Standards Manual

For

City of Madisonville

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Dallas Cunningham, Councilman
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June 16, 2003

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Foreword

The First Edition of the Standards Manual of the City of Madisonville represents the culmination of amendments to the Regulations and Specifications pertaining to new Water Mains and Sanitary Sewerage Facilities, Madisonville, Kentucky. The Standards Manual has been adopted by the City of Madisonville. The adoption of this document has established these specifications as the basic uniform standards for the planning, design, and construction of water and wastewater projects performed within the City of Madisonville's service areas.

Use of the Standards Manual, as the basic uniform specifications should accomplish the following improvements:

- Allow common interpretation of provisions.
- Simplify the development process for Developers, Engineers, Surveyors, and Contractors.
- Provide a continuing amendment process to meet the changing demands of new technology, new materials, and improved methods.
- Reduce Local Government expenditures associated with staff or consultant development of specifications and training of construction inspectors/observers.
- Result in decreased construction cost of water main and sanitary sewage facilities construction projects.

The City of Madisonville has published Standard Construction Detail Drawings as a companion document to the Standards Manual, entitled "The City of Madisonville Standard Details".

The City of Madisonville has established an ongoing review and updating process for the Standards Manual. Amendments will be forwarded to registered holders of copies of this document. Copies of this document may be purchased over the counter from the City of Madisonville or by mail from the City of Madisonville's Engineering Department.

City of Madisonville
Engineering Department
P.O. Box 700
900 McCoy Avenue
Madisonville, KY 42431

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CHAPTER 1
INTRODUCTION

1.1 MISSION STATEMENT

The City of Madisonville is committed to supplying the cleanest water and healthiest environment for the people of the City of Madisonville and Hopkins County service area. Further, the City will aid the advancement of local economic development by providing these services at the most prudent cost.

1.2 PURPOSE OF THE STANDARDS MANUAL

The Standards Manual is a guide for the planning, design, and construction of sanitary sewers, small sanitary pump stations, water distribution systems, and associated appurtenances for the City of Madisonville. These Standards shall govern and control the construction materials and methods used in the installation of water distribution systems and wastewater facilities that are, or will become the responsibility of the City of Madisonville, to operate and maintain as part of its system. The Standards Manual is intended to secure facilities of such quality, and design incorporated criteria, such that they will meet or exceed the requirements of the City of Madisonville, the Commonwealth of Kentucky's Natural Resources and Environmental Protection Cabinet, and other agencies exercising control. The Standards Manual is intended primarily for private Developers, Engineers, Surveyors, and Contractors wanting to construct water distribution systems and wastewater facilities within the City of Madisonville's service area. The guidelines and general procedures are as approved by the City of Madisonville.

This Manual:

A. Enumerates Standards written by the City of Madisonville and KRS 76 to facilitate the City of Madisonville's compliance with Local, State, and Federal Regulations.

B. Identifies submittal requirements and procedures for the review of infrastructure projects within the City of Madisonville service area.

C. Serves as a reference document for Developers, Professional Consultants and Contractors in the planning, design and construction of projects with the City of Madisonville's service area.

1.3 DESCRIPTION AND USE OF THE STANDARDS MANUAL

The Standards Manual identifies a single set of Standards, submittal requirements and approval procedures to be used in the planning, design, and construction of projects within the City of Madisonville's service area.

This Standards Manual is not intended to serve as a step-by-step design and construction

methodology nor can this manual address every situation that may arise. The application of sound engineering/surveying principles combined with the information contained herein are necessary to complete the planning, design, and construction for water and wastewater projects.

1.4 STRUCTURE OF THE STANDARDS MANUAL

The Standards Manual contains 12 Chapters. An index to Chapters is found at the beginning of the Standards Manual. To simplify use of the Standards Manual, a detailed table of contents can be found at the beginning of each Chapter.

The Manual is structured as follows:

A. Chapter 2 and 3 describe the City of Madisonville's general provisions and general planning information.

B. Chapters 4 through 7 detail the City of Madisonville Standards regarding drafting (manual and computer aided) Construction Drawings, Final Record Drawings, Surveying, and Easement Documents.

C. Chapter 8 describes general planning, design, and construction elements for wastewater systems within the City of Madisonville's service area.

D. Chapter 9 describes general planning, design, and construction elements for water distribution systems within the City of Madisonville's service area.

E. Chapter 10 describes detailed submittal, review, and approval procedures.

F. Chapter 11 describes general design elements for sewage pumping stations.

G. Chapter 12 describes construction materials and method's specifications.

1.5 UPDATES TO THE STANDARDS MANUAL

As design criteria and construction materials and methods evolve, the Standards Manual will require revisions and improvements. As changes are made, supplements, or revisions will be sent to registered holders of the Standards Manual. It will be each registered holders' responsibility to maintain a correct Standards Manual.

Comments and suggestions concerning the context and format are welcome from the users of the Manual. Comments and suggestions should be forwarded to:

City of Madisonville
Engineering Department
P.O. Box 705
900 McCoy Avenue
Madisonville, KY 42431

The City of Madisonville requests that all comments and suggestions be submitted in writing to ensure that the information is not misinterpreted.

1.6 RULES AND REGULATIONS FOR CUSTOMER SERVICE

1.6.1 APPLICATION FOR SERVICE

When a customer signs for service MMU will ask for the following information:

a. Your Name.
b. Location of the premises to be served.
c. Should the service request be new and/or on additional service, the applicant shall contact MMU Operations Center prior to making application.
d. Previous address, if any, of the party where MMU service was rendered.
e. Proper identification and Social Security Number.
f. Applicant must be at least 18 years of age.
g. A service contract may be required for commercial and industrial customers whose requirements are determined to have a significant impact on the ability to serve all customers.

All service agreements, except for short-term service, shall be for a term of five (5) years or longer unless permanently terminated by the customer. At the expiration of such term, unless the agreement contains a definite extension provision, the service agreement shall be automatically extended indefinitely until canceled by either party. Applications for temporary or short-term service shall be accepted when MMU has capacity available at the point of delivery and in accordance with the provisions of the applicable service schedule.

1.6.2 MEASURING WATER/SEWER SERVICE

For all Customers connected after March 1, 1966, the use of service at each point of delivery shall be metered separately. Whenever, for any reason, MMU furnishes two or more meter installations for a single customer, each point of metering shall be considered a separate service and be separately billed, including minimum service charges as outlined in the rate schedules.

1.6.3 RESALE OF WATER

Water service will only be offered to the ultimate consumer, except where such consumer is a temporary or transient occupant of an area normally held for rent as in hotels and motels. Water service shall not be re-metered, resold or shared by others nor shall it be extended outside the premises for service to other customers on or near the premises.

1.6.4 This provision does not apply to wholesale water and wastewater contracts with utility districts and other municipalities.

1.6.5 DEPOSIT

A deposit or suitable guarantee equal to twice the average monthly bill will be required of all commercial and industrial Customers and any residential Customer. Deposits form residential may be in the form of cash or letter of credit. In the case of Commercial or Industrial deposit shall be in the form of cash only.

The Utility may require any Customer to increase the deposit if the Customer's billing becomes delinquent. Upon termination of service, deposits, plus interest, may be applied against unpaid bills of Customer and if any balance remains after such application is made, said balance shall be refunded to Customer.

MMU may require a deposit or suitable guarantee equal to twice the average monthly bill of any other Customer before service is supplied upon the same terms and conditions as provided above.

A. Homeowners - Single Family Residence

1. MMU shall require from any customer or applicant for service a cash deposit to secure payment of bills except as noted below. The cash deposit shall be:

	Inside City	Outside
Deposit for Water	$ 20.00	$ 20.00
Sewer Customers	$ 30.00	$ 30.00

2. Any applicant requesting residential service who has been a customer of MMU for 18-months or longer may not be required to place a security deposit with MMU. The applicant must live at the location for which service is being requested.

B. Mobile Home, Rental Dwellings and Apartments

1. MMU shall require from any customer or applicant for service a cash deposit to secure payment of bills:

	Inside City	Outside
Deposit for Water	$ 20.00	$ 20.00
Sewer Customers	$ 30.00	$ 30.00

C. Non-Profit Organizations

1. MMU shall require from any non-profit organization applying for service a cash deposit to secure payment of bills:

	Inside City	Outside
Deposit for Water	$ 20.00	$ 20.00
Sewer Customers	$ 30.00	$ 30.00

D. All Other Customers

1. MMU shall require a cash deposit from all other customers or applicants for utility service(s) to secure payment of bills except as noted below:

	Inside City	Outside
Deposit for Water	$ 20.00	$ 20.00
Sewer Customers	$ 30.00	$ 30.00

2. MMU will also make special meter tests when requested by the customer. Upon receipt of payment for such test, MMU will schedule the metering facility for test. When an average error of more than two (2) percent fast is determined by a meter test, MMU will make a refund. Where the meter error average is more than two (2%) percent slow, the customer shall pay the difference. The billing adjustment will be made only for one-half (1/2) the period intervening since the last test, but in any case not to exceed twelve months. Where the amount due MMU is greater than the average monthly consumption, the customer will be given an equal time period to repay the un-metered portion. In case of special test any meter test shows the average registration of the meter to be in error more than two (2) percent fast, MMU will bear the cost of the test. If the amount of error is less than two (2) percent, the customer will be charged the applicable meter test fee.

   a. A fee of twenty-five dollars ($25.00) per test is hereby imposed for the testing of a 3/4" meter.
   b. A fee of seventy-five dollars ($75.00) per test is hereby imposed for the testing of all self-contained a 1" meter or greater.
   c. If it is determined by the City that the utility meter was malfunctioning, then there shall be a refund to the consumer of all amounts of money paid to the City for such test.

E. Transfer of Deposit

Deposits may be transferred from one location to another if the applicant is the owner of the home at the location for which service is being requested. However, if the amount already on deposit is not equal to the amount of deposit required at the time of the transfer, the homeowner must pay the difference between these two amounts. All other applicants will be required to pay the applicable security deposit in full each time an account is opened. When the previous account is terminated and all outstanding bills are paid, the previous security deposit will be returned.

F. Interest on Security Deposits

MMU shall accrue interest on all customer security deposits retained by MMU at interest rates as outlined in the Kentucky Revised Statutes. When an account is terminated and all outstanding bills are paid, the security deposit shall be returned along with any interest due to the customer.

1.6.6 REFUND OF SECURITY DEPOSIT AND INTEREST PAYMENT.

A deposit with applicable interest will be refunded by MMU to the customer upon termination of services to the customer's premises, or at an earlier date as selected by MMU. The utility may apply the deposit and the accrued interest to any amount owed by the customer at the time the deposit becomes refundable.

1.6.7 BILLING

Service bills will be rendered at regular intervals for all customers. MMU makes every effort to read each meter every twenty-eight (28) to thirty-two (32) days. When MMU is unable to read the meter after reasonable effort, the customer shall be billed for an estimated consumption based upon the best information available.

When closing an account where no billing demand is involved, bills may be rendered on the basis of estimated consumption. In the case of disconnects, no bill shall be rendered for less than the minimum charge set out in the rate.

Closing an account for service supplied for fractional billing period under rate schedules where a billing demand is involved, bills will be rendered on the basis of a thirty (30) day period prorated to the nearest whole tenth of a month.

Inquiries concerning charges for water/sewer services should be directed to MMU at 37 East Center Street, (270) 824-2102.

The due date for payment on all bills will not be less than fifteen (15) days after the date of the bill. Bills paid on or before the due date will be payable at the net amount. Payments made after the due date will be subject to a late payment charge. The late payment charge for all Customers will be ten (10%) percent of the balance of the unpaid portion of all monthly charges, excluding facilities rental, arrears and taxes. If the due date falls on Saturday, Sunday or any holiday which the Utility observes, the next business day following will become the due date. If remittance is made by mail, the date received by the MMU becomes the date of payment.

1.6.8 SERVICE CHARGES AND RECONNECTION CHARGES

The following charges will be applied by MMU to cover the cost of connecting or reconnecting a meter or service; see note 1 below:

	Description of Service	Charge
a.	New Connects - Connecting utility services at any location where services have been previously disconnected or where the billing account name and/or account number changes, except as noted below (during normal working hours)	$10.00

Note: In the event that a spouse wishes to do a name change only on a good credit account – no deposit required where there has been no change in location and no meter readings are required necessitating a service call, there will be no connection fee charged.

b. New Connect - Connecting utility services at any location where services have been previously disconnected and where the billing account name and/or account number changes, (after normal working hours). Minimum $40.00

c. Disconnecting and reconnecting utility services to any account due to non-payment (during normal working hours). Minimum $25.00

d. Disconnecting and reconnecting utility services to any account due to non-payment (after normal working hours). Minimum $50.00

e. Disconnecting and reconnecting utility services to any account that has been illegally reconnected by customer after the account was disconnected by MMU. In addition, all meter tampering charges shall apply, as contained elsewhere in MMU Policies and Procedures. Minimum.....$100.00

f. Any miscellaneous service call that requires dispatching an employee and pickup truck for the convenience of the customer (during normal working hours). Minimum $15.00

g. Any miscellaneous service call that requires dispatching an employee and pickup truck for the convenience of the customer (after normal working hours). Minimum $35.00

h. Processing fee for checks returned by the bank due to insufficient funds. When a check is returned to MMU by the Customer's bank, a twenty-dollar ($20.00) service charge will be applied. If a customer has three returned checks within a 6-month period, the Utility has the right to refuse any further personal checks from the customer for a 12-month period. If collection trips are made, a charge of fifteen dollars ($15.00) per trip will be applied also. Minimum..... $20.00

i. Trouble Calls - The Customer will pay twenty dollars ($20.00) during MMU's normal office hours and sixty dollars ($60.00) at other times for service calls to their premises providing the trouble proves to be in the facilities for which the customer is responsible. These charges will appear on the customers' next monthly billing. Minimum. ..... $20.00-$60.00

NOTES:

1. Any extra trips to the customers' premises imposed by the customer will result in additional fees for each trip.....$15.00

1.6.9 TEMPORARY SERVICE CHARGES

No temporary water/sewer services shall be installed.

