforcement.	29
Section 700.650. Inspection And Right Of Entry.....	30
ARTICLE IX Cross-Connection Control.....	30
Section 700.670. Purpose.....	30
Section 700.680. Application.....	31
Section 700.690. Policy.....	31
Section 700.700. Definitions.....	31
Section 700.710. Cross-Connections Prohibited.....	33
Section 700.720. Survey And Investigations.....	34
Section 700.730. Type Of Protection Required.	34
Section 700.740. Where Protection Is Required.....	34
Section 700.750. Backflow Prevention Devices.	36
Section 700.760. Installation.....	37
Section 700.770. Inspection And Maintenance.....	37
Section 700.780. Violations And Penalties.....	38

CHAPTER 700

ARTICLE I Administration

Section 700.010. Appointment Of Superintendent.

The President of the Board, with the consent of the Board of Trustees, shall appoint a Superintendent for the Utility Department. In the absence of such an appointment, the Village Administrator shall serve in this capacity.

Section 700.020. Responsibilities Of the Superintendent.

- A. The Superintendent of the Utility Department shall have supervisory responsibility for all activities and personnel of the Utility Department. Further, the Superintendent shall have the responsibility to enforce all ordinances, rules and regulations applicable to the Utility Department. The Superintendent may promulgate administrative rules and regulations consistent with the letter and intent of this Chapter.
- B. The Superintendent shall keep a correct and complete list of all consumers, make a monthly reading of all meters used by consumers, and make a monthly report of the readings in writing to the Village Clerk.

Section 700.030. Employee Authority.

No employee or agent of the Village shall have the right or authority to bind the Village by any promise, agreement, or representation contrary to these rules and regulations or the laws of the State of Missouri.

Section 700.040. Complaints Regarding Employees.

Any complaint against the service or employees of the Village shall be made at the office of Village Administrator in writing.

ARTICLE II Utilities Generally

Section 700.050. Definitions.

The following words, terms and phrases, when used in this Chapter, shall have the meanings ascribed to them in this Section, except where the context clearly indicates a different meaning:

BILLING PERIOD — A utility service usage period. **BOARD** — The Board of Trustees.

COMMERCIAL SERVICE — Service for business use. CUSTOMER or CONSUMER — A purchaser of utility service. DELINQUENT ACCOUNT — A utility bill unpaid after its due date.

DISCONTINUANCE OF SERVICE — An intentional cessation of utility service by the Village and not requested by a customer.

ECONOMIC HARDSHIP — An inability to make timely payment for utility service due to fiscal restraints. The level of economic hardship shall be determined by using the most current State guidelines for the utility assistance program.

ESTIMATED BILLING — A billing for utility service which is not based on an actual meter reading.

FUEL ADJUSTMENT CLAUSE — The adjustment procedure approved by the Board of Trustees to recognize variations in the cost of fuel for the generation of electric power.

GOOD FAITH ATTEMPT TO PAY — The requirement whereby a customer makes some payment each month as agreed to by the Village.

INDUSTRIAL SERVICE — Service for manufacturing purposes.

MAINS — Village-owned piping for the purpose of distributing gas or water to a customer or for the collection of sewage.

POINT OF DELIVERY — The point of delivery shall be at the meter, unless otherwise specified in the user's agreement or in any other agreement where it is mentioned.

RATE — The amount charged for usage of a specified unit of electricity, gas, water or sewer service.

REGISTERED ELDERLY OR HANDICAPPED CUSTOMER — A person who is above the age of sixty- two (62) or is handicapped and has registered with the Village by submitting a statement attesting to the condition.

RESIDENTIAL SERVICE — Service for household purposes. SERVICE — The same as utility service.

SERVICE LINE — Piping connecting a customer to a Village main. SEWER — Piping designed for the collection and transportation of sewage.

SUSPENSION OF SERVICE — A temporary cessation of utility service initiated by the Utility Department.

TERMINATION OF SERVICE — A cessation of utility service requested by the customer.

UNPAID BILL — Any account owed to the Village for services that have not been paid or satisfied within sixty (60) days.

USER or CONSUMER — Any individual, firm, partnership, corporation, Federal or State Government, or any unit, agency, political corporation or subdivision of either the Federal or State Government, or other agency receiving water and waste services, or to whom water services are made available from the Village's facilities pursuant to a written water user's agreement.

UTILITY CHARGES — The charges for utility service.

UTILITY SERVICE — The provision of electricity, gas, water or sewer and activities related to that provision.

Section 700.060. Extension Policies Established.

Certain policies regarding the extension of all public utilities, both within and beyond the Village limits, shall be as determined by the Board of Trustees.

Section 700.070. Sale Of Public Utilities.

The public utilities shall not be sold, disposed of in any way, abandoned or cease to operate, except by a majority of the votes cast at any Village election or a special election held for that purpose pursuant to ordinance.

Section 700.080 Access To Premises.

The Village shall have, at all reasonable hours, access to the premises of a customer of any utility for the purpose of reading, inspecting, adjusting, repairing, replacing, disconnecting service, removing meters, or otherwise caring for its service, connections and meters.

Section 700.090. Resale Of Utility Services Prohibited.

No customer shall re-sell or offer any utility service purchased for his/her sole use from the Village.

Section 700.100. Injuring Or Misusing Utility System.

- A. No person shall connect with or use any Village utility service without the knowledge and consent of the Village or
- B. after the utility service has been discontinued by the Village, reconnect to the system nor shall in any manner defraud the Village in the use of any utility service or tamper with any utility meter or shunt around any meter nor shall be willfully or maliciously injure or destroy any property whatsoever of the Village.

Section 700.110. Area Of Service.

- A. The area of utility service shall be within the corporate Village limits and within the area outside such corporate Village limits served by any Village utility.
- B. Nothing in this Section shall be construed to prevent the Village from purchasing, leasing, erecting, installing or otherwise acquiring real and personal property necessary, useful or desirable in the conduct of its operations at any place, whether within or without the corporate limits of the Village, subject to approval by the Board of Trustees.

Section 700.120. Specifications For Making Excavations.

Any utility operating within the Village shall insure that any pavements, sidewalks or curbing taken up or any and all excavations made shall be done under the supervision and direction of the Village under all necessary permits in such manner as to cause the least reasonable inconvenience; and repairs and replacements shall be made by and at the expense of the company with all convenient speed, leaving such properties in as good condition as before.

Section 700.130, Meters, User's Responsibility.

The user shall be responsible for any damage to the meter installed for the user's service for any cause other than normal wear and tear.

ARTICLE III BILLING, ALL UTILITIES

Section 700.140. Written Application For Utility Service; Normal Business Hours.

- A. Any person desiring utility service or termination of utility service shall make written application on a form furnished by the Village. Such application shall be made as far in advance of the effective date as possible.
- B. A customer may order utility service between the hours of 8:00 A.M. and 4:30 P.M., Monday through Friday, except on regularly scheduled Village holidays. Customers requesting normal utility connections during hours or days other than those established in this Subsection shall be required to pay a service charge of one hundred dollars (\$100.00).
- C. The Village shall not be obligated to provide utility connections or disconnections until a reasonable time has been allowed for proper planning.
- D. Requests for services submitted on different dates must be accompanied by a separate fee.

Section 700.150. Services, To Whom Provided.

Utility services shall be provided only to:

1. The property owner.
2. The owner of the business located at the property.
3. A tenant if the tenant has a lease or written consent from the property owner.
4. Services shall not be provided to anyone whose immediate household includes a member who has an unpaid bill. An individual must be at least eighteen (18) years old to apply for service and must present proof of identification.
5. Services will not be denied to any person based on age (if over eighteen (18)), race, gender, nationality, or sexual preference.
6. Any person having an unpaid bill with the Village shall not obtain utilities service by means of misrepresentation or by making application in the name of another family member or household member. If any person should obtain services in this manner, then the past bill shall become due and payable immediately, and the balance due shall be added to the customer's next monthly utility bill. An unpaid bill is any account of ineptness owed to the Village for utility services that has not been paid or satisfied within sixty (60) days. If it is found that any person having an unpaid bill moves to a residence receiving services, a letter shall be sent with a payment plan. The plan shall state that payment arrangements on delinquent accounts five hundred dollars (\$500.00) or less shall be paid in full within ninety (90) days and over five hundred dollars (\$500.00) shall be paid in full within six (6) months from the date of the letter. Payments shall be made in equal amounts every month. If a payment is missed, services shall be disconnected at the current residence.
7. If it is found that any person having an unpaid bill moves to a residence receiving services, a letter shall be sent with a payment plan. The plan shall state that payment arrangements on delinquent accounts five hundred dollars (\$500.00) or less shall be paid in full within ninety (90) days and over five hundred dollars (\$500.00) shall be paid in full within six (6) months from the date of the letter. Payments shall be made in equal amounts every month. If a payment is missed, services shall be disconnected at the current residence.

Section 700.155. Water And Sewer Services Deemed Furnished To Both Occupant And Owner Of Premises.¹

- A. Sewerage services, water services, or water and sewerage services combined shall be deemed to be furnished to both the occupant and owner of the premises receiving such service

¹ State Law Reference: Similar Statutory provisions, Section 250.140, RSMo.

and, except as otherwise provided in Subsection (A)(2) of this Section, the Village shall have power to sue the occupant or owner, or both, of such real estate in a civil action to recover any sums due for such services less any deposit that is held by the Village for such services, plus a reasonable attorney's fee to be fixed by the court.

1. When the occupant is delinquent in payment for thirty (30) days, the Village shall make a good faith effort to notify the owner of the premises receiving such service of the delinquency and the amount thereof. Notwithstanding any other provision of this Section to the contrary, when an occupant is delinquent for more than ninety (90) days, the owner shall not be liable for sums due for more than ninety (90) days of service. Any notice of termination of service shall be sent to both the occupant and owner of the premises receiving such service.
2. The provisions of this Section shall apply only to residences that have their own private water and sewer lines. In instances where several residences share a common water or sewer line, the owner of the real property upon which the residences sit shall be liable for water and sewer expenses.

Section 700.150. Deposits.

- A. Prior to connection, all applicants for utility service must post a deposit equal to the estimated average monthly bill for that location.
- B. If there are not sufficient records to determine the monthly average. After six (6) months the Village will recalculate the average and the deposit will be adjusted accordingly. The applicant must pay any additional deposit or the Village will refund any overage.
- C. Deposits are assessed for each service requested.
- D. If the applicant, or any member of the applicant's household, owes delinquent utility fees to the Village at the time of application, such fees must be paid prior to the Village accepting the application.
- E. When a service is discontinued, at the request of the user or for delinquency in payment, the deposit for service shall be applied first to any charges owed to the Village, and the remaining balance, if any, shall be refunded to the customer.
- F. All interest earned from deposits held shall be transferred to the City General Fund as an administrative fee.

Section 700.160. Utility Meters; Monthly Readings.

- A. All connections for water shall be metered by meters furnished by the Village without charge. All meters shall remain the property of the Village.

- B. An attempt shall be made to read all utility meters monthly. If the meter cannot be read do to no fault of the consumer, the Village will estimate the reading. The following month the Village will obtain an actual reading and adjust the consumer's bill accordingly.
- C. If a meter cannot be read do to something caused by or under the control of the consumer, the following steps shall be followed:
 - 3. The first time the meter reading shall be estimated, and the user shall receive a letter stating the problem.
 - 4. The second time the meter reading shall be estimated, the user shall pay an additional fifty dollars (\$50.00) charge; and the user shall receive a letter stating the problem.
 - 5. The third time, services shall be disconnected and shall remain disconnected until the problem is resolved and all fees for disconnection have been paid.

Section 700.170. Special utility services.

Customers requesting special utility services, such as meter relocation or special disconnections and connections, shall be charged on a labor-and-material basis.

Section 700.180. Denial of utility service.

No customer having an unpaid bill for utility service may be permitted new or additional utility service without approval by the city's chief financial officer.

Section 700.190. Notice When Customer Is Terminating Utility Service.

A customer who intends to vacate any premises, discontinue the use of utility services or terminate in any manner his/her liability to pay for utility services delivered to such premises shall give written notice on a form furnished by the Village at least one (1) business day prior to the effective date of the termination.

Section 700.200. Bills Shall Be Due As Follows.

- A. Meters will be read as close to the 25th day of the month as is practical.
- B. That all bills shall be rendered on the first business day of each month and shall be due and payable upon receipt.
- C. Bills which are not paid by the 16th of each month will be considered delinquent.

Section 700.210. Delinquent Payments.

- A. The penalty for payment of a utility bill after the due date shall be ten percent of the unpaid

amount.

- B. If a utility bill remains unpaid by the 25th day of any month, it has become delinquent, and utility service may be discontinued, except when such discontinuance is prohibited by law or special arrangements have been made with the Village Administrator.
- C. Before discontinuance of utility service, the city shall issue a notice to the customer stating that utility service may be shut-off within 24 hours and providing a phone number if the customer wishes to dispute the disconnection.
- D. Resumption of service after discontinuance prohibited under certain conditions. Service that has been discontinued to a particular household for default in payment of utility charges shall not be resumed in the name of any relative, friend or member of the family while that person resides in the household.
- E. If a location is shut off for more than 30 days, a new account and deposit must be established, and a connection fee will be charged.

Section 700.220 Water Rates To Be Charged.

A. From and after the 30th day of October 2024 monthly rates required and which shall be charged and collected by the Village of Kingdom City, Missouri, for water and wastewater service furnished by the Village of Kingdom City, Missouri, shall be as follows:

1. A base fee of four dollars (\$4.00) water and a base fee of eleven (\$11.00) per month wastewater, for every residential property served by the system, a base fee of seventeen dollars and fifty cents (\$17.50) water and seventeen dollars and fifty cents (\$17.50) wastewater for nonresidential micro users per month, and a base fee of thirty-five dollars (\$35.00) water and a base fee thirty-five dollars (\$35.00) wastewater commercial up to the first thousand gallons (including no usage); and

2. For each one thousand (1,000) gallons of water residential, the following usage rate shall apply:

Beginning November 1, 2024	\$5.00
Beginning November 1, 2025	\$5.25
Beginning November 1, 2026	\$5.50
Beginning November 1, 2027	\$5.75

Beginning November 1, 2028	\$6.00
Beginning November 1, 2029	\$6.25
Beginning November 1, 2030	\$6.50
Beginning November 1, 2031	\$6.75
Beginning November 1, 2032	\$7.00
Beginning November 1, 2033	\$7.25
Beginning November 1, 2034	\$7.50

For each one thousand (1,000) gallons of water commercial, the following usage rate shall apply:

Beginning November 1, 2024	\$6.00
Beginning November 1, 2025	\$6.25
Beginning November 1, 2026	\$6.50
Beginning November 1, 2027	\$6.75
Beginning November 1, 2028	\$7.00
Beginning November 1, 2029	\$7.25
Beginning November 1, 2030	\$7.50
Beginning November 1, 2031	\$7.75
Beginning November 1, 2032	\$8.00
Beginning November 1, 2033	\$8.25
Beginning November 1, 2034	\$8.50

Section 700.230 Wastewater/Treatment Works/Sewer Rates To Be Charged.

- A. Each user shall pay for the services provided by the Village based on their use of the treatment works as determined by water meter(s) acceptable to the Village.
- B. Rates Based On Monthly Averages.