1.6.10 NEW FACILITY CHARGES

All cost estimates for services and work to be performed will be calculated at MMU's rates for Labor, Equipment and Materials in effect at the time of such estimate. Should the services or work to be performed extend beyond thirty (30) days after the date of the cost estimate, such estimate will be billed at the prevailing rate at the time of the performance of work.

1.6.11 Reserved

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1.6.12 RECONNECTION CHARGE

When service is disconnected for nonpayment of a bill or any violation of these service regulations, MMU will require the customer to pay all costs of disconnection and

reconnection, but not less than the applicable reconnection fee of twenty-five dollars ($25.00) for meter disconnect. When a customer requests reconnection of service at the same location within twelve (12) months of disconnection of such service, the charge for reconnection shall be the applicable connection fee plus the applicable minimum bill provision for each month of the period involved or the actual reconnection charges, whichever is the greater amount. If service is connected after 4:00 P.M. or on a holiday, or during non-operating hours, the applicable after hours connection fee will apply. MMU will make every reasonable effort to reconnect said service within two (2) business days

Unless otherwise stated above, when service is initiated, the customer may be allowed a reasonable time (up to thirty (30) days) to meet any deficiency, before service is disconnected

1.6.13 MOVING OR RELOCATING MMU EQUIPMENT

Whenever MMU shall make changes in its equipment or facilities for the convenience of the customer or requesting party, the cost of the work shall be billed to and paid by the contractor, customer or other agreeable party. Upon receiving such request, MMU will render an estimate of the project cost. Should the applicant agree to proceed with the request they shall pay the cost estimate prior to commencement of work. Upon completion of the project, the customer/contractor will be invoiced actual cost. Should the estimated cost not cover the actual work performed by MMU, the applicant shall pay the balance due. Should the estimated cost exceed the actual expense incurred, MMU will refund the difference.

Only authorized MMU employees may remove facilities, cut service laterals, meters or handle facilities belonging to MMU.

1.6.14 COST CALCULATIONS

All cost estimates for services and work to be performed will be calculated at MMU's rates for Labor, Equipment and Materials in effect at the time of such estimate. Should the services or work to be performed extend beyond thirty (30) days after the date of the cost estimate, such estimate will be billed at the prevailing rate at the time of the performance of work.

1.6.15 NOTICE OF TROUBLE

MMU provides 24-hour emergency service in the event of service interruptions or other problems associated with the service rendered. The Customer should call MMU immediately if the problem is on the utility side of the demarcation point of service delivery (utility side of the metering). Customer shall notify MMU immediately should the service be unsatisfactory for any reason, or should there be any defects, trouble, or accidents affecting the supply of water or the collection of wastewater. Such notices, if verbal, should be confirmed in writing.

Customer Problem

The Customer will pay twenty dollars ($20.00) during MMU office hours and sixty dollars ($60.00) at other times for service calls to their premises if the trouble proves to be in the facilities for which the Customer is responsible.

Any condition on the customer's side of the meter, such as faulty piping, groundwater, faulty water-heater, faulty shutoff valves, etc., for which the customer shall check before calling MMU to investigate, are subject to billing. This charge will appear on the next monthly billing. Conditions that are found to be a problem at the meter will not be subject to charges, unless tampering is the cause.

1.7 WATER RATES SCHEDULE, METER MINIMUM RATE, FIRE PROTECTION, WASTEWATER SERVICE FEES

The City of Madisonville publishes a document identifying current schedules and fees associated with service to customers within the City of Madisonville's service area. This document is available free of charge from the City of Madisonville's Utility Office.

1.8 Reserved

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1.9 SEWER USE ORDINANCE. (Chapters 52.34 of the City of Madisonville Code of Ordinances, including adopted regulations)

The City of Madisonville has established ordinances dictating rules and regulations applicable to the trade of plumbing, regulating the installation and use of plumbing connections and fixtures, regulating the use of public and private sewer and drains, private sewage disposal, the installation and connection of building sewers, and the discharge of water and waste into the public sewer system. This includes wastewater pretreatment program administration, industrial discharge limits, surcharge rates and formula, enforcement of pretreatment and sewer use regulations and penalties for violation thereof.

Developers are encouraged to familiarize themselves with applicable sections of these ordinances they relate to the development of property within the City of Madisonville's

service area.

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General Information

Chapter 2
General Information

2.1 PURPOSE

This chapter:

A. Provides an overview of the City of Madisonville's planning, design, and construction approach relating to water and wastewater facilities and their related appurtenances.

B. Defines an overview of the City of Madisonville's process for the submittal, review, and approval of Construction Documents for water and wastewater facilities.

C. Defines information relating to area utility coordination.

D. Provides direction relating to the development of water and wastewater projects within the City of Madisonville's service area.

2.2 DEFINITIONS

A complete listing of definitions used in this document is found in Appendix A.

2.3 STANDARD PROCEDURE

If the Developer elects to perform the construction of water and/or wastewater facilities within and adjacent to his development, as required to connect to the City of Madisonville's existing water and/or wastewater facilities, the following is to be provided by the Developer:

A. The Developer must obtain Kentucky Division of Water approval of Plans and Specifications for construction of water and wastewater facilities.

B. Employ a Registered Professional Engineer, experienced in water and wastewater engineering, to prepare Construction Plans for the proposed work, and submit the Construction Plans to the City of Madisonville for its review and approval. The Construction Plans to be submitted shall be prepared according to this manual. If a sanitary sewage pumping station is required to serve the development, complete technical specifications (design calculations, Shop Drawings, Control Drawings, and Operation and Maintenance Instructions) must be submitted to the City of Madisonville for review and approval. The Professional Engineer shall be employed throughout the duration of the project to provide on-site construction inspection to certify that all construction materials and methods are furnished and installed according to the approved Construction Plans and Specifications. The City of Madisonville will provide periodic on-site construction inspection during the construction phase of the project and report inconsistencies to the Professional Engineer and Developer. This periodic inspection will be in no way relieving the Professional Engineer of his responsibility for construction inspection/observation on

the project.

C. Employ an experienced Utility Contractor to perform the necessary construction work. The Contractor shall employ during its progress, a competent superintendent and any necessary assistants, all satisfactory to the City of Madisonville. Equipment and tools shall be of adequate size and in proper condition to perform the work.

D. The Developer shall make written application to the City of Madisonville; if the Developer is requesting that the City of Madisonville perform any part of the construction involved in the development of the project. The Developer shall be responsible for the cost of all construction materials involved in the installation of the proposed water distribution system. This material cost shall include all onsite improvements necessary to provide adequate flow and pressure to the development.

2.4 DESIGN APPROACH / DESIGN CRITERIA

Proposed construction or expansion of water and wastewater facilities within the City of Madisonville's service area shall be in compliance with the approved City of Madisonville's 201 Facilities Plan, the Recommended Standards for Wastewater Facilities (commonly referenced as the Ten State Standards), the Recommended Standards for Water Works (commonly referenced as the Ten State Standards), the Sewer Use Ordinance, the Kentucky Administrative Regulations, and guidelines defined in this Standards Manual. Any person, company, corporation, or other entity proposing to develop land, or proposing to install new or replacement water and wastewater facilities within the City of Madisonville service area must prepare, for review and approval by the City of Madisonville, Planning and Design Documents according to the standards and requirements of this Manual. Planning and Construction Documents must be prepared and certified by a Professional Engineer, registered in the Commonwealth of Kentucky and authorized to transact business within the Commonwealth of Kentucky. The service level of proposed facilities shall be according to standards referenced in these documents. Design Standards shall be those referenced herein.

2.5 SUBMITTAL REQUIREMENTS

The Engineer may submit to the City of Madisonville for its review and comment, a concept plan (a preliminary water and sewer plan) to aid the Engineer in preparation of the Final Construction Plans.

All Construction Documents, excluding preliminary water and sewer plans, prepared for the City of Madisonville's review and approval must be signed and sealed by a Professional Engineer and/or Registered Land Surveyor (as appropriate), currently registered in the Commonwealth of Kentucky.

2.6 UTILITIES/AGENCIES COORDINATION

The Engineer shall coordinate the design of all water and wastewater facilities improvements with all Utility Companies and/or appropriate agencies actively involved in the provision of service in Hopkins County. Final Construction Plans shall accurately reflect the location of

all existing and proposed utilities.

The City of Madisonville should be copied on all correspondence with other utilities and agencies. A sample listing of contact persons and respective agencies is listed in Exhibit 2-1.

2.7 DEVELOPMENT RELATED FEES

The City of Madisonville performs design review, construction observation, and other development related activities at no cost to the Developer. However, the Commonwealth of Kentucky's Natural Resources and Environmental Protection Cabinet charges a review fee for Construction Documents. Developers should contact the Division of Water for fee assignments.

2.8 SECOND HAND AND SALVAGED MATERIALS

The use of second hand or salvaged materials will not be permitted unless authorized by the City of Madisonville.

All materials and/or equipment specified to be salvaged from existing structures shall remain the property of the City of Madisonville. Such materials and/or equipment shall be delivered by the Contractor and stored on sites as directed by the City of Madisonville.

2.9 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

Shop Drawings are diagrams, schedules, and other data specifically prepared for the work by the Contractor or any manufacturer, supplier, or distributor to illustrate some portion of the work. Product data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor to illustrate a material, product, or system for some portion of the work: samples are physical examples that illustrate materials, equipment, or construction and establish standards by which the work shall be judged.

Before any construction begins, the Engineer shall review and approve: all Shop Drawings, product data, and samples of construction materials to be used on the project, unless the materials are purchased by the City of Madisonville. The Engineer shall determine and verify that all materials, field measurements, and field construction criteria related thereto, are in conformance with the design criteria and construction materials specifications referenced in this Standard's Manual.

The Engineer's review is for conformance with the requirements of the Construction Documents. The Engineer shall not be relieved of responsibility for any deviation from the requirements of the Construction Documents by the Engineer's approval of the Shop Drawings unless the Engineer has specifically informed the City of Madisonville, in writing, of such deviation at the time of submission and the City of Madisonville has given written approval of the specific deviation.

The Contractor shall maintain "Approved" copies of all Shop Drawings, bearing the approval

of the Engineer, on the job site at all times.

Two copies of all approved Shop Drawings, product data and samples shall be submitted to the City of Madisonville before construction is to begin.

2.10 PERMITS AND REGULATIONS

Encroachment permits, easements, and licenses necessary for the prosecution of the work, shall be secured and paid for by the Developer. The Developer shall provide the City of Madisonville copies of all permits, easements, and licenses before construction. The Developer, Engineer, and Contractor shall give all notices and comply with all laws, ordinances, rules and regulations bearing on the conduct of the work, as drawn and specified.

2.11 INSURANCE REQUIREMENTS

The Contractor shall not commence work until he has obtained all insurance required under this section and such insurance has been reviewed and approved by the Engineer, nor shall the Contractor allow any Sub contractor to commence work on his Sub contract until all similar insurance required of the Sub contractor has been so obtained and approved by the Engineer.

The minimum amounts of insurance coverage to be furnished by the Contractor for all work performed are:

A.	Workers' Compensation	Statutory
	Employer's Liability	$100,000
B.	Comprehensive General Liability Including Coverage for the Explosion, Collapse, and Underground Hazards, Contractual Liability, Products and/or Completed Operations, Personal Injury (Employment exclusion waived), Broad Form Property Damage (No deductible clauses are acceptable for these coverage's), and Independent Contractors (Sub contractors)	
	Bodily Injury Liability	$500,000 each occurrence
	Personal Injury Liability	$500,000 each occurrence
	Property Damage Liability	$100,000 each occurrence
		$300,000 each policy period
C.	Comprehensive Automobile Liability, Including Hired Car and Employer's Non-ownership Liability Coverage	
	Bodily Injury Liability	$200,000 each person
		$500.000 each occurrence
	Property Damage Liability	$100,000 each occurrence
D.	All Risk Type Builder's Risk or	

	Installation Floater	100% of construction cost
E.	Railroad Protective Insurance	
	Bodily Injury	As required by railroad
	Property Damage	As required by railroad
F.	Umbrella Excess Liability	$2,000,000 each occurrence
G.	Owners Protective Liability	
	Owner to be named insured (No deductible)	
	Bodily Injury	$500,000 each occurrence
	Personal Injury	$500,000 each occurrence
	Property Damage	$250,000 each occurrence

The City of Madisonville must be provided with 30-days advance written notice of cancellation or any material change. Notice shall be provided to the City of Madisonville and the Engineer.

2.12 CONTRACTOR'S GUARANTEE AND UNDERSTANDING

All work that has been rejected shall be repaired. If it cannot be repaired satisfactorily, it shall be removed and replaced at the Contractor's expense. Defective materials shall be immediately removed from the site of the work. Work done without line and grade having been given, work done beyond the lines or not in conformity with the grades shown on the plans or as given, same as herein provided, work done without written authority and prior agreement in writing as to process, shall be done at the Contractor's risk and shall be considered unauthorized and, at the option of the Engineer and the City of Madisonville, may be ordered removed at the Contractor's expense.

2.13 COMPLIANCE WITH LAWS

The Developer, Engineer, and the Contractor shall fully comply with all Local, State, and Federal laws, including all codes, ordinances, and regulations applicable to the work. The Developer shall secure and pay for all permits and licenses necessary for the execution of the work and shall fully comply with all their terms and conditions.

2.14 PROTECTION OF WORK AND OF PERSONS AND PROPERTY

During performance and up to the date of Final Acceptance, the Contractor shall be under the absolute obligation to protect the finished work against any damage, loss, or injury. All risk of loss or damage to the work shall be borne solely by the Contractor until completion and acceptance of all work by the Engineer and the City of Madisonville, as evidenced by the City of Madisonville's issuance of a Letter of Acceptance.

The Contractor shall have the full responsibility to provide and maintain all warning devices and take all precautionary measures required by law or otherwise to protect persons and property while said persons or property are approaching, leaving, or within the work site or

any area adjacent to the work site. Minimum standards for safeguarding pedestrian and vehicular traffic are contained in the "Manual of Uniform Traffic Control Devices," Federal Highway Administration of the U.S. Department of Transportation, and the "Kentucky Manual of Uniform Traffic Control Devices," Kentucky Transportation Cabinet.