1. For residential contributors, monthly user charges will be based on average monthly water usage during the months of January, February, and March. If a residential contributor has not established a January, February, and March average, their monthly bill shall be the median charge of all other residential contributors.
2. The monthly rate charged shall be as follows:
 - a. For the first three thousand (3,000) gallons (including no usage), a fee of eleven dollars (\$11.00) for residential users, a base fee of seventeen dollars and fifty cents (\$17.50), for micro-nonresidential and thirty-five dollars (\$35.00) for commercial; plus
 - b. For each one thousand (1,000) gallons, residential, or part thereof, used above the initial three thousand (3,000) gallons a rate as follows:

Beginning November 1, 2024	\$5.00
Beginning November 1, 2025	\$5.25
Beginning November 1, 2026	\$5.50
Beginning November 1, 2027	\$5.75
Beginning November 1, 2028	\$6.00
Beginning November 1, 2029	\$6.25
Beginning November 1, 2030	\$6.50
Beginning November 1, 2031	\$6.75
Beginning November 1, 2032	\$7.00
Beginning November 1, 2033	\$7.25
Beginning November 1, 2034	\$7.50

3. For industrial and commercial contributors, user charges shall be based on water used during the current month. If a commercial or industrial contributor has a consumptive use of water, or in some other manner uses water which is not returned to the wastewater collection system, the user charge for that contributor may be based on wastewater meter(s) or separate water meter(s) installed and maintained at the contributor's expense, and in a manner acceptable to the Village.

Beginning November 1, 2024	\$9.00
Beginning November 1, 2025	\$9.75
Beginning November 1, 2026	\$10.50
Beginning November 1, 2027	\$11.25
Beginning November 1, 2028	\$12.00
Beginning November 1, 2029	\$12.75
Beginning November 1, 2030	\$13.50

Beginning November 1, 2031	\$14.25
Beginning November 1, 2032	\$15.00
Beginning November 1, 2033	\$15.75
Beginning November 1, 2034	\$16.50

4. For users using more than 10,000 gallons per month an additional charge of 20% over the existing usage charge.

5. Definitions:

a) “residential” means a property that is used primarily for residential dwelling, not including properties used for occupancies of less than 30 days.

b) “Micro-nonresidential” means a property which is used exclusively for charitable purposes and consumes less than 3000 gallons per year.

c) All other properties will be considered commercial

C. For those contributors which contribute wastewater, the strength of which is greater than normal domestic sewage, a surcharge in addition to the normal user charge will be collected. The surcharge for operation and maintenance, including replacement is:

1. Twelve cents (\$0.12) per pound BOD per month.
2. Five and three-tenths cents (\$0.053) per pound SS per month.

D. Any user which discharges any toxic pollutants which cause an increase in the cost of managing the effluent or the sludge from the Village's treatment works, or any user which discharges any substance which singly or by interaction with other substances causes identifiable increases in the cost of operation, maintenance, or replacement of the treatment works, shall pay for such increased costs. The charge to each such user shall be as determined by the responsible plant operating personnel and approved by the Board of Trustees.

E. The user charge rates established in this Section apply to all users of the Village's treatment works, regardless of the user's location.

ARTICLE IV STREET LIGHTING

Section 700.240. Board May Contract For Street Lighting.

The Board may enter into a contract with the electrical service franchisee or any other party for the provision of streetlights in the Village.

Section 700.250. Additions To System.

Additional streetlights may be added with the approval of the Board. Resident's desiring a streetlight shall make application to the Board in writing, stating the reasons.

ARTICLE V WATER AND WATER METERS

Section 700.260. Location Of Meters.

- A. Meters for water shall be located in a place convenient for the Village. In most cases new water meters should be located in a pit or box designed for that purpose as close to the property line as possible. Commercial meters shall be placed inside building for meter safety.
 - 1. Variance from the general policy of this Section may be taken only after written permission has been granted by the Superintendent of Utilities. The customer shall bear any costs incurred, as a result of the requested variance, less the cost of conventional installation.

Section 700.262. Additional Grounds For Disconnection.

- A. In addition, the Utility Superintendent may cause service to be discontinued due to:
 - 1. Violation of electric codes (per recommendation of Utility Superintendent or Building Inspector); or
 - 2. Violation of health ordinance (per recommendation of Health Department); or
 - 3. Request of Fire Department due to fires or fire danger; or
 - 4. Request from Utility Superintendent or Building Inspector because of unsafe condition of structure or dwelling.
- B. Notice To Customer Of Disconnection.
 - 1. Prior to any service disconnection for non-payment, the Village shall give five (5) working days' written notice of such intent by mail to the customer at his/her billing address or by placing a notice on the property. Such notice shall give a telephone number and address at which such discontinuance may be contested. A copy of such notice shall be furnished to the property owner if different from the occupant. However, when misrepresentation of water use is detected, or if the Village's regulating or measuring equipment has been tampered with, or if a dangerous condition exists on the user's premises, or when service has been connected or reconnected without authorization, service may be shut off without notice in advance.
 - 2. If a user contests a disconnection, the service shall not be disconnected until after the user has been given an opportunity, in person or by phone, to speak with a Village official with authority to resolve the issue, to state the user's reasons why such disconnection should not happen, and to hear the reasons why the Village intends to

disconnect the service.

C. If service is disconnected due to the user's delinquency, the user shall pay to the Village, in addition to all other charges provided herein, a fee of one hundred dollars (\$100.00) prior to reconnection.

D. If services are turned on after normal business hours, an additional one hundred dollars (\$100.00) overtime fee for each trip made during such period of time shall be imposed.

Section 700.264. Connection Fee, Water.

The fee for being connected to the water supply system will be as follows:

Meter Size	Cost
1 inch and smaller	\$1000
Greater than 1 inch and less than 2 inch	\$1600
2 inch and greater	Time and materials

ARTICLE VI. SEWERS AND SEWAGE DISPOSAL²

Section 700.300. Definitions.

The following words, terms and phrases, when used in this article, shall have the meanings ascribed to them in this section, except where the context clearly indicates a different meaning:

BOD (biochemical oxygen demand) means the quantity of oxygen utilized in the biochemical oxidation of organic matter under standard laboratory procedure in five days at five degrees Celsius, expressed in milligrams per liter.

Building drain means that part of the lowest horizontal piping of a drainage system which receives the discharge from soil, waste and other drainage pipes inside the walls of the building and conveys it to the building sewer, beginning five feet (1.5 meters) outside the inner face of the building wall.

Building sewer means the extension from the building drain to the public sewer or other place of disposal.

Combined sewer means a sewer receiving both surface runoff water and sewage.

Garbage means solid waste from domestic and commercial preparation, cooking and dispensing of food and from the handling, storage and sale of produce.

Industrial wastes means liquid wastes resulting from an industrial manufacturing process, trade or business.

Natural outlet means any outlet into a watercourse, pond, ditch, lake or other body of surface water or groundwater.

Person shall mean any individual, firm, company, association, society, corporation, or group.

pH means the logarithm of the reciprocal of the weight of hydrogen ions in grams per liter of solution.

Properly shredded garbage means waste from the preparation, cooking and dispensing of food that has been shredded to such a degree that all particles will be carried freely under the flow conditions normally prevailing in public sewers with no particle being greater than one-half inch (1.27 centimeters) in any dimension.

Public sewer means a sewer controlled by public authority to which all owners of abutting property have equal rights of access.

Sanitary sewer means a sewer carrying sewage into which stormwater, surface water or groundwater is not intentionally admitted.

Sewage means a combination of water-carried wastes, together with such groundwater, surface water or stormwater as may be present.

Sewage treatment plant means any arrangement of devices and structures used for treating sewage.

Sewage works means all facilities for collecting, pumping, treating and disposing of sewage.

Sewer means a pipe or conduit for carrying sewage.

Slug means any discharge of water, sewage or industrial waste which, in concentration of any given constituent or in quantity of flow, exceeds for any period longer than 15 minutes more than five times the average 24-hour concentration of flows during normal operation.

Storm sewer means a sewer which carries stormwater, surface water, drainage and unpolluted cooling water, but not sewage or waste.

Suspended solids means solids that either float on the surface of or are in suspension in water or other liquids and which are removable by laboratory filtering.

Watercourse means a channel in which a flow of water occurs continuously or intermittently.

Section 700.310. Enforcement; violations.

- A. Any person violating this article shall be guilty of an ordinance violation.
- B. If, upon conviction of a violation of this article, it appears that the violation continues to exist, the court having jurisdiction may permit the Village to make the requested corrections or cause them to be made and report the cost thereof to the judge who shall make such expense a part of the judgment in addition to any other fine or costs taxed in the action.
- C. It shall be unlawful to discharge to any natural outlet within the city, or in any area under the jurisdiction of the Village, any sewage or other polluted waters, except where suitable treatment has been provided in accordance with subsequent provisions of this ordinance.
- D. No unauthorized person shall maliciously, willfully, or negligently break, damage, destroy, uncover, deface, or tamper with any structure, appurtenance, or equipment which is part of the sewage works. Any person violating this provision shall be subject to immediate arrest under charge of disorderly conduct.
- E. Any person found to be violating any provision of this article except section 114-172, (d), shall be served by the Village with written notice stating the nature of the violation and providing a reasonable time limit for the satisfactory correction thereof. The offender shall, within the period of time stated in such notice, permanently cease all violations.
- F. Any person who shall continue any violation beyond the time limit provided for in this section, shall be guilty of a misdemeanor. Each 24-hour period in which any such violation shall continue shall be deemed a separate offense.
- G. Any person violating any of the provisions of this article shall become liable to the Village for any expense, loss, or damage occasioned the Village by reason of such violation.

Section 700.320. Objectionable waste.

It shall be unlawful for any person to deposit or permit to be deposited in an unsanitary manner on any property within the Village or in any area under the jurisdiction of the Village any human or animal excrement, garbage or other objectionable waste.

Section 700.330. Unauthorized sewage disposal.

- (a) Except as otherwise provided, it shall be unlawful to construct or operate any facility intended for or used for the disposal of sewage or to discharge into any natural outlet under the jurisdiction of the Village any sewage or polluted water, until treatment has been provided in accordance with this chapter.
- (b) Except as hereinafter provided, it shall be unlawful to construct or maintain any privy, privy vault, septic tank, cesspool, or other facility intended or used for the disposal of sewage.

Section 700.340. Connection required.

The owner of any structure that produces sewage is required to connect such structure directly to a proper Village sewer. The connection shall be completed within 90 days after official notice.

Section 700.350. Expense and liability incident to installation.

All costs and expense incident to the installation and connection of the building sewer to the Village's system shall be borne by the owner. The owner shall indemnify the Village from any loss or damage that may, directly or indirectly, be occasioned by the installation of the building sewer.

Section 700.360. Separate building sewer required.

A separate and independent building sewer shall be provided for every building; except where one building stands at the rear of another on an interior lot and no private sewer is available or can be constructed to the rear building through an adjoining property, the building sewer from the front building may be extended to the rear building and the whole considered as one building sewer.

Section 700.370. Use of old building sewers.

Old building sewers may be used in connection with new buildings only after approval by the planning and code enforcement officer.

Section 700.380. Construction methods and materials.

Construction methods and materials used in the construction of sanitary sewers shall conform to this article or other ordinances of the Village or to regulations established by the Village Administrator.

Section 700.390. Lifts.

- A. In all buildings in which any drain is too low to permit gravity flow to the public sanitary sewer, sewage carried by such building drain shall be lifted by an approved means to facilitate discharge to the public sanitary sewer.
- B. Lifts serving a single building or grinder pumps shall be the property of and be maintained by the customer, unless the Village has agreed in writing to assume that equipment.

Section 700.400. Connection to public sewer.

- A. All buildings in the Village that are occupied shall be connected to the public sewer.
- B. Any connection of a building sewer to a Village sewer shall conform to this article or other ordinances of the Village. Any deviation from the prescribed procedures and materials must be approved by the planning and code enforcement officer.

- C. The connection of the building sewer into the public sewer shall conform to the requirements of the building and plumbing code or other applicable rules and regulations of the Village, or the procedures set forth in appropriate specifications of the A.S.T.M. and the W.E.F. Manual of Practice No. 9. All such connections shall be made gastight and watertight. Any deviation from the prescribed procedures and materials must be approved by the superintendent before installation.
- D. An applicant for a building sewer permit shall notify the planning and code enforcement officer when the building sewer is ready for inspection and connection to the Village sewer. The connection shall be made under the supervision of the Village.

Section 700.410. Excavations.

All excavations for building sewer installations shall be adequately guarded with barricades and lights to protect the public from hazard. Streets, sidewalks, parkways and other public property disturbed in the course of the work shall be restored in a manner satisfactory to the Village.

Section 700.420. Prohibited sanitary sewer discharges; storm sewers.

- A. No person shall discharge or cause to be discharged any stormwater, surface water, groundwater, roof runoff, subsurface drainage, including interior and exterior foundation drains, uncontaminated cooling water or unpolluted industrial process waters to any sanitary sewer.
- B. Stormwater and all other unpolluted drainage shall be discharged to such sewers as are specifically designated as combined sewers or storm sewers or to a natural outlet approved by the Village. Industrial cooling water or unpolluted process water may be discharged, on approval of the Village, to a storm sewer, combined sewer or natural outlet.

Section 700.425 Interceptors.

- A. Grease, oil and sand interceptors shall be provided when, in the opinion of the Village, they are necessary for the proper handling of liquid wastes containing grease in excessive amounts, any flammable wastes, sand or other harmful ingredients, except that such interceptors shall not be required for private living quarters or dwelling units.
- B. All interceptors shall be of a type and capacity approved by the Village and shall be located as to be readily and easily accessible for cleaning and inspection.
- C. A grease interceptor or trap shall be installed in the waste line leading from sinks, drains, or other fixtures in all restaurants, hotel kitchens, bars where food is served, factory cafeterias, clubs, fraternal organizations, or other commercial establishments where grease may be introduced into the drainage system.
- D. Grease Traps are required to be inspected once a month by Village employees and records

of clean out are to be sent to City Hall yearly.

Section 700.430. Waters and waste that are specifically prohibited.

No person shall discharge or cause to be discharged any of the following waters or wastes to any public sewers:

- (1) Gasoline, benzene, naphtha, fuel oil or other flammable or explosive liquid, solid or gas.
- (2) Waters or wastes containing toxic or poisonous solids, liquids or gases in sufficient quantity, either singly or by interaction with other wastes, to injure or interfere with any sewage treatment process, constitute a hazard to humans or animals, create a public nuisance or create any hazard in the receiving waters of the sewage treatment plant, including but not limited to cyanide in excess of two mg/l as CN in the wastes as discharged to the public sewer.
- (3) Waters or wastes having a pH lower than 5.5 or having any other corrosive property capable of causing damage or hazard to structures, equipment and personnel of the sewage works.
- (4) Solid or viscous substances in quantities or of such size capable of causing obstruction to the flow in sewers or other interference with the proper operation of the sewage works, such as but not limited to ashes, cinders, sand, mud, straw, shavings, metal, glass, rags, feathers, tar, plastics, woods, unground garbage, whole blood, paunch manure, hair and fleshing, entrails and paper dishes, cups, milk containers, etc., either whole or ground by garbage grinders.

Section 700.440. Waters and wastes subject to review by Village.

- A. Any waters or wastes having the following are subject to review by the Village:
 1. A five-day BOD greater than 300 parts per million by weight;
 2. Containing more than 350 parts per million by weight of suspended solids; or
 3. Having an average daily flow greater than two percent of the average sewage flow of the Village.
 4. Where necessary in the opinion of the Village, the owner shall provide, at his expense, such preliminary treatment as may be necessary to:
 - (1) Reduce the biochemical oxygen demand to 300 parts per million by weight;
 - (2) Reduce the suspended solids to 350 parts per million by weight; or
 - (3) Control the quantities and rates of discharge of such waters or wastes.
 5. Plans, specifications and any other pertinent information relating to proposed preliminary treatment facilities shall be submitted for approval by the Village, and no construction of such facilities shall be commenced until such approval is obtained in writing.