The Contractor shall be responsible for complying with State Laws and Federal Regulations relating to trench safety.

2.15 MATERIALS AND WORKMANSHIP; WARRANTIES AND GUARANTEES

The work shall be performed according to the best modern practice with materials and construction of the required quality and suitable for the purpose. The Engineer and the City of Madisonville shall judge and determine the Contractor's compliance with these requirements.

The Contractor shall promptly correct or replace all work rejected by the Engineer or the City of Madisonville as defective or as failing to conform to the Construction Documents, whether observed before or after substantial completion, and whether or not fabricated, installed, or completed.

If within one (1) year of Final Acceptance by the City of Madisonville, as evidenced by the Final Certificate of Acceptance or within such longer or shorter period as may be prescribed by law or by the terms of any other applicable special warranty on designed equipment or portions of work as required by the Construction Documents, the Contractor shall correct it promptly after receipt of a written notice from the Engineer to do so. The City of Madisonville shall give notice promptly after discovery of such condition. The Contractor shall remove from the site all portions of the work that are defective or nonconforming which have not been corrected unless removal is waived in writing by the City of Madisonville.

2.16 SUBSTITUTIONS

Whenever materials or equipment is specified or described in the Standards Manual by using the name of a proprietary item, or the name of a particular supplier, the naming of the item is to be intended to establish the type, function and quality desired. Unless the name is followed by words indicating that no substitution is permitted, materials and equipment of other suppliers may be accepted by the City of Madisonville if sufficient information is submitted by the Engineer to determine that the material or equipment proposed is equivalent or equal to that named. Request for review of substitute items or material and equipment will not be accepted by the City of Madisonville from anyone other than the Engineer. If the Engineer wishes to furnish or use a substitute item of material or equipment, the Engineer shall make written application to the City of Madisonville for acceptance thereof, certifying that the proposed substitute will perform adequately the functions and achieve the results called for by the general design, be similar and of equal substance to that specified and be suited to the same use as that specified.

The City of Madisonville will be the sole judge of acceptability, and no substitute will be ordered, installed, or used without the City of Madisonville's prior written acceptance.

2.17 INSPECTION AND TESTING OF MATERIALS

The Contractor shall furnish the Engineer and the City of Madisonville with every reasonable facility for ascertaining whether or not the work performed was according to the requirements and intent of the Construction Documents. Any work done or materials used without suitable inspection by the Engineer and the City of Madisonville may be ordered removed and replaced at the Contractor's expense.

The Engineer shall be responsible for all inspections of the progress of the work. The Engineer and the City of Madisonville shall make Final Inspection of all work included in the Construction Documents, and provisions provided in the Division of Water approval letter when practicable after the work is completed and ready for acceptance. If the work is not acceptable to the City of Madisonville at the time of such inspection, the City of Madisonville shall inform the Engineer as to the particular defects to be remedied before Final Acceptance shall be made.

When the project is completed, the Engineer shall submit a written certification to the Division of Water that the project has been constructed and tested according to the approved Construction Plans and Specifications, and the provisions listed in the Division of Water approval letter. The certification must be sealed, signed, and dated by a Professional Engineer licensed in the Commonwealth of Kentucky. One (1) original copy of the certification shall be submitted to the City of Madisonville.

2.18 SURVEYS / LAYOUT OF WORK

The layout of the work shall be the responsibility of the Engineer and shall be subject to checking by the City of Madisonville. The Engineer shall establish base lines and a system of bench levels (Tied to USGS Datum) for the Contractors use as required.

A. Sanitary Sewer Lines

The Engineer shall mark the locations of all manholes on the ground. The Engineer shall set all line and grade stakes for all gravity sewers, offset from the centerline of the trench. The Engineer shall also prepare Cut Sheets according to Chapter 12. Two copies of the Cut Sheets shall be delivered to the City of Madisonville a minimum of 48- hours prior to trenching.

B. Water and Sewage Force Mains

Trench line stations will be set by the Engineer ahead of trenching. These stakes shall be installed at least each 100-feet of pipeline and at the locations of all pipeline accessories (valves, fire hydrants, fittings, etc.)

The Engineer shall have all property corners on the site clearly visible during construction of the work. If the Developer requests that the City of Madisonville install the water main and appurtenances within the development, the City of

Madisonville will be responsible for construction staking.

2.19 AUTHORITY OF THE ENGINEER

All work shall be performed in a competent manner, to the satisfaction of the Engineer and the City of Madisonville. The Engineer and the City of Madisonville shall decide all questions that arise as to the quality and acceptability of materials furnished, work performed, the manner of performance, rate of progress of the work, sequence of the construction, and interpretation of the plans. The Engineer and the City of Madisonville shall determine the amount and quality of work performed, materials furnished. Their decisions shall be final. The Engineer shall be responsible for certifying that the project has been constructed according to the approved Construction Document, and the provisions of the Division of Water's Approval letter(s). Deviations from the Division of Water's approved Construction Plans and Specifications shall be approved in writing by the City of Madisonville.

2.20 AUTHORITY OF THE CITY OF MADISONVILLE (Owner)

All work shall be performed in a competent manner and to the satisfaction of the City of Madisonville. The City of Madisonville shall provide periodic construction observations of the work in progress to insure that the work is being performed according to the Construction Documents and the provisions of the Division of Water approval letter(s). This observation shall not relieve the Engineer from his responsibility of inspecting the construction of the work.

2.21 SUPERVISION BY THE CONTRACTOR

The status of the Contractor is that of an independent Contractor under Kentucky Law and the work shall be under the direct charge and superintendence of the Contractor. Except where the Contractor is an individual and gives his personal superintendence to the work, the Contractor shall provide a competent Superintendent or General Supervisor on the work at all times during progress with full authority to act for him.

If the Superintendent or his General Supervisor should be or become unsatisfactory to the Engineer or the City of Madisonville, he shall be removed by the Contractor upon written direction of the Engineer or the City of Madisonville.

2.22 EMPLOYEES

The Contractor shall employ only competent, efficient employees and shall not use on the work any unfit person or one not skilled in the work assigned to him; and shall at all times maintain good order among his employees.

2.23 FINAL INSPECTION AND ACCEPTANCE

Whenever the improvements have been completely performed by the Contractor, the Contractor shall notify the Engineer and the City of Madisonville that the work is ready for Final Inspection. The Engineer and the City of Madisonville shall then make Final Inspection,

and if the work is satisfactory and according to the Construction Documents, the Engineer shall provide written certification to the Kentucky NREPC that the project has been constructed in accordance with the approved Construction Plans and Specifications.

2.24 CORRECTION OF WORK

If required by the Engineer or the City of Madisonville, the Contractor shall promptly either correct defective work, whether or not fabricated, installed or completed, or if the Engineer or the City of Madisonville has rejected the work, remove it from the site and replace it with non-defective work.

The Contractor shall bear all direct, indirect, and consequential costs of such correction or removal made necessary hereby.

2.25 FINAL RECORD DRAWINGS

Final Record Drawings, also known as "As-Built Drawings," shall be submitted by the Engineer before issuance of the "Letter of Acceptance" by the City of Madisonville. These Final Record Drawings shall be prepared to ensure that all proposed water and sanitary sewer plans correctly depict the facilities as constructed. Chapter 5 of this manual describes the preparation and submittal of the Final Record Drawings in detail. Note that Final Record Drawings shall be submitted in digital and paper format.

2.26 THE CITY OF MADISONVILLE'S SERVICE AREA

The geographic boundary of the City of Madisonville's service area is illustrated on Exhibit 2-2.

2.27 THE CITY OF MADISONVILLE CONSTRUCTION PARTICIPATION

The Developer may request the City of Madisonville install the water system within developments. The City of Madisonville will only participate in the construction of water systems to be owned, operated, and maintained by the City of Madisonville. The Developer should notify the City of Madisonville during design review concerning a request for the City of Madisonville, construction participation on the project. Additionally, the Developer's Engineer shall remain responsible for the construction inspection and project certification. The acquisition of all easements, permits, rights-of-entry, and other construction documentation shall be the sole responsibility of the Developer.

The Developer shall be responsible for furnishing and installing all casing pipe required furnishing water service.

Prior to any construction participation by the City of Madisonville, the Developer's grading Contractor shall rough cut all rights-of-way and easements within the development to within 0.20-feet of final subgrade. The Developer shall be financially responsible for the relocation of any pipeline or related appurtenances due to revisions in the grading work on the project site.

If the City of Madisonville participates in the installation of the water systems, no claim against the City of Madisonville shall be made for trench settlement due to water system construction. The Developer shall be responsible for the compaction of trenches prior to the construction of drives and/or other structures along the route of the proposed improvements. The Developer will be responsible for the installation of all casing pipe and shall pay all material cost.

2.28 SEQUENCE OF CONSTRUCTION

If the Developer requests that the City of Madisonville install the water distribution system within the development, the Developer must sequence the construction of the other infrastructure to allow for the water distribution system construction to immediately follow the sanitary sewer collection system installation. The Developer shall not allow the installation of other underground utilities (storm drainage, electric, telephone, gas, cable) that may interfere with the water main construction. All rights-of-ways shall be rough cut to within 0.20-feet of subgrade as shown on the approved paving plans prior to installation of the water and wastewater systems.

If requested, the City of Madisonville will begin the installation of the water main and related appurtenances upon completion of the sanitary sewer system low-pressure air test. The work shall be placed on a priority list based on who successfully completes the sanitary sewer system tests first. The City of Madisonville will install water mains as time permits with the first responsibility to maintaining the existing distribution system.

No water service shall be provided by the City of Madisonville until the Engineer has issued the Engineering certification stating that the water and wastewater facilities have been constructed and tested in accordance with the Division of Water approved Construction Plans, specifications, and special provisions.

Kentucky Statutes (KRS 367.4901 through 367.4917) require that all excavators planning excavation or demolition work shall notify all utility companies in the area and/or an Underground Protection Service such as BUD at least two (2) working days before commencing work to alert Utility Companies in the area with underground facilities of the planned excavation or demolition activities.

Prior to commencing any work, the Contractor shall have available a list of local emergency contact names and telephone numbers for all utilities within the service area.

Kentucky BUD
Phone: 1-800-752-6007

The City of Madisonville
Engineering Department
900 McCoy Avenue
Madisonville, KY 42431
Phone (270) 824-2187
Fax: (270) 824-2188

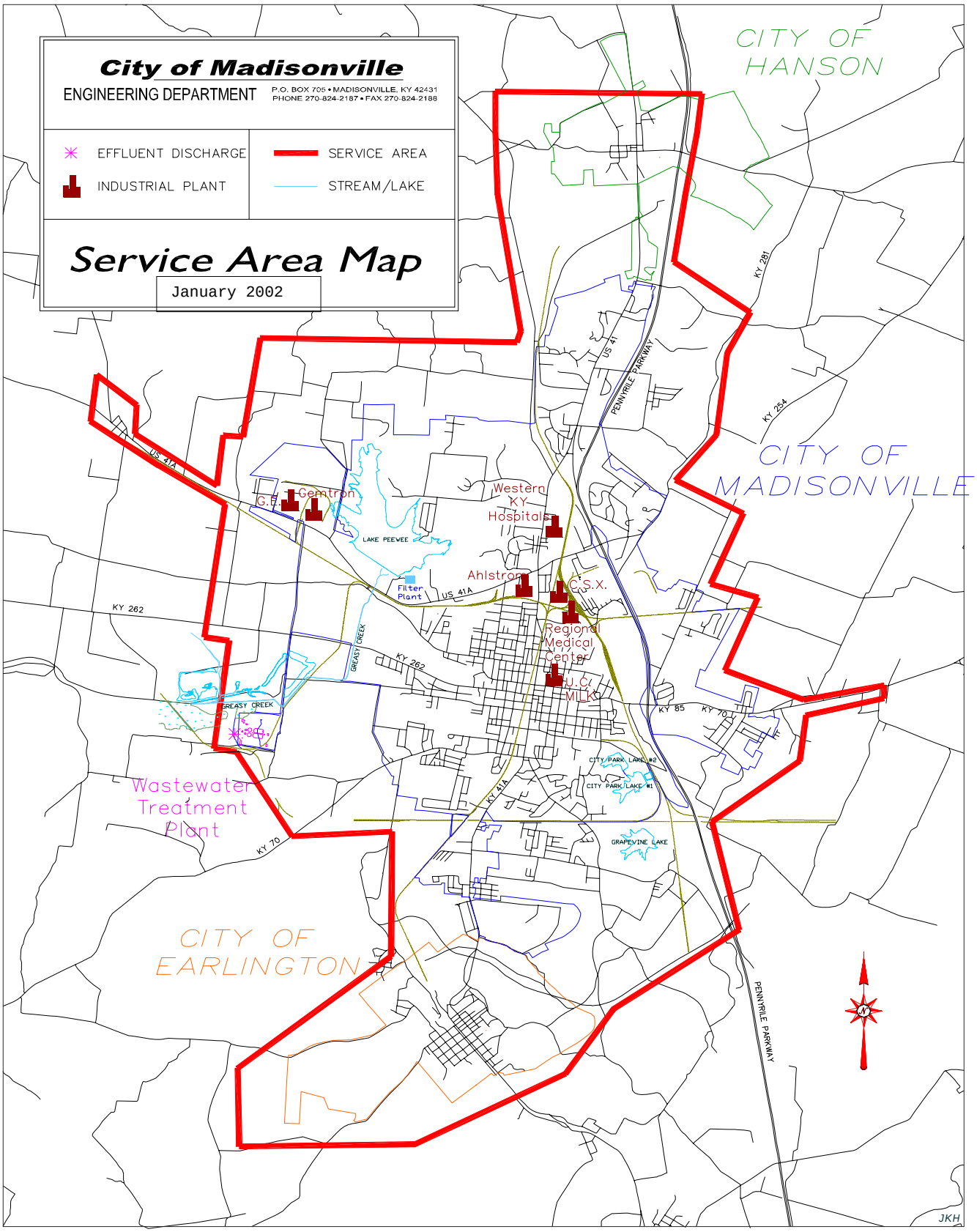
Madisonville Electric
(270) 824-2130

Madisonville Water Distribution
(270) 824-2140

Madisonville Wastewater Collection
(270) 824-3717

Bellsouth
Phone: 1-825-7800

Western Kentucky Gas
209 South Main Street
Hopkinsville, KY 42240
Phone: (270) 886-1244


City of Madisonville
ENGINEERING DEPARTMENT
P.O. BOX 705 • MADISONVILLE, KY 42431
PHONE 270-824-2187 • FAX 270-824-2188
EFFLUENT DISCHARGE
INDUSTRIAL PLANT
SERVICE AREA
STREAM/LAKE
Service Area Map
January 2002
CITY OF HANSON
CITY OF MADISONVILLE
CITY OF EARLINGTON
KY 281
US 41
PENNYRILE PARKWAY
KY 254
US 41A
G.E.
Gentron
Western KY Hospitals
LAKE PEEWEE
Filter Plant
Ahlstrom
C.S.X.
Regional Medical Center
U.C. MLK
KY 262
GREASY CREEK
KY 85
KY 70
CITY PARK LAKE #2
CITY PARK LAKE #1
KY 41A
GRAPEVINE LAKE
Wastewater Treatment Plant
JKH

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CHAPTER 3
General Planning Information

CHAPTER 3
GENERAL PLANNING INFORMATION

3.1 PURPOSE

This Chapter

A. Documents the City of Madisonville's philosophy for a regionalized (watershed) approach for the provisions of sanitary sewerage in the City of Madisonville's service area.