Section 700.450. Substances Village may prohibit.

No person may discharge or cause to be discharged the following described substances, materials, waters, or wastes if it appears likely, in the opinion of the Village, that such might harm either the sewers, sewage treatment process or equipment or have an adverse effect on the receiving stream, endanger life, limb, public property or constitute a nuisance. In forming an opinion as to the acceptability of these wastes, the superintendent will give consideration to such factors as the quantities of subject wastes in relation to flows and velocities in the sewers, materials of construction of the sewers, nature of the sewage treatment process, capacity of the sewage treatment plant, degree of treatability or wastes in the sewage treatment plant, and other pertinent factors. The substances prohibited are:

- (1) Any liquid or vapor having a temperature higher than 150 degrees Fahrenheit (65 degrees Celsius).
- (2) Any water or waste containing fats, wax, grease or oils, whether emulsified or not, in excess of 100 mg/l or containing substances which may solidify or become viscous at temperatures between 32 and 150 degrees Fahrenheit (0 and 65 degrees Celsius).
- (3) Any garbage that has not been properly shredded. The installation and operation of any garbage grinder equipped with a motor of three-fourths horsepower (0.76 horsepower metric) or greater shall be subject to review and approval by the Village.
- (4) Any waters or wastes containing strong acid iron pickling wastes or concentrated plating solutions, whether neutralized or not.
- (5) Any waters or wastes containing iron, chromium, copper, zinc and similar objectionable or toxic substances or wastes exerting an excessive chlorine requirement to such degree that any such material received in the composite sewage at the sewage treatment works exceeds the limits established for such materials.
- (6) Any waters or wastes containing phenols or other taste or odor-producing substances, in such concentrations exceeding limits which may be established by the superintendent as necessary, after treatment of the composite sewage, to meet the requirements of state, federal, or other public agencies of jurisdiction for such discharge to the receiving waters.
- (7) Any radioactive wastes or isotopes of such halflife or concentration as may exceed limits established by state or federal regulations.
- (8) Any waters or wastes having a pH in excess of 9.5.
- (9) Materials which exert or cause:
 - (a) Unusual concentrations of inert suspended solids, such as but not limited to fuller's earth, lime slurries and lime residues, or of dissolved solids, such as but not limited to sodium chloride or sodium sulfate.
 - (b) Excessive discoloration, such as but not limited to dye wastes and vegetable tanning solutions.
 - (c) Unusual BOD, chemical oxygen demand or chlorine requirements in such quantities as to constitute a significant load on the sewage treatment works.
 - (d) Unusual volume of flow or concentration of wastes constituting slugs.

- (10) Waters or wastes containing substances which are not amenable to treatment or reduction by the sewage treatment processes employed or are amenable to treatment only to such degree that the sewage treatment plant effluent cannot meet the requirements of other agencies having jurisdiction over discharge to the receiving waters.

Section 700.460. Actions Village may take with reference to certain wastes.

- (a) If any waters or wastes are discharged or are proposed to be discharged to the public sewers, which waters contain the substances or possess the characteristics enumerated in section 114-199 and which in the judgment of the Village may have a deleterious effect upon the sewage works, processes, equipment or receiving waters or which otherwise create a hazard to life to constitute a public nuisance, the Village may:
 - (1) Reject the wastes.
 - (2) Require pretreatment to an acceptable condition for discharge to the public sewers.
 - (3) Require control over the quantities and rates of discharge.
 - (4) Require payment to cover the added cost of handling and treating the wastes not covered by existing taxes or sewer charges under section 114-205.
- (b) If the Village permits the pretreatment or equalization of waste flows, the design and installation of the plants and equipment shall be subject to review and approval by the Village and subject to the requirements of all applicable codes, ordinances and laws of the Village and state.

Section 700.480. Preliminary treatment facilities.

Where preliminary treatment or flow-equalizing facilities are provided for any waters or wastes, they shall be maintained continuously in satisfactory and effective operation by the owner at his expense.

Section 700.490. Control manhole.

When required by the Village the owner of property serviced by a building sewer carrying industrial wastes shall install in the building sewer a control manhole, together with necessary meters and appurtenances, to facilitate observation, sampling and measurement of wastes. The manhole shall be installed by the owner at his expense, and installation shall be in compliance with Village specifications.

Section 700.500. Measurements, tests and analyses.

- (a) All measurements, tests and analyses of the characteristics of water and wastes to which reference is made in this article shall be determined in accordance with an EPA approved edition of "Standard Methods for the Examination of Water and Wastewater," published by the American Public Health Association, and shall be determined at the control manhole provided or upon suitable samples taken at such control manhole. If no special manhole has been required, the control manhole shall be considered to be the nearest downstream manhole in the public sewer to the point at which the building sewer is connected. Sampling shall be carried out by customarily

accepted methods to reflect the effect of constituents upon the sewage works and to determine the existence of hazards to life, limb and property.

- (b) The particular analyses involved will determine whether a 24-hour composite of all outfalls of a premises is appropriate or whether a grab sample or samples should be taken. Normally, but not always, BOD and suspended solids analyses are obtained from 24-hour composites of all outfalls, whereas pH analyses are determined from periodic grab samples.

Section 700.510. Special agreements.

Nothing in this division shall prevent any agreement or arrangement between the Village and an industrial concern whereby an industrial waste of unusual strength or character may be accepted by the Village for treatment, subject to payment therefore, by the industrial concern.

Section 700.520. Private Systems.

1. NO PRIVATE SYSTEMS ALLOWED

ARTICLE VII Lead Ban Policy

Section 700.530. Purpose.

The purpose of this Article is:

- 1. To ban the use of lead materials in the public drinking water system and private plumbing connected to the public drinking water system; and
- 2. To protect City residents from lead contamination in the Village's public drinking water system and their own private plumbing systems.

Section 700.540. Application.

This Article shall apply to all premises served by the public drinking water system of the Village of Kingdom City.

Section 700.550. Policy.

- A. this Article will be reasonably interpreted by the water purveyor. It is the purveyor's intent to ban use of lead-based material in the construction or modification of the Village's drinking water system or private plumbing connected to the Village's system. The cooperation of all consumers is required to implement the lead ban.
- B. If, in the judgment of the water purveyor or his authorized representative, lead-based materials have been used in new construction or modifications after January 4, 2014, due notice shall be given to the consumer. The consumer shall immediately comply by having the lead-

based materials removed from the plumbing system and replaced with lead-free materials. If the lead-based materials are not removed from the plumbing system, the water purveyor shall have the right to discontinue water service to the premises.

Section 700.560. Definitions.

The following definitions shall apply in the interpretation and enforcement of this Article.

CONSUMER — The owner or person in control of any premises supplied by or in any manner connected to a public water system.

LEAD-BASED MATERIALS — Any material containing lead in excess of the quantities specified in the definition of "lead-free."

LEAD-FREE —

1. When used with respect to solder and flux, refers to solders and flux containing not more than two tenths percent (0.2%) lead; and
2. When used with respect to pipes, pipe fittings, plumbing fittings, and fixtures, refers to pipes, pipe fittings, plumbing fittings, and fixtures containing not more than a weighted average of twenty-five hundredths percent (0.25%) lead.

PUBLIC DRINKING WATER SYSTEM — Any publicly or privately owned water system supplying water to the general public which is satisfactory for drinking, culinary and domestic purposes and meets the requirements of the Missouri Department of Natural Resources.

WATER PURVEYOR — The owner, operator, or individual in responsible charge of a public water system.

Section 700.570. Exemptions.

- C. "Pipes, pipe fittings, plumbing fittings or fixtures, including backflow preventers, that are used exclusively for non-potable services such as manufacturing, industrial processing, irrigation, outdoor watering, or any other uses where the water is not anticipated to be used for human consumption"; [SDWA 1417(a)(4)(A)]³
- D. "Toilets, bidets, urinals, fill valves, flushometer valves, tub fillers, fire hydrants, shower valves, service saddles, or water distribution main gate valves that are two (2) inches in diameter or larger." [SDWA 1417(a)(4)(B)]⁴

³ Editor's Note: See now the Safe Drinking Water Act, 42 U.S.C.A. § 300g-6(a)(4)(A).

⁴ Editor's Note: See now the Safe Drinking Water Act, 42 U.S.C.A. § 300g-6(a)(4)(B).

Section 700.580. Lead Banned From Drinking Water Plumbing.

- A. No water service connection shall be installed or maintained to any premises where lead-based materials were used in new construction or modifications of the drinking water plumbing after January 4, 2014.
- B. If a premises is found to be in violation of Subsection (A), water service shall be discontinued until such time that the drinking water plumbing is lead-free.

ARTICLE VIII Protection Of Drinking Water

Section 700.590. Statement Of Intent.

As the residents of the Village of Kingdom City depend exclusively on groundwater for a safe drinking water supply, it is recognized that certain land use practices and activities can seriously threaten or degrade groundwater quality. The intent of this Article is to protect the Village's municipal water supply, its well(s) and well fields. The regulations and prohibitions specified by this Article shall apply to all lands within the Village of Kingdom City that lie within 100 feet minimum (the Protection Zone) of a municipal well within the City.

Section 700.600. Definitions.

When used in this Article, the following words and phrases shall have the meanings set forth in this Section:

HAZARDOUS OR TOXIC WASTE OR MATERIAL — Any material or waste which because of its quantity, concentration, or physical, chemical, or infectious characteristics may:

- 1. Cause or significantly contribute to an increase in mortality or an increase in serious irreversible incapacitation or illness; or
- 2. Pose a substantial present or future potential hazard to human health or to the environment when improperly used, treated, stored, transported, disposed of or otherwise managed.
- 3. **PROTECTION ZONE** — That property within the Village of Kingdom City lying within a one-hundred-foot radius of the any municipal water well.

SANITARY LANDFILL — A disposal site where solid wastes, or hazardous wastes, including putrescible wastes, or hazardous wastes, is disposed of on land by placing earth cover thereon.

Section 700.610. Required Separation Distances.

- A. The required horizontal separation distances between a municipal well and the following land uses and facilities are as follows:

1. Fifty (50) feet between a well and a storm sewer main.
2. Three hundred (300) feet between a well and any sanitary sewer main or lift station. A lesser separation distance may be allowed for sanitary sewer mains where the sanitary sewer main is constructed of water main materials and joints and pressure tested in place to meet current AWWA six hundred (600) specifications and the lesser separation distance is not in violation of applicable rules, regulations or guidelines of the Missouri Department of Natural Resources. In no case may the separation distance between a well and a sanitary sewer main be less than fifty (50) feet.
3. Four hundred (400) feet between a well and a septic tank receiving less than eight thousand (8,000) gallons per day, a cemetery or a stormwater detention or retention pond.
4. One thousand (1,000) feet between a well and the outer boundary of land used for the application of municipal, commercial or industrial waste; industrial, commercial or municipal wastewater lagoons or storage structures; and septic tanks or soil absorption units receiving eight thousand (8,000) gallons of wastewater per day or more.
5. One hundred (100) feet between a well and any solid waste storage, transportation, transfer, incineration, air curtain destructor, processing, one-time disposal or small demolition facility; sanitary landfill; salt or deicing material storage area; gasoline or fuel oil storage tanks; bulk fuel storage facilities; and pesticide or fertilizer handling or storage facilities.

Section 700.620. Prohibited Uses Within Protection Field.

- A. The following uses are prohibited uses within the Protection Zone:
1. Animal waste storage facilities;
 2. Asphalt products manufacturing;
 3. Bulk fertilizer and pesticide storage facilities;
 4. Bus or truck terminals;
 5. Dry-cleaning facilities;
 6. Electroplating;
 7. Exterminating shops;
 8. Garage and vehicular towing;
 9. Gas stations;
 10. Hazardous and toxic materials storage and use;

11. Hazardous and toxic waste facilities;
12. Junk yards or auto salvage yards;
13. Sanitary landfills or waste disposal facilities;
14. Non-municipal spray wastewater facilities;
15. Non-municipal wastewater treatment facilities;
16. Paint and coating manufacturing;
17. Printing shop;
18. Public and municipal maintenance garages;
19. Radioactive waste facilities;
20. Salt storage;
21. Seepage and/or sludge spreading;
22. Tire and battery services;
23. Underground storage tanks;
24. Vehicle repair establishments, including auto body repair; and
25. Waste transfer stations.

Section 700.630. Contaminants And Remediation.

- A. In the event any person causes the spill or release of any contaminants which endanger the Protected Zone, such person shall:
 1. Take immediate action to terminate the spill or release and contain or remediate any damage;
 2. Notify the City Clerk that a spill or release of contaminants has occurred, further notifying the City Clerk of the properties of the contaminant and the actions taken to terminate the spill or release; and
 3. Clean up the spill or release of contaminants to the satisfaction of the City. The costs of remediation and cleanup shall be borne by the person causing the spill or release as provided by law.

Section 700.640. Enforcement.

- A. Notice Of Violation. Whenever a determination has been made that there are reasonable grounds to believe that a violation of any provision of this Article exists on any land within the Protection Zone, the City Clerk shall give notice of such alleged violation to the owner or occupant of said land as follows. Such notice shall:
1. Be in writing and include a statement of any alleged violations, what remedial action(s) are to be taken, and any fines or fees associated with the enforcement of this Article;
 2. Allow a reasonable time for the correction of any violation or the performance of any required act;
 3. Be served upon the owner or occupant personally, by registered mail to his or her last known address, or by posting the notice conspicuously in or about the land, building or structure affected by the action.
- B. Abatement Of Violation. If a person violates this Article or fails to comply with a notice of violation within the time specified by the notice, the City may, in addition to any other remedies available at law or equity, seek an injunction to restrain, correct or abate such violation or to acquire removal or termination of the unlawful use of the land, building or structure in violation of the provisions of this Article or any order or direction made pursuant thereto.
- C. Fines And Penalties. Any person violating this Article, or failing to comply with any order issued pursuant to any Section thereof, shall be guilty of an ordinance violation and upon conviction thereof shall be punished as set out in Section 100.220 of this Code.
- D. Legal Action. The imposition of the fines herein prescribed shall not limit the City from instituting appropriate action to prevent unlawful construction or to restrain, correct or abate a violation, or to prevent illegal use or occupancy of a building, structure or premises, or to stop an illegal act, conduct, business or use of building or structure in or about any premises, in violation of this Article.

Section 700.650. Inspection And Right Of Entry.

An authorized representative of the City shall have the authority to enter at any reasonable hour any building, structure or premises in the City to enforce the provisions of this Article. Any person making such inspection shall furnish to the owner or occupant of the building or structure to be inspected sufficient identification and information to enable the owner or occupant to determine that he or she is a representative of the City and to determine the purpose of the inspection. Inspections may be prompted on the basis of complaint or as part of a systematic inspection program.

ARTICLE IX Cross-Connection Control

Section 700.670. Purpose.

- A. The purpose of this Article is:
1. To protect the public potable water supply from contamination or pollution by containing within the consumer's internal distribution system or private water system contaminants or pollutants which could backflow through the service connection into the public potable water supply system.
 2. To promote the elimination, containment, isolation, or control of existing cross-connections, actual or potential, between the public or consumer's potable water system and non-potable water systems, plumbing fixtures, and industrial-process systems.
 3. To provide for the maintenance of a continuing program of cross-connection control which will systematically and effectively prevent the contamination or pollution of all potable water systems.