B. Identifies the source of planning and design information for development of sanitary sewerage and water infrastructure in the City of Madisonville's service area.

C. Identifies the goals of the Facilities Plan.

3.2 PLANNING APPROACH

The City of Madisonville's regionalized approach for the planning, design, construction, operation and maintenance of water and wastewater facilities are structured to ensure a level of service that protects the general health, safety and welfare of the citizens of the City of Madisonville' service area. The regionalized approach will further the City of Madisonville's efforts to satisfy Local, State and Federal Regulations as they relate to water quality.

The City of Madisonville's 201 Facilities Plan for Wastewater Treatment Works provides the framework for planning and design of sanitary sewerage facilities in the City of Madisonville's service area. A Sanitary Sewer Master Plan and a Water Master Plan will be prepared to provide the required technical information necessary for the regionalized planning and design of sanitary sewerage systems and water distribution systems in the City of Madisonville service area. Upon completion, these documents should be used by the Developers and Engineers for planning, and as reference documents for the development of water and wastewater facilities projects in the respective watersheds.

3.3 FACILITIES PLAN

The area 201 Facilities Plan for Wastewater Treatment Works was prepared to conform to the requirements of the Federal Water Pollution Control Act Amendments of 1972. A copy of the 201 Facilities Plan is available for reference at the City of Madisonville's Engineering Department.

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CHAPTER 4
Drafting Standards

CHAPTER 4
Drafting Standards

4.1 PURPOSE

This chapter establishes the Drafting Standards that must be followed by Developers, Engineers, and Land Surveyors for the development of Construction Plans and Record Drawings to ensure that all proposed water and wastewater facility Construction Plans are correctly depict the facilities to be constructed.

4.2 GENERAL

Construction Plans for water and wastewater facilities will be prepared in a neat and professional manner. All lettering and lines will be of a proper weight and well spaced to provide overall composition of the plans. It is very important that information be presented so that it will be returned to the Developer.

All final submittals of Construction Plans shall have the original Professional Engineer seal, signature, and date on each sheet. Plans submitted without the original seal, signature, and date will be returned to the Engineer.

4.3 DRAFTING MEDIA AND STANDARDS

A. Final Construction Plans will be on blackline or blueline drafting media, and will conform to the 24" X 36" dimension. Any drawing submitted with pencil will be returned for re-drafting.

B. Preliminary water and sanitary sewer plans may be prepared on photo-enlargements of aerial mosaics with ink used for clarity in presentation.

The City of Madisonville recommends a scale for Construction Plans of :

- 1" = 50' horizontal with vertical scale of 1" = 5'

  or
- 1" = 20' horizontal with vertical scale of 1" - 2'.

Sewage pumping station site plans will be provided with a site plan at a horizontal scale of 1" = 10'. Other scales may be allowed with prior approval of the City of Madisonville for the purpose of clarity. A graphic scale is required on all drawing sheets.

D. Plan Sheets shall have a standard Engineer's name and title block including a north arrow.

4.4 STANDARD AND TYPICAL DRAWINGS

4.4.1 DEFINITIONS

A. Standard Construction Details are prepared by the City of Madisonville and furnished for inclusion in all submittals of Construction Plans. These drawings are available from the City of Madisonville in digital format or on blackline paper at no charge to the Engineer. The City of Madisonville may add or revise the Standard Drawings at any time. These drawings are commonly called the "The City of Madisonville Standard Details."

The Engineer can modify the details to meet the specific needs of a particular project with the written approval of the City of Madisonville.

B. The Engineer will submit sheets within the set of Construction Plans under the following format.

Description of Sheet

Title Sheet
Copy of the Final (Record) Plat
Plan Index Sheet (Optional, this information can be included on the Title Sheet)
Plan Sheet(s)*
Profile Sheet(s)
Standard Construction Details
Special Details

*The City of Madisonville prefers that the Engineer use combination Plan/Profile Sheet for gravity sewer construction.

4.4.2 TITLE SHEET REQUIREMENTS

The following data will be shown on cover of the Construction Plans.

A. The name of project.
B. Plan Index.
C. Name and address of the Engineer.
D. Name and address of the Developer.
E. Project (vicinity) map.

4.4.3 COPY OF THE FINAL (RECORD) PLAT

A copy of the Final Plat shall be included in the Construction Plans. If the Final Plat has not been approved by the City of Madisonville/Hopkins County Planning Commission, the Engineer will include an approved copy of the Preliminary Plat in the Construction Plans. The Final Plat, when processed, must include all onsite easements required for the maintenance and operations of all water and wastewater facilities within the development.

4.4.4 PLAN INDEX SHEET REQUIREMENTS

A Plan Index Sheet will be prepared to identify the location of the work shown on each Plan and Profile Sheet. The Plan Index will include a reference to the location of the profile for the sewer lines on each Plan Sheet if the profile is on a separate Plan Sheet. For most projects, the Plan Index will be shown on the Project Map. If drawing space is restrictive, the Plan Index can be shown on the Vicinity Map Sheet.

4.4.5 SPECIAL DETAILS

Any proposed construction that is not covered in the City of Madisonville's Standard Details shall be shown on Special Detail Sheets prepared by the Engineer. Details will be shown on a Standard Plan Sheet and should clearly and accurately depict the proposed construction. Special pipe bedding and pumping station design are typical examples of items that might require Special Details.

4.4.6 TITLE BLOCK REQUIREMENTS

All sheets included in the Plans, except the Title Sheet, will contain a Title Block. Information in the Title Block should include the project title indicating sanitary sewer or water plans, what type of sheet and the specific information on the sheet.

4.5 PLAN AND PROFILE FORMAT

4.5.1 GENERAL CRITERIA

The Plan View of proposed sanitary sewer construction generally should be shown on the same sheet as the Profile with the Plan View at the top of the sheet and the Profile at the bottom of the sheet. Profiles will be required for all water mains 10-inch or larger in diameter.

No Profile is required for water construction if the main is less than 10-inch in diameter unless other utilities are expected to be within 18-inches of the water main. If drafting efficiency can be achieved, a Profile View may be shown on a different sheet than the Plan. In this case, the Plan Sheet and the Profile Sheet shall be cross-referenced. The entire Profile for each line will be shown on one sheet when possible. A Profile Sheet with Profiles for more than one Plan Sheet will be acceptable. Profiles shown on sheets separate from the Plan Views should follow the Plan Views in a logical order. The information that appears on both the Plan and Profile Views will include, but not be limited to, the following:

A. The location of a proposed manholes and cleanouts and all associate stations will be shown.

B. Lot numbers for all properties shall be shown and drawn parallel with the streets in the Plan View. House number for all existing homes and businesses shall be shown and drawn parallel with the streets in the Plan View.

C. All existing pipes, culverts, and appurtenances will be hatched.

D. The size and location of the following items will be shown:
   1. Stubs.
   2. Property Service Connections.

E. All existing pipes, culverts, conduits, and utilities of any nature crossing the proposed improvements location will be plotted and labeled in both the Plan and Profile.

F. If the length of a line causes a Plan or Profile to cover more than one sheet, a cross-reference will be shown on each sheet to identify the location of the attendant profile or Plan Sheet.

G. Match lines are acceptable in the Plan View with proper referencing station and attendant sheet number.

H. One hundred -foot stations will be shown.

4.5.2 PLAN VIEW

The information to appear in the Plan View will include, but not limited to, the following:

A. Locations of future connections.

B. The location of the centerline of pipelines and structures will be referenced by dimensions to the easement lines and to the appropriate property lines.

C. Benchmarks will be accurately plotted and labeled on the plans. A description and location of each benchmark, including its station and offset relative to the proposed line, will also be given. When a benchmark's location and description cannot be plotted with the plan coverage, a descriptive location and elevation shall be given on the plans in a location in close proximity to the reference marker.

D. Houses, fences and drives will be shown for a minimum of 50-feet beyond the right-of-way or to the fronts of the houses for lines in the rights-of-way. Trees, steps, walks, and other topographical features will be shown to the extent that they may be pertinent to the improvement location or construction. These items will be field located. Trees will be shown with a designation of size and description.

E. Property lines, lot lines, easement lines, and other boundary lines will be shown a minimum of 75-feet, beyond any proposed or existing right-of-way. In instances where additional information might be required, the limit will be extended.

F. Property service connections for sanitary sewers shall be shown 10-feet downstream of the midpoint of the lot if the lot is to be served toward the front building line. Property service connections for water services will be shown at the midpoint of the lot along the public right-of-way. If a specific location needs to be shown, an arrow will be added to the symbol indicating the desired location of the service and a note will be shown on the area indicating the station of the proposed property service

connection.

G. Generally, only the centerline of the pipe will be shown on the Plat View and the invert and crown lines of the pipe will be shown on the Profile. However, a thin centerline will be shown, within these outside lines where any of the following conditions exist:

1. A distance is shown from a point or line to the centerline of the pipe.
2. The delta angle is shown.
3. The angle of intersection is shown.

H. Existing ditches having a bottom width of four (4) feet or less will be indicated by drawing the centerline of the ditch. Ditches and channels having a bottom width greater than four (4) feet will be shown by drawing each side of the ditch and noting its width. Where ditch paving exists, the width of the paved area will be shown.

I. Existing and proposed sewers, their direction of flow and size including the location of all manholes. The Deed Book and Page Number will be shown for existing sewer easements affected by sewer construction.

J. Existing and proposed water mains and their size. The Deed Book and Page Number will be shown for existing Water Easements affected by water construction.

K. All gas, electric, telephone conduits, fiber optic cables, and any other underground or overhead utilities will be shown with the size or primary voltage and ownership identified.

L. Where sanitary sewers and water mains are to be in existing streets, the front dimension of each lot will be shown. When sanitary sewers and water mains are to be placed in easements and rights-of-way, property line dimensions adjacent to the proposed sewer construction will be shown.

M. Highways, street names, alleys, and major streams and ditches will be shown with the width and type of all surfaces will be indicated.

N. Street right-of-way widths will be shown adjacent to and after the street name.

O. The name of each sanitary sewer line will be noted (*e.g.*, Line "A"). The pipe size and direction of flow will be noted above the pipe between all manholes.

P. The general notes and legend of the standard symbols used throughout the Plans will be shown on the Plan Index Sheet or on the first Plan Sheet if the Plan Index is shown on the Title Sheet.

Q. Stations will be shown above each 100-foot station on 50-scale and 20-scale plans and above each 500-foot station on 100-scale plans. For example: 1+00, 5+00, etc., (water main and sewerage force main extension plans only).

4.5.3 PROFILE VIEW

In addition to those items in Section 4.4.2, the information to appear in the profile view will include, but not be limited to, the following:

A. The grid will be set up on a two (2) inch square basis. The vertical scale for 50-scale plans will be 1"=5' and for 20-scale plans will be 1"=2'.

B. The limits, by station, will be shown for all concrete caps, cradles, encasements, tunnels and bored segments.

C. When a line, in an easement, crosses a public right-of-way, the limits of the right-of-way, including its width will be shown.

D. The pipe size and grade will be indicated between manholes. This information will be parallel to and shown above the pipes. Grades will be shown as a percent, *e.g.*, 0.50%.

E. Invert elevations will be shown to the nearest hundredth of a foot and at the following locations:

1. All breaks in grade.
2. Breaks necessary for profile continuation onto another sheet.
3. Centerline of standard manholes with continuous grades.
4. Other conduits critical to the pipe gradient.
5. Intersecting pipe.
6. All locations necessary to substantiate the profile grade.
7. Both pipe invert edges where there is a drop or slant inlet.

F. Proposed manhole rims will be shown to the nearest tenth in earth areas and the hundredth in existing and proposed paved areas.

G. The water surface elevations of the 100-year flood areas will be shown.

H. The flow line of all ditches having impact on sewer depth of location that are deeper than one (1) foot will be plotted and labeled as a flowing of a ditch, left or right. On large channels, it may be necessary to show left and right tops of banks.

I. Existing ground profile including any proposed street grades or improvements will be shown.

J. Any underground telephone conduit, water main, gas lines, etc, will be shown when crossing the proposed City of Madisonville facilities.

4.5.4 GENERAL NOTES

General Notes are notes common to the complete set of plans and will be shown on the first Plan Sheet, if space permits, or title sheet, if necessary. The type of backfill, pipe material, and classification may be shown in the general notes if most of the pipes on a particular project have these items in common. The City of Madisonville will provide a listing of general notes commonly used on City of Madisonville projects, at the Engineer's request.