Section 700.680. Application.

This Article shall apply to all premises served by the public potable water system of the Village of Kingdom City.

Section 700.690. Policy.

- B. This Article will be reasonably interpreted by the water purveyor. It is the water purveyor's intent to recognize the varying degrees of hazard and to apply the principle that the degree of protection shall be commensurate with the degree of hazard.
- C. The water purveyor shall be primarily responsible for protection of the public potable water distribution system from contamination or pollution due to backflow or contaminants or pollutants through the water service connection. The cooperation of all consumers is required to implement and maintain the program to control cross-connections. The water purveyor and consumer are jointly responsible for preventing contamination of the water system.
- D. If, in the judgement of the water purveyor or his authorized representative, cross-connection protection is required through either piping modification or installation of an approved backflow prevention device, due notice shall be given to the consumer. The consumer shall immediately comply by providing the required protection at his own expense; and failure, refusal, or inability on the part of the consumer to provide such protection shall constitute grounds for discontinuing water service to the premises until such protection has been provided.

Section 700.700. Definitions.

The following definitions shall apply in the interpretation and enforcement of this Article:

AIR GAP SEPARATION — The unobstructed vertical distance through the free atmosphere

between the lowest opening from any pipe or faucet supplying water to a tank, plumbing fixture, or other device and the overflow level rim of the receptacle, and shall be at least double the diameter of the supply pipe measured vertically above the flood level rim of the vessel, but in no case less than one (1) inch.

AUXILIARY WATER SUPPLY — Any water source or system, other than the public water supply, that may be available in the building or premises.

BACKFLOW — The flow other than the intended direction of flow, of any foreign liquids, gases, or substances into the distribution system of a public water supply.

BACKFLOW PREVENTION DEVICE — Any device, method, or type of construction intended to prevent backflow into a potable water system.

CONSUMER — The owner or person in control of any premises supplied by or in any manner connected to a public water system.

CONTAINMENT — Protection of the public water supply by installing a cross-connection control device or air gap separation on the main service line to a facility.

CONTAMINATION — An impairment of the quality of the water by sewage, process fluids, or other wastes to a degree which could create an actual hazard to the public health through poisoning or through spread of disease by exposure.

CROSS-CONNECTION — Any physical link between a potable water supply and any other substance, fluid, or source, which makes possible contamination of the potable water supply due to the reversal of flow of the water in the piping or distribution system.

HAZARD, DEGREE OF — An evaluation of the potential risk to public health and the adverse effect of the hazard upon the potable water system.

1. **HAZARD, HEALTH** — Any condition, device, or practice in the water supply system and its operation which could create or may create a danger to the health and well-being of the water consumer.
2. **HAZARD, PLUMBING** — A plumbing type cross-connection in a consumer's potable water system that has not been properly protected by a vacuum breaker, air gap separation or backflow prevention device.
3. **HAZARD, POLLUTIONAL** — An actual or potential threat to the physical properties of the water system or to the potability of the public or the consumer's potable water system but which would constitute a nuisance or be aesthetically objectionable or could cause damage to the system or its appurtenances, but would not be dangerous to health.
4. **HAZARD, SYSTEM** — An actual or potential threat of severe damage to the physical

properties of the public potable water system or the consumer's potable water system, or of a pollution or contamination which would have a protracted effect on the quality of the potable water in the system.

INDUSTRIAL PROCESS SYSTEM — Any system containing a fluid or solution, which may be chemically, biologically, or otherwise contaminated or polluted in a form or concentration such as would constitute a health, system, pollutional, or plumbing hazard if introduced into a potable water supply.

ISOLATION — Protection of a facility service line by installing a cross-connection control device or air gap separation on an individual fixture, appurtenance, or system.

POLLUTION — The presence of any foreign substance (organic, inorganic, or biological) in water which tends to degrade its quality so as to constitute a hazard or impair the usefulness of the water to a degree which does not create an actual hazard to the public health but which does adversely and unreasonably affect such waters for domestic use.

PUBLIC POTABLE WATER SYSTEM — Any publicly or privately owned water system supplying water to the general public which is satisfactory for drinking, culinary, and domestic purposes and meets the requirements of the Missouri Department of Natural Resources.

SERVICE CONNECTION — The terminal end of a service line from the public water system. If a meter is installed at the end of the service, then the service connection means the downstream end of the meter.

WATER PURVEYOR — The owner, operator, or individual in responsible charge of a public water system.

Section 700.710. Cross-Connections Prohibited.

- E. No water service connection shall be installed or maintained to any premises where actual or potential cross-connections to the public potable or consumer's water system may exist unless such actual or potential cross-connections are abated or controlled to the satisfaction of the water purveyor, and as required by the laws and regulations of the Missouri Department of Natural Resources.
- F. No connection shall be installed or maintained whereby an auxiliary water supply may enter a public potable or consumer's water system unless such auxiliary water supply and the method of connection and use of such supply shall have been approved by the water purveyor and the Missouri Department of Natural Resources.
- G. No water service connection shall be installed or maintained to any premises in which the plumbing system, facilities, and fixtures have not been constructed and installed using acceptable plumbing practices considered by the water purveyor as necessary for the protection

of health and safety.

Section 700.720. Survey And Investigations.

- H. The consumer's premises shall be open at all reasonable times to the water purveyor, or his authorized representative, for the conduction of surveys and investigations of water use practices within the consumer's premises to determine whether there are actual or potential cross-connections to the consumer's water system through which contaminants or pollutants could backflow into the public potable water system.
- I. On request by the water purveyor or his or her authorized representative, the consumer shall furnish information on water use practices within his premises.
- J. It shall be the responsibility of the water consumer to conduct periodic surveys of water use practices on his or her premises to determine whether there are actual or potential cross-connections to his or her water system through which contaminants or pollutants could backflow into his or the public potable water system.

Section 700.730. Type Of Protection Required.

- A. The type of protection required by this Article shall depend on the degree of hazard which exists, as follows:
 - 1. An approved air gap separation shall be installed where the public potable water system may be contaminated with substances that could cause a severe health hazard.
 - 2. An approved air gap separation or an approved reduced pressure principle backflow prevention device shall be installed where the public potable water system may be contaminated with a substance that could cause a system or health hazard.
 - 3. An approved air gap separation or an approved reduced pressure principle backflow prevention device or an approved double check valve assembly shall be installed where the public potable water system may be polluted with substances that could cause a polluttional hazard not dangerous to health.

Section 700.740. Where Protection Is Required.

- A. An approved backflow prevention device shall be installed on each service line to a consumer's water system serving premises where, in the judgement of the water purveyor or the Missouri Department of Natural Resources, actual or potential hazards to the public potable water system exist. The type and degree of protection required shall be commensurate with the degree of hazard.
- B. An approved air gap separation or reduced pressure principle backflow prevention device

shall be installed at the service connection or within any premises where, in the judgement of the water purveyor or the Missouri Department of Natural Resources, the nature and extent of activities on the premises, or the materials used in connection with the activities, or materials stored on the premises, would present an immediate and dangerous hazard to health should a cross-connection occur, even though such cross-connection may not exist at the time the backflow prevention device is required to be installed. This includes, but is not limited to, the following situations:

1. Premises having an auxiliary water supply, unless the quality of the auxiliary supply is acceptable to the water purveyor and the Missouri Department of Natural Resources.
 2. Premises having internal cross-connections that are not correctable, or intricate plumbing arrangements which make it impractical to ascertain whether or not cross-connections exist.
 3. Premises where entry is restricted so that inspection for cross-connections cannot be made with sufficient frequency or at sufficiently short notice to ensure the cross-connections do not exist.
 4. Premises having a repeated history of cross-connections being established or reestablished.
 5. Premises which, due to the nature of the enterprise therein, are subject to recurring modification or expansion.
 6. Premises on which any substance is handled under pressure so as to permit entry into the public water supply, or where a cross-connection could reasonably be expected to occur. This shall include the handling of processed waters and cooling waters.
 7. Premises where materials of a toxic or hazardous nature are handled such that if back-siphonage or backpressure should occur, a serious health hazard may result.
- C. The following types of facilities fall into one (1) or more of the categories of premises where an approved air gap separation or reduced pressure principle backflow prevention device is required by the water purveyor and the Missouri Department of Natural Resources to protect the public water supply and must be installed at these facilities unless all hazardous or potentially hazardous conditions have been eliminated or corrected by other methods to the satisfaction of the water purveyor and the Missouri Department of Natural Resources:
1. Aircraft and missile plants.
 2. Automotive plants.
 3. Auxiliary water systems.
 4. Beverage bottling plants.