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CHAPTER 5
Final Record Drawings

CHAPTER 5
Final Record Drawings

5.1 PURPOSE

This chapter establishes the procedures that must be followed by Developers, Engineers, and Land Surveyors concerning the preparation of Final Record Drawings to ensure that all proposed water and wastewater facilities Construction Plans correctly depict the facilities as constructed.

5.2 GENERAL

A record of all deviations from the Construction Plans shall be made by the Engineer who shall, upon completion of the project, generate Final Record Drawings. Final Record Drawings are generated by revising the original design information and adding the corrected data. Therefore, the Final Record Drawings will depict the constructed information.

The Engineer shall submit two (2) blackline or blueline copies of the Final Record Drawings and one (1) complete set in digital format. Digital files shall be submitted in the AutoDesk AutoCAD .dwg format.

5.3 PROCESS

Certification to the Natural Resources and Environmental Protection Cabinet by the Engineer will notify the Developer that a particular project is ready for Final Record Drawings. The completed Final Record Drawings shall be submitted to and reviewed by the City of Madisonville's Engineering Department for verification of information. The plans are either accepted as Final Record Drawings or rejected and the above process is repeated. Final Record Drawings shall be approved by the City of Madisonville before the City of Madisonville will release the Letter of Credit issued to the City of Madisonville/Hopkins County Planning Commission.

5.4 DRAWING INFORMATION

The drawings shall depict the Engineers' verification of the horizontal and vertical locations of the water and wastewater system. This information should be used by the Engineer in preparing the Final Record Drawings. Each drawing shall have the following statement affixed in the lower right-hand corner of each sheet:

> "I hereby certify that these Construction Drawings represent a true and accurate depiction of the As-Built conditions."

The Engineer shall place a Professional Engineering seal on each sheet including signature and date.

5.5 CONSTRUCTION PLANS

The following construction items, at a minimum, should be reviewed and verified to produce the “Final Record Drawings”.

5.5.1 ALIGNMENT CHANGES

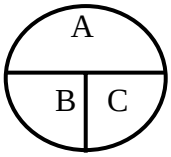
5.5.1.1 CHANGES IN STATION ON:

A. Manholes

B. Clean outs

C. Property Service Connections

1. Property Service Connections for sanitary sewer laterals shall be shown as follows:



Whereas:

A = The horizontal distance from the center of the wye or tee to the center of the downstream manhole.

B = The horizontal distance from the center of the wye or tee to the end of the lateral.

C = The vertical distance from the top of the ground to the top of the lateral at the plug.

D. Fittings

E. Valves

F. Fire Hydrants

5.5.1.2 CHANGES IN ELEVATION FOR:

A. Inverts (to the nearest hundredth).

B. Manhole covers (to the nearest tenth).

C. Flow Lines.

D. Structures.

5.5.2 CHANGES IN STRUCTURES

A. All revisions in pipe sizes, lengths, slopes, and angles.

B. Changes in offset distances of structures.

C. For Pump Stations:

1. All revisions in pipe sizes.
2. All revisions to electrical controls.
3. All revisions to ventilation systems.
4. Pump modifications.
5. Changes in elevation for inverts and level controls.
6. Equipment layout modifications.
7 Building modifications.

5.5.3 GENERAL

A. The Engineer shall stamp and sign **ALL SHEETS** of the Final Record Drawings.

B. Any unverified data shall show +/- thereby indicating that information has not been verified.

C. The Engineer shall affix a note on each sheet identifying the drawings as “Final Record Drawings”.

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Surveying

CHAPTER 6
Surveying

6.1 PURPOSE

Private development projects requiring the City of Madisonville approval and/or acceptance of constructed facilities should follow these guidelines. Engineers, Surveyors, and Field Survey Party Chiefs should familiarize themselves with this and all other Chapters of this Standards Manual before the start-up of any field survey effort. Familiarity with this Manual will enable the Field Survey Party to obtain the necessary field information for design and construction and reduce the occurrence of improper activities.

6.2 GENERAL

6.2.1 CONDUCT

These members of the Survey Party are normally the first representatives of a firm or organization to contact the property owner or residents along the route of the proposed improvement. It is imperative, therefore, that the Survey Party conducts themselves properly, both on the project and in the surrounding community.

6.2.2 RIGHT OF ENTRY

When the survey work will obviously require entry onto private property, the owner shall be contacted, the survey work described, and permission to enter obtained.

6.3 HORIZONTAL AND VERTICAL CONTROL

6.3.1 GENERAL

Trees are not to be used for surveying purposes except in remote areas where there is no practical alternative. No spikes, nails, etc., are to be driven into a tree except under the above-described circumstances. Trees will not be "blazed" under any circumstances, and only water-based paint may be used if marking a tree is necessary.

6.3.2 GUIDELINES

Horizontal and vertical control shall be established according to the guidelines defined by these publications:

A. A Professional Land Surveyor, licensed in the Commonwealth of Kentucky, must complete the surveying.

B. "Standards and Specifications for Geodetic Control Networks," Federal Geodetic Control Committee (FGCC).

C. "Horizontal Control," NOAA Technical Report NOS 88 NGS 19.

D. "Geodetic Leveling," NOAA Manual NOS NGS 3.

E. "Geometric Geodetic Accuracy Standards and Specifications Using GPS Relative Positioning Techniques" (or its subsequent revisions), FGCC.

F. All pertinent statutes, laws, and regulations.

6.3.3 DATUM

All control shall be related to existing monumentation approved by the City of Madisonville and must reference the appropriate datum as indicated below:

HORIZONTAL

All horizontal control points will be based on the North American Datum of 1983 (NAD-83). HARN State Plane Coordinates will be based on the Kentucky State Plane System (South Zone) in U.S. survey feet or as otherwise specified by the City of Madisonville.

VERTICAL

All control points will be referenced to the North American Datum, 1988 Adjustment in U.S. survey feet or as otherwise specified by the City of Madisonville.

6.3.4 BENCHMARKS

Project vertical control shall be referred to as "benchmarks." Benchmarks shall be established at a maximum interval of 800-feet and must maintain a minimum distance of 50-feet from the improvement centerline. Each benchmark should be placed to avoid movement caused by construction or other activities.

All benchmarks must conform to specification for quality Code "C", or better, as designated by NGS for preparation of NOAA Form 76-186. Sidewalks, steps (unless massive), small concrete slabs, and similar structures are not acceptable. Each project must contain at least one benchmark that conforms to NGS quality Code "B" specifications, as designated for preparation if NOAA Form 76-186.

6.3.5 LOCATION REFERENCE

All benchmarks are to be exactly defined and shall be referenced to the centerline of sewers by line designation, station and offset in addition to other field references such as lot numbers, addresses, etc., in plans and any other pertinent documents submitted.

6.4 DEGREE OF ACCURACY

6.4.1 GENERAL

The instruments used shall meet the specifications indicated in these guidelines or in

following sections. All instruments shall be certified to National Institute of Standards and Technology Standards and Manufacturers Specifications. Certification shall be performed by the previously mentioned institute, the instrument manufacturer or a certified instrument, repair facility.

6.4.2 ACCURACY CRITERIA

6.4.2.1 SANITARY INTERCEPTOR

Horizontal surveys shall adhere to Second Order, Class II Specifications, except that the error of closure after adjustment will equal or exceed 1:50,000.

Vertical control will adhere to Second Order, Class II Specifications.

6.4.2.2 SANITARY SEWER COLLECTOR AND WATER MAINS

Horizontal surveys shall adhere to Third Order, Class I Specifications, except that adjustments may be made by either the Least Squares or Compass Rule Method.

Vertical control shall adhere to Third Order Specifications, except that the error of closure will be equal to or exceed Second Order, Class II Requirements.

6.5 FIELD PROFILE AND TOPOGRAPHY

6.5.1 FIELD PROFILE REQUIREMENTS

Profile elevations shall be determined along sanitary sewer centerlines at 25-foot intervals, where possible, or at 50-foot intervals of paved streets, and at all necessary intermediate breaks. Profiles shall delineate existing structures, roads, streams, etc. Elevations shall be established to the nearest one-tenth of a foot on natural terrain and to one-hundredth of a foot on artificial surfaces. Profiles will not be established without an intermediate turning point between benchmarks.

Cross-sections shall be taken at critical locations when it is necessary to determine what effect open cuts or trenching might have on other facilities such as structures, utilities, pavements, fences, trees, or landscaping. Sufficient original ground elevations must be determined to establish the slopes necessary to serve the property adequately.

Roadside ditches within 30-feet and parallel to the sewer and greater than 1.5-feet in depth shall be shown in a Profile with the sewer. These ditches and other elevations critical to design and/or construction must be shown on the Plans.

6.5.2 TOPOGRAPHIC REQUIREMENTS

In addition to the topographic requirements established in Chapter 4, the following information shall be obtained in the field:

A. Topography generated from serial photography shall be identified and field checked for any errors or omissions. Omitted topography shall be located by field survey and appropriately recorded. This work is the specific responsibility of the Engineer and/or Land Surveyor. All topography within the project construction limits and/or easements and rights-of-way shall be field located.

6.6 SPECIAL SURVEYS

6.6.1 PROPERTY SURVEYS

Where the relationship of the improvements location and adjacent property line are critical, the location of existing property lines and other boundaries shall be established by a property survey sufficient to define the easement. All property surveys shall comply with the "Minimum Standards of Practice for Land Surveying in Kentucky," latest revision, as set forth and enforced by the Kentucky Revised Statutes. Property lines, boundary lines, easements, etc., shall be referenced by stations and offsets from the centerline or baseline to the nearest one-hundredth of the foot, by measurement of the angles at the PI with the centerline, and by other means of comparable accuracy. Surveys shall ascertain the names of owners, lessees or tenants, sources of title and date of acquisition and shall be verified from the appropriate Hopkins County records.

6.6.2 UTILITY SURVEYS

All publicly and privately-owned surface and subsurface utilities affected by the proposed improvement shall be located and identified by field survey and by use of maps supplied by the utilities. Locations, elevations, and other pertinent data as may be required for possible relocation or adjustment shall be secured for all such utilities to the limits of information currently available. Overhead power lines near the intended improvements alignment, or those that may be construction hazards should be shown on the plans using the proper symbol and labeled with their primary voltage.

6.6.3 RAILROAD AND HIGHWAY SURVEYS

When the centerline of improvements crosses a railroad or highway, all existing and proposed railroad tracks, roadways and affected structures shall be tied to the improvement's centerline. The topography shall be provided on either side of the proposed crossing to the extent required by the affected reviewing agency.

6.7 STAKING GRAVITY SANITARY SEWER LINES

The construction staking of the work shall be the responsibility of the Engineer. The Engineer shall establish a system of benchmarks for use during construction.

The Engineer will stake the centerline of all proposed manholes on the ground. The Engineer shall set line and grade stakes for all gravity sewers, offset from the centerline of the trench. The Engineer shall also prepare Cut Sheets showing the following:

1. Elevation of the offset stake (hub).
2. Depth of cut from the top of the offset stake (hub) to the invert of the sewer.
3. Elevation of invert of the sewer.
4. Offset distance from the stake (hub) to the centerline of the pipe.
5. Elevation of the existing ground over the sewer.
6. The depth of cut from the surface of the existing ground to the invert of the pipe.
7. Grade of the sewer.
8. Length of the sewer between manholes (center to center).

The Cut Sheets shall be prepared in at least three (3) copies on forms provided by the Engineer. The Engineer shall submit Final Cut Sheets to the City of Madisonville prior to construction.

Offset stakes will be set by the Engineer at 100-foot intervals if the Contractor uses laser alignment equipment to install the gravity sanitary sewer and 25-foot intervals if the Contractor uses batter boards to install the lines. In no case will Contractors be allowed to install a gravity sanitary sewer line without the use of either laser alignment equipment or batter boards.

6.8 STAKING WATER MAIN AND SANITARY SEWER FORCE MAIN

The construction staking of the work will be the responsibility of the Engineer and will be subject to checking by the City of Madisonville. The Engineer will stake the centerline on the proposed water main and/or sanitary sewer force main ahead of trenching. These stakes shall be set by the Engineer at least each 100-feet of pipeline and at the location of all pipeline accessories (valves, fittings, hydrants, etc).

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Easements

CHAPTER 7
Easements

7.1 PURPOSE

All water and wastewater facilities to be owned, operated, and maintained by the City of Madisonville shall be constructed in public rights-of-ways, permanent utility easements, or on the City of Madisonville owned properties. No approval will be given for construction or improvement of any water or wastewater facilities within the City of Madisonville service area without provision of suitable public right-of-way, permanent utility easement, or deed to the City of Madisonville. The Developer shall acquire and record all onsite and offsite easements for private development projects.

7.2 EXISTING EASEMENTS

Each existing easement to be used shall be shown on the Plans submitted for review and approval. The information shown on the Plans shall include the Deed Book and Page Number of the recorded instrument. All restrictive clauses as to the use of the easements; i.e., for utility purposes, drainage, sanitary sewers, etc., shall be noted on the Plan adjacent to the pertinent easement. Construction of sanitary sewers or water systems will not be permitted in existing exclusive gas, electric, or telephone easements unless a sanitary sewer and water easement is acquired overlapping the existing easement with prior approval of the City of Madisonville and the affected agency.

7.3 DEFINITIONS

The following terms define the methods under which the City of Madisonville currently acquires interest in property for the purpose of constructing, operating and maintaining water and wastewater facilities.

7.3.1 FEE SIMPLE TITLE

For construction major structures, the Developer shall be required to provide all rights to the required property in fee simple title with the City of Madisonville retaining permanent ownership. This generally refers to pumping station sites and pumping station access roads.

7.3.2 WATER AND/OR SANITARY SEWER EASEMENTS

For constructing facilities (water distribution systems, sanitary sewer systems, etc.), the Developer shall acquire the right to construct facilities within the limits of easements and to have reasonable ingress and egress over each affected property to the easements for construction, operation, maintenance and reconstruction.

These easements are permanent in nature and are referred to as water main, sanitary sewer, and utility easements.

The limits of water main, sanitary sewer, and utility easements shall be set around permanent structures. Existing or proposed structures shall not be located within an existing or proposed easement.

A property owner is restricted from constructing any facility within the limits of water main, sanitary sewer, and utility easements that might interfere with the maintenance, operation, or reconstruction of the facility.

7.4 EASEMENT WIDTHS

Minimum widths of water main and sanitary sewer main easements using trench construction methods are tabulated below, however, in no case will these guidelines be a substitute for sound engineering judgment.

Minimum Easement Width		
Size if Pipe	Sanitary Sewer	Water Main
6” through 12”	15’	15’
15” through 48”	20’	20’

The City of Madisonville reserves the right to request easement widths at greater widths than those described in the referenced table if (a) the pipeline is installed at depths exceeding 10-vertical feet, or (b) the City of Madisonville proposes possible future system extensions or improvements, or (c) other utilities are to be located within the easement.

Developer must provide a recorded plat showing each utility easement prior to construction of facilities.

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CHAPTER 8
SANITARY SEWER SYSTEMS

8.1 PURPOSE

This Chapter establishes the minimum standards and technical design criteria for sanitary sewer systems in the City of Madisonville's service area. Adherence to these will expedite review and approval of Plans. Any departure from these requirements should be brought to the attention of the City of Madisonville and discussed before the submission of Construction Plans for approval. Such departure shall be documented and justified.

8.2 BASIC ELEMENTS

The designs of sanitary sewer systems consist of the determination of the following elements:

A. The location of the horizontal alignment that most efficiently provides service to proposed users.

B. The vertical restrictions on establishing the sewer alignment including: depths required to serve users, minimum cover, elevation of other sewers in the system, conflicts with other underground facilities, and maintaining the required hydraulic gradients.

C. The design flows, generated by the future users, which must be transported by the sewer and the probable depths necessary to serve future users with a gravity system.

D. The size, material, bedding, and method of construction required.

E. The necessary appurtenances and special structures required.

8.3 GENERAL LOCATION CRITERIA

Sewers shall be located using sound engineering judgment to determine the most cost effective and environmentally sensitive alignment which best serves the needs of the entire tributary area. Additionally, it is imperative that all alternatives worthy of consideration receive maximum and equal consideration with regard to environmental impact.

When selecting the sewer alignment, consideration shall be given, but will not be limited to, the following general location criteria:

A. Elevation requirements necessary to provide appropriate service with due consideration of sanitary facilities, excluding basements.

B. Environmentally sensitive areas and constraints such as wetlands, creeks, drainage channels, trees, protected habitats, etc.

C. Existing or proposed utilities, railroads, highways, and overhead facilities.
D. Location of proposed or existing sewage and stormwater facilities.

E. Existing and proposed FEMA designated high water elevations, including high water for appropriate design.

F. Anticipated extension of existing streets and the potential for the development of contiguous areas.

G. Continuity with adjacent design segments.

8.4 HORIZONTAL ALIGNMENT CRITERIA

8.4.1 GENERAL

All gravity sewers shall be constructed with a straight alignment between manholes.

8.4.2 STRAIGHT STREETS

It is the recommended that sanitary sewers shall be located five (5) feet off the back of the curb on curbed streets and five (5) feet inside the right-of-way on streets without curbs, and on the opposite side of the street from the water main. Consideration of possible conflicts with proposed drainage features and other utilities shall be required so the sewer can be built without modification during or after construction.

8.4.3 CURVED STREETS

The manholes may be either within the pavement or completely outside the pavement, but will not be partially in the pavement. In all cases, the centerline of the manhole shall be a minimum distance of three (3) feet from the edge of the pavement, and a minimum distance of five (5) feet inside the street right-of-way.

8.4.4 STATIONING

All gravity sewer stations shall increase upstream. Every effort will be made to begin the stationing of a sewer with Station 10+00 at the downstream end. When an existing sewer is to be extended, the stationing should be continued from the end of the existing sewer whenever possible. The PI stations and deflection angles or interior angles shall be shown on the plans at all changes in alignment.

8.4.5 SEWER DESIGNATIONS

The designation of the first sewer in a collection system will be LINE “A”. The next sewer contributing to LINE “A” shall be designated LINE “B,” and the station of LINE “B” at this point shall be Station 10+00. This method will continue throughout the collection system and subsequent sewers shall be assigned appropriate designations by ascending letters. For very short segments not extending beyond one manhole, designation such as LINE “B-1" will be

allowed.

8.5 VERTICAL ALIGNMENT CRITERIA

8.5.1 SEWER DEPTHS

Gravity sewers shall have a minimum cover of 36-inches. Specific exemptions to these minimum requirements may be made with prior approval of the City of Madisonville.

In establishing the elevation of the proposed sanitary sewer, the elevation of existing or proposed interceptor sewers, and the elevations of inflow pipes to existing pump stations and all other utilities, shall be considered.

The top of sewers entering or crossing streams shall be at a sufficient depth below the natural bottom of the streambed to protect the sewer line. In general, the following other requirements shall be met:

A. One (1) foot of cover where the sewer is located in solid rock; and

B. Three (3) feet of cover in other material. In major streams, more than three (3) feet of cover may be required; and

C. In paved stream channels, the top of the sewer line should be placed one (1) foot below the bottom of the channel pavement.

Sewers entering or crossing streams shall be constructed of ductile iron with mechanical joints or encased in steel casing pipe in accordance with the Standard Details.

The sanitary sewer elevation necessary to serve the entire tributary area shall be considered in establishing the upstream flow line of any sanitary sewer segment including the area beyond the boundary of the development. Gravity sewer design shall allow for serving upstream properties, whether developed or undeveloped.

8.5.2 FLOODING AND PONDING AREAS

The top of sanitary manholes shall be constructed at or above the existing, proposed or projected 100-year high water elevations. However, when this minimum elevation causes the manhole to be above the natural ground creating obstructive mounds, the top of the manhole elevation will be lowered to the natural ground elevation and a watertight, manhole diaphragm shall be specified.

8.5.3 MINIMUM WATER MAIN CLEARANCES

The following minimum clearances between the sanitary sewer and existing or proposed water mains shall be used in establishing the sewer alignment.

8.5.3.1 HORIZONTAL CLEARANCE

Sewers shall be laid a minimum of 10-feet horizontally from any existing or proposed water main. The distance shall be measured from edge to edge. Where this is not possible, the Engineer should reference the "Ten State Standards" Section 38.31, Page 30-10.

8.5.3.2 VERTICAL CLEARANCE

The vertical clearance for sewers crossing water mains should be at least 18-inches. If possible, the sewer shall be located below the water main. The crossing shall be constructed such that the sewer joints are equidistant and as far as possible from the water main joints.

8.6 DESIGN FLOW

8.6.1 COLLECTOR SEWERS

Collector sewers are primarily installed to receive wastewater directly from property service connections. A major change in land use within a tributary area can have a significant impact on the collector system's ability to transport the necessary flow. Collector sewers should, therefore be designed to transport the saturation population flow that might be expected during their service life (flowing full).

8.7 HYDRAULIC DESIGN CRITERIA

8.7.1 GENERAL

In general, sewer capacities shall be designed for the entire drainage area and the estimated ultimate tributary population. No public gravity sewer conveying raw wastewater shall be less than eight (8) inches in diameter.

8.7.2 DRAINAGE AREA

Sanitary sewers and pumping stations shall be designed to serve the entire drainage area.

Wastewater flows shall be calculated using the best available information for the drainage area. The current proposed development, all known future developments, and allowances for undeveloped land must be included in the flow calculations. The maximum number of units allowed by current zoning shall be used for undeveloped areas.

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Allowances for undeveloped land must consider the current zoning of the land, possible future zoning changes, land-use planning documents, location of the land relative to the City of Madisonville corporate boundary, and any other relevant information as well as input from the City of Madisonville Engineering Department.

8.7.3 FLOW CALCULATIONS

In the absence of data to the contrary, sanitary sewers and pumping station capacity shall be determined by using the information provided in Table 8-1, Wastewater Flows and Table 8-2, Peaking Factors.

TABLE 8-1
WASTEWATER FLOWS

Development Type	**Design Flow Per Unit**	**Avg. Flow Rate Per Unit**
	gpd	gpm
Single Family	400	0.28
Duplex (2 units)	400	0.28
Condominiums	400	0.28
Private Estates	400	0.28
Townhouses & Apartments	400	0.28
Residential unit	400	0.28
	Gpd/acre	gpm/acre
Commercial	2,000	1.39
Industrial	3,600	2.50
Non-developable Land	100	0.07

Calculations shall also be provided showing the capacity of the existing sewer system to receive the projected flows. After obtaining the average flow rate from Table 8-1, a peaking factor shall be applied from Table 8-2 to obtain the design flow rate. Population estimates and flow calculations are subject to review and approval by the City of Madisonville.

TABLE 8-2
PEAKING FACTORS

Average Daily Flow Rate gpd	Average Daily Flow Rate Gpm	Tributary Population	Ratio Of Peak Instantaneous Flow Rate To Average Daily Flow Rate
<100,000	<69	<1,000	4.0
100,000-300,000	69-208	1,001-3,000	3.8
300,000-400,000	208-278	3,001-4,000	3.6
400,000-600,000	278-417	4,001-6,000	3.3
600,000-800,000	417-556	6,001-8,000	3.1
800,000-1,000,000	556-694	8,001-10,000	3.0
1,000,000-1,500,000	694-1,042	10,001-15,000	2.9
1,500,000-2,000,000	1,042-1,389	15,001-20,000	2.8
2,000,000-3,000,000	1,389-2,083	20,001-30,000	2.7
3,000,000-4,000,000	2,083-2,778	30,001-40,000	2.6
4,000,000-6,000,000	2,778-4,167	40,001-60,000	2.5
6,000,000-8,000,000	4,167-5,556	60,001-80,000	2.3
8,000,000-10,000,000	5,556-6,944	80,001-100,000	2.1
>10,000,000	>6,944	>100,000	2.0

8.7.4 RECOMMENDED MINIMUM SLOPES

The following are the minimum slopes, which should be provided; however, slopes greater than these are desirable.

Sewer Size	Minimum Slope in Feet per 100-Feet
8-inch	0.40
10-inch	0.28
12-inch	0.22
15-inch	0.15
18-inch	0.12
21-inch	0.10

Sewers on 20-percent slopes or greater shall be anchored securely with concrete or equal anchors.

8.7.5 VELOCITY

Gravity sewer lines and force mains shall be designed and constructed to give mean velocities, when flowing full, of not less that 2.0-feet per second. The roughness coefficient used in the Mannings and Kutters formula shall be 0.013. The "C" factor used in the Hazen-Williams formula shall be 100 for ductile iron pipe and 120 for PVC pipe.

The maximum allowable design velocity will be 15-feet per second based on the design flow. When severe topographic or other unusual conditions require a design velocity greater than 15-feet per second, the hydraulic design and pipe material must be specifically approved in writing by the City of Madisonville.

8.8 SEWER PIPE

PVC gravity sewer pipe shall be SDR35 and shall conform to ASTM D3034. For bury depths greater than 15-feet, heavy wall (SDR26) PVC pipe or ductile iron pipe is required. Sanitary force mains shall be SDR21 PVC (Class 200) or ductile, iron pipe (AWWA C150). Alternative pipe materials must have written approval of the City of Madisonville prior to installation. Refer to Section 12.17 for detailed pipe specifications.

8.9 MANHOLES

8.9.1 MANHOLE LOCATIONS

Manholes will be required at the following locations:

A. Changes in sewer grades or alignment.

B. Sewer junctions.

C. Where required, not to exceed the maximum manhole spacing.

D. Changes in sewer diameters.

E. Inspection/sampling manhole for Pretreatment candidates.

F. At each side of a stream or creek to allow for I/I evaluation.

8.9.2 MAXIMUM MANHOLE SPACING

Manhole shall be installed at distances not greater than 400-feet. Cleanout shall be used only for special conditions and shall not be substituted for manholes nor installed at the ends of laterals greater than 150-feet in length.

8.9.3 DIAMETER

The minimum inside diameter of manholes will be 48-inches. All manholes must be checked to ensure that sufficient wall is supplied between pipe openings to meet all precast manhole criteria.

8.9.4 WATER TIGHTNESS

Watertight manholes and covers are to be used whenever the manhole covers may be flooded by street runoff or anticipated high water. Each new manhole shall be tested for watertightness.

8.9.5 DROP INLETS

A drop pipe shall be provided for a sewer entering a manhole at an elevation of 24-inches above the manhole invert. Where the difference in elevation between the incoming sewer and the manhole invert in less than 24-inches, the invert shall be filleted to prevent solid deposition.

Drop manholes shall be constructed with an outside drop connection. Inside drop connections shall be allowed only with the written approval of the City of Madisonville. Inside drop connections (when necessary) shall be secured to the interior wall of the manhole with stainless steel straps and hardware and shall provide access for cleaning. Drop connections shall be constructed in accordance with Chapter 12 of this manual and the City of Madisonville's Standard Details.

8.9.6 MANHOLE FLOW CHANNELS

The flow channel straight through a manhole should be made to conform as closely as possible in shape, and slope to that of the connecting sewers. The channels should be formed and shaped three-fourths 3/4 of the full height of the crown of the outlet sewer and shall have a smooth, steel trowel finish. Bench walls should be sloped no less that one-half (1/2) inch per foot and no greater than one (1) inch per foot. No sewer, service lateral, or drop manhole pipe shall discharge onto the surface of the bench wall. There shall be a maximum of four of 8-inch manholes penetrations.

8.10 STUBS

Generally, stubs will be provided at the terminal manhole (upstream end) of all sewers. Stubs will be minimum eight (8) inch diameter, one (1) foot long measured from the outside of the manhole barrel according to the City of Madisonville's Standard Details.

8.11 PROPERTY SERVICE CONNECTIONS

A minimum slope of one-fourth (1/4) inch per foot (2.083%) for private laterals will be used for determining design elevations between the structure to be serviced and the City of Madisonville service connection to be provided at the right-of-way or easement line. However, in all cases, the invert elevation of the property service connection at the easement or property line will be equal to or higher than the crown of the sewer. A maximum slope of

45% will be used for property service connections with vertical stacks not allowed.