5. Canneries, packing houses, and reduction plants.
6. Car-washing facilities.
7. Chemical manufacturing, processing, compounding or treatment plants
8. Film laboratories.
9. Fire protection systems.
10. Hazardous waste storage and disposal sites.
11. Hospitals, mortuaries, clinics.
12. Irrigation and sprinkler systems.
13. Laundries and dye works.
14. Metal manufacturing, cleaning, processing and fabricating plants.
15. Oil and gas production, storage or transmission properties.
16. Paper and paper products plants.
17. Plating plants.
18. Power plants.
19. Printing and publishing facilities.
20. Radioactive material processing plants or nuclear reactors.
21. Research and analytical laboratories.
22. Rubber plants, natural and synthetic.
23. Sewage and storm drainage facilities—pumping stations.
24. Waterfront facilities and industries.

Section 700.750. Backflow Prevention Devices.

- A. Any backflow prevention device required by this Article shall be of a model or construction approved by the water purveyor and the Missouri Department of Natural Resources.
 1. Air gap separation to be approved shall be at least twice the diameter of the supply pipe, measured vertically above the top rim of the vessel, but in no case less than one (1) inch.

2. A double check valve assembly or a reduced pressure principle backflow prevention device shall be approved by the water purveyor, and shall appear on the current "list of approved backflow prevention devices" established by the Missouri Department of Natural Resources.
- B. Existing backflow prevention devices approved by the water purveyor at the time of installation and properly maintained shall, except for inspection and maintenance requirements, be excluded from the requirements of this Article so long as the water purveyor is assured that they will satisfactorily protect the water system. Whenever the existing device is moved from its present location, or requires more than minimum maintenance, or when the water purveyor finds that the maintenance constitutes a hazard to health, the unit shall be replaced by a backflow prevention device meeting the requirements of this Article.

Section 700.760. Installation.

- A. Backflow prevention devices required by this Article shall be installed at a location and in a manner approved by the water purveyor and shall be installed at the expense of the water consumer.
- B. Backflow prevention devices installed on the service line to the consumer's water system shall be located on the consumer's side of the water meter, as close to the meter as is reasonably practical, and prior to any other connection.
- C. Backflow prevention devices shall be located so as to be readily accessible for maintenance and testing, protected from freezing, and where no part of the device will be submerged or subject to flooding by any fluid.

Section 700.770. Inspection And Maintenance.

- A. It shall be the duty of the consumer at any premises on which backflow prevention devices required by this Article are installed to have inspection, tests, and overhauls made in accordance with the following schedule or more often where inspections indicate a need.
1. Air gap separations shall be inspected at the time of installation and at least every twelve (12) months thereafter.
 2. Double check valve assemblies shall be inspected and tested for tightness at the time of installation and at least every twelve (12) months thereafter. They shall be dismantled, inspected internally, cleaned, and repaired whenever needed and at least every thirty (30) months.
 3. Reduced pressure principle backflow prevention devices shall be inspected and tested for tightness at the time of installation and at least every twelve (12) months thereafter. They shall be dismantled, inspected internally, cleaned, and repaired whenever needed

and at least every five (5) years.

- B. Inspections, tests, and overhauls of backflow prevention devices shall be made at the expense of the water consumer and shall be performed by a State of Missouri certified backflow prevention device tester.
- C. Whenever backflow prevention devices required by this Article are found to be defective, they shall be repaired or replaced at the expense of the consumer without delay.
- D. The water consumer must maintain a complete record of each backflow prevention device from purchase to retirement. This shall include a comprehensive listing that includes a record of all tests, inspections, and repairs. Records of inspections, tests, repairs, and overhauls shall be made available to the water purveyor upon request.
- E. Backflow prevention devices shall not be bypassed, made inoperative, removed, or otherwise made ineffective without specific authorization by the water purveyor.

Section 700.780. Violations And Penalties.

- A. The water purveyor shall deny or discontinue, after reasonable notice to the occupants thereof, the water service to any premises wherein any backflow prevention device required by this Article is not installed, tested, and maintained in a manner acceptable to the water purveyor, or if it is found that the backflow prevention device has been removed or bypassed, or if an unprotected cross-connection exists on the premises.
- B. Water service to such premises shall not be restored until the consumer has corrected or eliminated such conditions or defects in conformance with this Article to the satisfaction of the water purveyor.

APPENDIX B



**Site Development
Application for Plan
Examination and Building
Permit**

Village of Kingdom City

App Date: _____

Applicant is Owner Contractor

Property Information

Street Name: _____ Lot Size: _____ acres
Subdivision: _____ Lot Number: _____
Physical Location/Street Address: _____

Owner Information

First Name: _____ Last Name: _____
Email Address: _____ Phone: _____
Mailing Address: _____ City: _____ State: _____ Zip: _____

Applicant Information (if different from above)

First Name: _____ Last Name: _____
Business Name: _____
Email Address: _____ Phone: _____
Mailing Address: _____ City: _____ State: _____ Zip: _____

General Contractor Information

First Name: _____ Last Name: _____
Business Name: _____
Email Address: _____ Phone: _____
Mailing Address: _____ City: _____ State: _____ Zip: _____
City of Osage Beach Contractor's License #: _____
Job Superintendent Name: _____ Job Superintendent Phone: _____

All contractor's must hold a current Contractor's License with the Village of Kingdom City

Estimated Work Start Date: _____

Estimated Work Completion Date: _____

Description of Work:

Property Type

- Residential
- Commercial
- New Development

Has this property ever been connected to City Sewer? Yes No

Are you paying for a ghost meter for this property? Yes No

If yes, please provide the account number: _____

Check all that apply

- Driveway
- Excavation
- Grading
- Retaining Wall
- Sewer
- Sidewalk
- Water

Meter Size Needed

Check one below

- 5/8" 1 1/2" 3"
- 1" 2" 4"

Water Impact Fees

- 5/8" | \$1,000 1 1/2" | \$1,600 3" | \$ T&E
- 1" | \$1,000 2" | \$ T&E 4" | \$ T&E

**The above fees are for Inside City Limits. Additional fees may apply for properties outside City Limits.*

Does this project include a utility that is eligible for acceptance into City Inventory? Yes No

If yes, the eligible utility MUST meet City Design Guidelines to be accepted into City Inventory.

Utility to be added to City Inventory

(Please check all that apply)

- Water Main
- Force Main
- Gravity Main
- Sewer Station
- Water Meter

All the above information is true and correct, and I understand that all installations must be approved prior to work commencement and inspected during construction and that the service will not be turned on until a final inspection and acceptance has been made by the Village of Kingdom City.

Signature of Owner

Date

Signature of Applicant

Date

Printed Name of Owner

Printed Name of Applicant

For Building Department Use Only

SDC Area: _____

Total Site Development Fees: _____

Total Water Fees: _____

Total Sewer Fees: _____

Fees Calculated by:

Application Reviewed and Approved by:

Building Dept Representative

Date

Building Official

Date