Service laterals to single-family houses shall be four (4) inch minimum diameter from a four (4) inch tee. If two or more residential units are connected to a common lateral, the line and tee shall be six (6) inch minimum diameter. For commercial or multi-family connections, the lateral shall be sized based on the number of units, but in no case shall it be less than six (6) inch diameter. Service laterals shall not be located in storm retention basins.

8.12 FLOATATION

All sewers and sewer structures to be constructed where high groundwater conditions exist or where flooding of the trench is anticipated will be designed to prevent floatation or excessive pipe flexing.

8.13 CONCRETE ENCASEMENTS

Concrete encasement will extend a minimum length of two (2) feet beyond the point where a 36-inch depth of cover is reached or to a point five (5) feet beyond the tops of banks when crossing a ditch or stream. Concrete encasements will be used when preventing floatation is necessary, when crossing streams, ditches, or existing storm drains, where soil conditions may indicate the possibility of heavy erosion, where crossing over or under utilities with less than 18-inches of clearance, or in areas where the sewer has less than the required cover.

Concrete encasement is required at stream crossings in non-erodible (rock bottom) channels where the depth of cover below the streambed is less than 30-inches. Refer to the City of Madisonville Standards Details for stream crossing requirements.

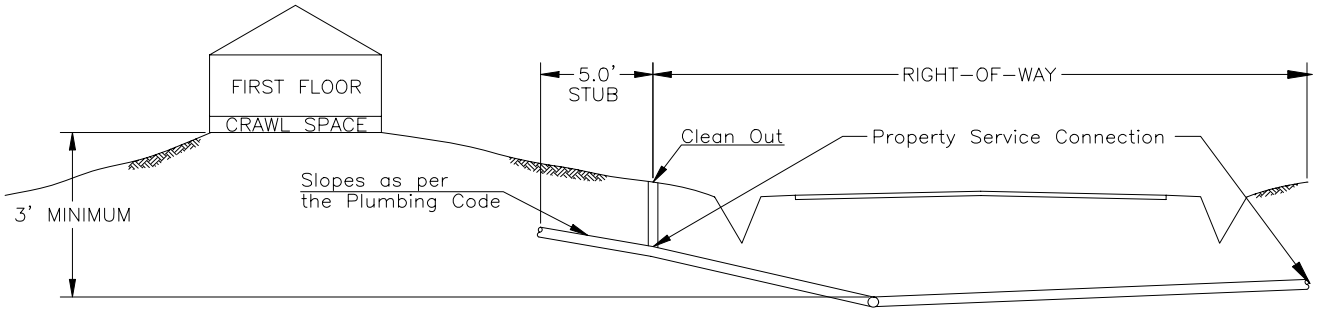
8.14 CASING PIPE

The following criteria will be followed whenever a casing pipe is used. Any deviation from these criteria will require prior approval from the City of Madisonville:

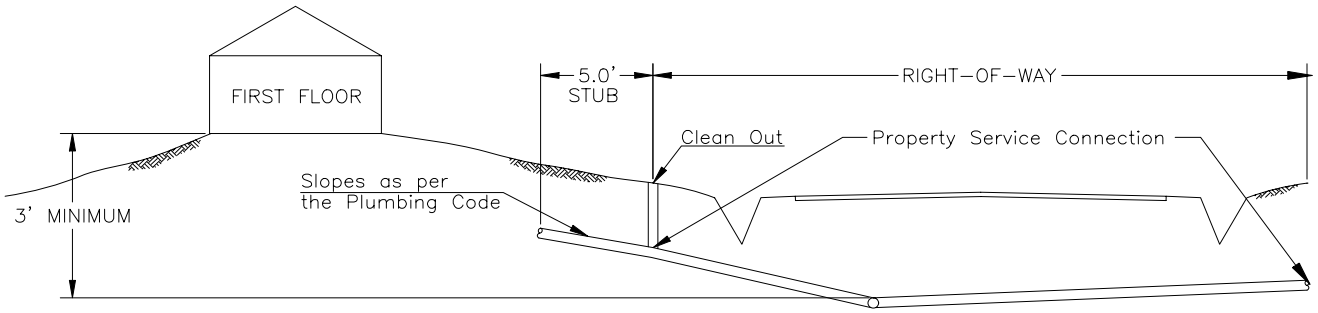
A. Steel casing pipe will be a minimum of 12-inches in diameter and have minimum yield strength of 35,000 p.s.i.

B. In boring excavation, the carrier pipe will be encased in a steel casing pipe of sufficient size to provide clearance for the proper installation of the sewer pipe. The inside diameter of the casing pipe will be at least four (4) inches greater than the largest outside diameter of the bell of the carrier pipe, joints, or couplings, thus providing a clearance of at least two (2) inches between the casing pipe and the carrier pipe.

Additional Specifications on casing pipe are found in Chapter 12.



HOUSE DRAIN THROUGH FIRST FLOOR CRAWL SPACE
The crown of the sewer shall be a minimum of 3' below the groung at the point of service outlet.



HOUSE DRAIN THROUGH FIRST FLOOR CRAWL SPACE
The crown of the shall be a minimum of 3' below the first floor elevation.

General Notes:

1. It is the City of Madisonville official policy that sanitary sewers shall be designed to serve only sanitary facilities on or above the first floor of any structure by gravity systems. The depth of the sewer main shall not be dictated by the possible installation of plumbing fixtures that may be installed in basement areas. The Individual homeowner or business owner will be responsible for any private sewer lift station that may be required for any basement fixtures. It is also possible that due to local topography, an entire structure may be required to install and operate a private sewer lift station.

2. Where roadside ditches occur, sewer laterals must be placed at an elevation such that the sewer lateral will have a minimum cover of 30-inches from the flow line of the

ditch to the top of sewer lateral.

3. In all cases, the invert of the sewer lateral at the property service connection at the right-of-way shall be equal to or higher than the crown of the gravity sewer main.

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CHAPTER 9
Water Distribution Systems

CHAPTER 9
Water Distribution Systems

9.1 PURPOSE

This chapter establishes the minimum standards and technical design criteria for water distribution systems in the City of Madisonville's service area. Adherence to these will expedite review and approval of plans. Any departure from these requirements should be brought to the attention of the City of Madisonville and discussed before the submission of plans for approval. Such departure shall be documented and justified.

9.2 BASIC ELEMENTS

The design of extensions to the water distribution system will consist of the determination of the following elements:

A. The location of the horizontal alignment that most efficiently provides service to proposed users.

B. The vertical restrictions on establishing the water alignment including; minimum cover, elevation of the existing and proposed sanitary sewer system, elevation of the existing or proposed storm drainage system, and conflicts with other underground facilities.

C. The size, material, bedding, and method of construction required.

D. The necessary appurtenances and special structures required.

9.3 GENERAL LOCATION CRITERIA

Water mains shall be located using sound engineering judgment to determine the most cost effective and environmentally sensitive alignment, which best serves, the needs of the development. Additionally, it is imperative that all alternatives worthy of consideration receive maximum and equal consideration regarding environmental impact.

When selecting the water main alignment, consideration shall be given, but shall not be limited to, the following general location criteria:

A. Environmentally sensitive areas and constraints such as wetlands, creeks, drainage channels, trees, protected habitants, etc.

B. Existing and proposed utilities, railroads, highways, and overhead facilities.

C. Location of existing and proposed sanitary sewage and stormwater facilities.

D. Existing and proposed high water elevations, including high water for appropriate

design.

E. Anticipated extension of existing streets and the potential for the development of contiguous areas.

F. Continuity with adjacent developments.

9.4 HORIZONTAL ALIGNMENT CRITERIA

9.4.1 GENERAL

All water mains will be constructed with a straight alignment when possible.

9.4.2 STREETS

Generally, water mains shall be located five (5) feet off the back of the curb on curbed streets and five (5) feet inside the right-of-way on streets without curbs, and on the opposite side of the street from the sanitary sewer line. Consideration of possible conflicts with other utilities shall be required so the water main can be built without modification during or after construction. Consideration shall be given to locating the water main on the high side of the street.

9.4.3 STATIONING

All water mains shall be stationed. Every effort shall be made to begin the stationing of a water main with Station 10+00 at the tie into the existing water main(s). The PI stations and deflection angles and other water main appurtenances shall be shown on the plans.

9.4.4 LINE DESIGNATIONS

The designation of the primary water main feed in a distribution system shall be LINE "A". A secondary leg originating from LINE "A" shall be designated LINE "B", and the station of LINE "B" at this point shall be Station 10+00. This method shall continue throughout the distribution system and subsequent water mains shall be assigned appropriate designations by ascending letters.

9.5 VERTICAL ALIGNMENT CRITERIA

9.5.1 WATER MAIN DEPTHS

Water mains will have a minimum cover of 36-inches. Specific exemptions to these minimum requirements may be made with prior approval by the City of Madisonville.

A minimum cover of 30-inches shall be maintained when crossing under erodible steams or drainage channels (existing or proposed). In non-erodible (rock bottom) channels, the water main shall have 12-inches of cover and shall be encased in concrete. Refer to the City of Madisonville Standard Details for stream crossing regiments.

Water mains shall be extended to the perimeters of the development to serve undeveloped areas and/or areas not presently served by the City of Madisonville distribution system.

9.5.2 FLOODING AND PONDING AREAS

In general, water mains will not be located in flood prone areas.

9.5.3 MINIMUM WATER MAIN CLEARANCES

The following minimum clearances between the water main and existing or proposed sanitary sewer mains shall be used in establishing the water main alignment:

9.5.3.1 HORIZONTAL CLEARANCES

The horizontal clearance shall be 10-feet minimum measured from outside of pipe to outside of pipe. Where this is not possible, the Engineer should reference the "Ten State Standards" Section 38-31, Page 30-10.

9.5.3.2 VERTICAL CLEARANCE

The vertical clearance should be at least 18-inches measured from outside of pipe to outside of pipe. If at all possible, the sewer shall be located below the water main.

9.6 WATER MAIN DESIGN

9.6.1 PRESSURE

All water mains shall be designed to provide fire protection to the proposed development. Water mains shall be sized after the Engineer has prepared a hydraulic analysis based on flow demands and pressure requirements. The water distribution system shall be designed to maintain a minimum pressure of 30 psi on the discharge side of all meters under all conditions of flow. The normal working pressure in the proposed distribution system should be approximately 60 psi and not less than 35 psi.

9.6.2 DIAMETER

The minimum size of water mains for providing fire protection and serving fire hydrants shall be six (6) inches in diameter. Larger size mains will be required if necessary to allow the withdrawal of the required fire flow while maintaining the minimum residual pressure of not less that 35 psi.

9.6.3 FIRE PROTECTION

The system design should be such that fire flows and facilities are in accordance with the requirements of the State Insurance Services Office.

9.6.4 DEAD ENDS

A. In order to provide increased reliability of service and reduce head loss, dead ends shall be minimized by making appropriate tie-ins whenever practical.

B. Where dead end mains occur, they shall be provided with a fire hydrant and pilot valve.

9.6.5 HYDRAULIC MODELING

9.7 WATER PIPE

A. The minimum allowable inside diameter for a water distribution main shall be six (6) inches. All residential service connections shall have a minimum inside diameter of three-fourths (3) 4-inch; however, commercial or industrial connections shall be individually considered.

B. Pipe material shall be in accordance with Chapter 12.

C. Pipe testing and bedding requirements shall be in accordance with Chapter 12, except for unusual conditions requiring special design and specifications.

D. Backfill classifications, materials, and methods of compaction shall be in accordance with Chapter 12, except in unusual conditions requiring special design and specifications.

E. All water mains shall be designed to prevent damage from superimposed loads during and after construction. Proper allowance for loads on water pipe shall be made, based on trench width and depth. When standard strength water pipe is not sufficient, extra strength pipe or special construction methods shall be specified.

9.8 VALVES

Sufficient valves shall be provided on water mains so that inconvenience and sanitary hazards will be minimized during repairs. Valves should be located at no more than 500-foot intervals in commercial or industrial district and at not more than one block or 800-foot intervals in residential districts.

9.9 FIRE HYDRANTS

9.9.1 LOCATIONS AND SPACING

In general, fire hydrants shall be located at street intersections and near the midpoint of the block. Thoroughfares with medians and with continuous left turn lanes shall have fire hydrants on each side of the thoroughfare.

In residential districts, fire hydrants shall be installed at no more than 500-foot intervals with each front lot corner within 250-feet of a fire hydrant.

In commercial districts, fire hydrants shall be installed at no more than 500-foot intervals with each front lot corner within 250-feet of a fire hydrant.

In industrial districts, fire hydrants shall be installed at street intersections and other midpoints deemed necessary by the City of Madisonville or the City of Madisonville's Fire Department as required on a case-by-case basis.

In under developed or rural areas, fire hydrants shall be installed at a minimum of 2000-foot intervals.

9.10 SERVICE CONNECTIONS

The City of Madisonville will own, operate, and maintain service lines and connections from the water meter to the distribution main. Construction materials and methods shall be in accordance with Chapter 12.

In general, water meters shall be located on the right-of-way line at the midpoint of the front property line in residential districts.

9.11 CASING PIPE

The following criteria shall be followed whenever a casing pipe is used. Any deviation from these criteria will require prior approval from the City of Madisonville.

A. Steel casing pipe shall be a minimum of 10-inches in diameter and have minimum yield strength of 35,000 psi.

B. In boring excavation, the carrier pipe shall be encased in a steel casing pipe of sufficient size to provide clearance for the proper installation of the sewer pipe. The inside diameter of the casing pipe shall be a least four (4) inches greater than the outside diameter of the bell of the carrier pipe, joints, or couplings, thus providing a clearance of at least two (2) inches between the casing pipe, and the carrier pipe.

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Submittal Review And Approval

CHAPTER 10
Submittal Review And Approval

10.1 PURPOSE

This Chapter establishes the minimum water and wastewater construction plan requirements and the City of Madisonville procedures for submittal, review, construction inspection, and final approval of construction for private development projects. Water and wastewater systems should be designed in accordance with the applicable provisions of this and other chapters of this Standards Manual. Adherence to these procedures will facilitate timely review and approval for construction.

10.2 GENERAL PROCEDURES

The design of water and wastewater facilities within the City of Madisonville's service area requires the approval of the following agencies:

A. The City of Madisonville.

B. Kentucky Natural Resources and Environmental Protection Cabinet (NREPC), Department for Environmental Protection, Division of Water.

Construction within blueline streams and regulatory floodplains requires approval of and a permit by the Kentucky NREPC. U.S. Corp of Engineers approval may also be required. Work within Federal and State right-of-way requires approval and/or permits from the Kentucky Transportation Cabinet. Work within railroad rights-of-way requires approval and/or permits from the affected railroad company.

Wastewater facilities shall be designed in accordance with "Recommended Standards for Wastewater Facilities" of the Great Lakes-Upper Mississippi River Board of State Public Health and Environmental Managers commonly referred to as the "Ten States Standards", 1990 edition in addition to appropriate sections of this manual.

Water facilities shall be designed in accordance with the "Recommended Standards for Water Works" of the Great Lakes-Upper Mississippi River Board of State Public Health and Environmental Managers, commonly referred to as the '"Ten States Standards", 1992 edition; in addition to appropriate sections of this manual.

Deviations from the "Ten States Standards" requirements and the requirements described in this manual may be approved if the applicant submits a written request for a deviation with the basis for the request. The basis for the deviation request shall be supported by current engineering practice.

In instances where construction materials and methods are not specifically referenced or are contradicting, the City of Madisonville's decision will apply.

An infrastructure Development Flow Chart is located at the back of this chapter to aid in scheduling submittal review and approval policies and procedures.

10.3 SUBMITTALS

10.3.1 PRELIMINARY WATER AND SANITARY SEWER PLAN REQUIREMENTS (OPTIONAL)

Property to be developed within the City of Madisonville's service area shall be properly served by a water distribution and sanitary sewer collection system. Preliminary plans for these improvements identifying proposed improvements and connection points to the existing system shall be submitted to the City of Madisonville's Engineering Department prior to preparation of Construction Plans. The Plan shall show the lot layout, sanitary sewer alignment, water alignment, and drainage area for each sanitary sewer collector, and hydraulic calculations. It is highly recommended that the Engineer designing the improvements arrange to meet with the City Engineer to discuss the preparation of the Plan. This can save an unnecessary loss of time and effort. The City Engineer will complete a review of the Plan within 10 working days. The Plan shall be submitted on 24" X 36" blueline or blackline paper unless permission is obtained from the City Engineer for a larger or smaller size drawing prior to submittal.

Note that the preliminary Water and Sewer Plan is optional to the Developer. The Plan criteria are established to allow the Developer the flexibility to submit a Preliminary Plan for review prior to the generation of "full-blown" Construction Drawings.

10.3.2 SUBMITTAL OF CONSTRUCTION PLANS

All Construction Plans shall be submitted on 24" x 36" blackline or blueline paper. All drafting shall be in accordance with Chapter 4 of this Manual.

The submittal of the Construction Plans shall include:

# Rec'd.	Item Description
1	Construction Plan Review Application filled out completely, with the original signature of the Developer and the Engineer.
2	Blackline or blueline copies of the Construction Plans.

The submittal will be review by the Engineering Department. A listing of staff comments will be returned to the Engineer within 10 working days after receipt of a complete submittal.

10.3.3 FINAL SUBMITTAL OF CONSTRUCTION PLANS

Any Conditions of the initial submittal of Construction Plans must be addressed at the time of final submittal of the Construction Plans.

# Rec'd.	Item Description
3	Blackline or blueline copies of the Construction Plan addressing each City of Madisonville comment from the initial submittal. Note that the Engineer shall seal, sign, and date each sheet within the Final Submittal of the Construction Plans.

The Final Submittal is reviewed by the Engineering Department in comparison to the original staff comments. If the submittal is complete and acceptable to the City of Madisonville, a letter is prepared to the Kentucky NREPC stating that the Construction Plans have been reviewed and approved by the City of Madisonville and that the City of Madisonville water distribution system has adequate flows to provide service to the development and/or that the City of Madisonville sanitary sewer system has the capacity to convey the additional flows generated by the development. The letter to the Kentucky NREPC will be issued within 10 working days of receipt of a complete submittal, if the Engineer has satisfactorily addressed each City of Madisonville comments. A final resubmittal will be required if the Construction Documents do not meet the requirements of this manual.

10.4 ADDITIONAL SUBMITTED ITEMS

10.4.1 SPECIFICATIONS AND SPECIAL PROVISIONS

All water and wastewater facilities construction shall conform to the Standards Manual. Any deviations from these Standards must be noted in the Special Provisions of the Construction Documents.

10.4.2 APPROVALS AND PERMITS

Provide documentation showing that Plans and a Permit Form have been submitted to the Transportation Cabinet for construction within Federal and/or State rights-of-way (if applicable).

Provide documentation showing that the Construction Documents have been submitted to the rail company for a permit (if applicable).

Provide documentation showing that Construction Documents and Permit Forms have been submitted to the Kentucky NREPC. A permit will be required from the Kentucky NREPC if a blue line or intermittent blue line stream as shown on a 7.5-minute USGS map is affected by the construction.

10.4.3 OFF-SITE EASEMENTS (IF APPLICABLE)

Off-site easements signed and stamped by a Registered Land Surveyor must be submitted to the City of Madisonville's Engineering Department.

10.4.4 CONSTRUCTION PERMIT APPLICATION

The City of Madisonville requires that the Developer submit a copy of the application for a Construction Permit and supporting information to the City of Madisonville prior to issuance of the City of Madisonville acceptance letter. Supporting information is defined as follows:

1. The identity of who will inspect and certify that the facility under construction conforms with the Plans and Specifications approved by the Cabinet in accordance with the Kentucky Administrative Regulations, Chapter 5.

2. A construction estimate of the cost of the facilities.

3. An estimate, and the basis for the estimate, for the average daily flow added by the proposed wastewater project.

4. Engineering calculations necessary for the understanding of the basis and design of the facilities.

10.5 DESIGN PLAN APPROVAL

After all the City of Madisonville concerns are satisfied, the City of Madisonville shall issue a letter to the Kentucky NREPC stating that the City of Madisonville will accept operation and maintenance responsibilities for the water and/or wastewater facilities when it is constructed. Additionally, the letter will state that the City of Madisonville approves the connections(s) to the existing system and accepts responsibility for additional wastewater flows generated by the development.

10.6 PRECONSTRUCTION REQUIREMENTS

The Developer's Contractor shall proceed with construction when the following conditions are met:

A. Kentucky NREPC has issued a Construction Permit.

B. Offsite easements, if required, have been recorded at the courthouse by the City of Madisonville. Please note that the Developer is required to prepare and execute all offsite easements and deliver them to the City of Madisonville for filing. Developers shall pay all costs associated with the filing of easements. The Developer shall submit prepare and executed easements to the City Clerk for filing.

C. Permits have been issued for work within Federal and/or State rights-of-way, if applicable.

D. All Shop Drawings; product data and samples have been submitted and approved in accordance with Chapter 12, unless the construction materials are purchased from the

City of Madisonville.

E. Permits have been issued by the Transportation Cabinet for work with railroad right-of-way, if applicable.

F. Revised Construction Documents, signed, sealed, and dated by a Professional Engineer if the Kentucky NREPC required plan revisions.

10.7 INSPECTION OF CONSTRUCTION

10.7.1 GENERAL

The Developer shall provide continuous onsite inspection for the construction of all water and wastewater facilities construction for private development projects. The City of Madisonville will assign an onsite construction observer to periodically check the quality of construction materials and methods. Neither observations by the City of Madisonville nor inspections shall relieve the Developer's Engineer of certifying that the work has been performed in accordance with the Construction Documents.

10.7.2 INSPECTION ASSIGNMENTS

The Developer will retain a Professional Engineer to certify to the City of Madisonville and the Kentucky NREPC that the construction materials and methods are in compliance with the approval Construction Plans, specifications, and provisions of the Kentucky NREPC approval letter. The City of Madisonville project representative shall be present during testing.

The City of Madisonville recommends a five (5) day notice to schedule the City of Madisonville project representative. To schedule the City of Madisonville project representative, please call the City of Madisonville at (270) 824-2187, ask for the City Engineer, weekdays from 7:00 A.M. to 4:00 P.M. Additionally, the City of Madisonville shall be provided with a forty-eight hour notice prior to testing.

10.7.3 FINAL RECORD DRAWINGS

Deviations from approved Construction Plans as a result of unexpected field conditions will require documentation to and approval by the City of Madisonville. To obtain this approval, a marked-up print of the Plans showing the proposed revisions should be submitted by the Engineer to the City of Madisonville for review. At the completion of construction, a Final Record copy of the Construction Plans bearing the Engineer's original seal, signature, date, and incorporating all approved changes shall be submitted to the City of Madisonville. Final Record Drawings shall be prepared in accordance with Chapter 5.

Task 1 Optional
The Developer has a Professional Engineer prepare a Preliminary Water and Sewer Plan to define connection points to the existing City of Madisonville system, and identify general locations of proposed utilities and submit same to the City of Madisonville.

Task 2 The City of Madisonville reviews the Preliminary Water and Sewer Plan, then prepares and transmits written review comments to the Developer.

Task 3 The Developer has a Professional Engineer prepare Final Construction Plans and Specifications and submit the documents to the City of Madisonville. This submittal shall also include a Water and Wastewater Review Application.

Task 4 The City of Madisonville reviews the Final Construction Plans and Specifications, then prepares and transmits review comments to the Developer. Note that the City of Madisonville requires a minimum of 10 working days to review the documents.

Task 5 If the Construction Documents meet the requirements of the City of Madisonville rules and regulations, the City of Madisonville issues a letter to the Developer stating that the City of Madisonville will accept operation and maintenance of the facilities when constructed; and the City of Madisonville approves the connections(s) and accepts responsibility for the additional flows.

Task 6 The Developer prepares and transmits a Construction Permit Application and related submittal items to the Kentucky Natural Resources and Environmental Protection Cabinet (NREPC), Division of Water with one complete copy of the submittal forwarded to the City of Madisonville offices.

Task 7 The NREPC either approves or rejects the application.

Task 8 Upon issuance of the Construction Permit from the NREPC, the Developer shall submit the following items to the City of Madisonville prior to commencement of construction:

1. Offsite easements, if applicable.
2. Permits to work within State or Federal right-of-way, if applicable.
3. Permits to work within railroad right-of-way, if applicable.

4. Shop Drawings.

Task 9 The Developer shall ensure construction of the facilities are in accordance with the approved Construction Plans and Specifications with inspection and certification provided by a Professional Engineer to the City and State Agencies.

Task 10 Certification of the construction in accordance with the Construction Plans and Specifications.

Task 11 Preparation and submittal of the Final Record Drawings by the Professional Engineer.

Task 12 Release of the Letter of Credit by the City of Madisonville.

The City of Madisonville **EXHIBIT 10-2**
Construction Plan Review Checklist

The City of Madisonville Engineering Dept. **Effective Date: June 16, 2003**

Project Name _____

The applicant shall check each item to indicate it has been shown and addressed on the Construction Plans. If an item is not applicable, indicate with a N/A in the space provided.

PART 1 GENERAL

A. General

_____ 1. Plans submitted on 24" X 36" sheets.
_____ 2. Two sets of plans submitted.
_____ 3. North arrow and scale of drawing on each sheet.
_____ 4. Benchmarks shown on plans.
_____ 5. Title blocks shown on each sheet excluding cover sheet.
  a. Title block completely filled out.
  b. Title agrees with the Record Plat.
_____6. Commonwealth of Kentucky Licensed Engineer's seal, signature, and date on each sheet.
_____7. Copy of Preliminary or Record Plat included in Plan Set.
_____8. Easements shown on preliminary or Record Plat correspond with locations of proposed utility lines.
_____9. All drawings and lettering must be clear and legible.

B. Cover Sheet

_____1. Location map for project, include a north arrow.
_____2. Index to drawings.
_____3. Name, address, and telephone number of the Developer/owner
_____4. Name, address, and telephone number of the Engineer.
_____5. Project name identified on the right border of the cover sheet.

PART II WATER SYSTEM IMPROVEMENTS

A. Plan View

_____1. Size, type, and pressure class of all proposed water mains identified.
_____2. General notes for water system construction**.**
_____3. Location and size of all on-site water mains shown.
_____4. Conflicts with existing and proposed utilities shown.
_____5. Names and phone numbers of utility company contracts having utilities in the area.

_____6. Locations of proposed service lines and meters shown.
_____7. Location of existing and proposed sanitary sewer lines.
_____8. Location of existing and proposed storm drainage lines and inlets.
_____9. Location of existing and proposed pavement and rights-of-way.
_____10. Profiles of proposed water mains crossing channel sections.
_____11. All lot and block numbers shown.
_____12. Location, width, and type of easements.
_____13. Water mains stubbed out to the common property line with undeveloped or un-serviced adjacent property.
_____14. Proposed water main dimensioned to rights-of-ways.
_____15. Legend. Identifying existing and proposed lines.
_____16. Insure that the water main can be "valved" down without putting more than one fire hydrant out of service.
_____17. Fire hydrants locations identified.
_____18. All fire hydrants have a clear 36-inch operating radius for the top nut.
_____19. Fire hydrants shall be located 2'-6" behind the pavement edge and shall not be located in the sidewalk.

B. Details

_____1. The City of Madisonville Standard Details for water mains included.
_____2. Special provisions to the City of Madisonville details shown.

PART III SANITARY SEWER SYSTEM IMPROVEMENTS

A. General

_____1. General notes for sanitary sewer system construction.
_____2. Names and phone number of Utility Companies having utilities in the area.

B. Plan View

_____1. Location, size and direction of existing sewers shown.
_____2. Location and size of all on-site sanitary sewer lines and laterals shown.
_____3. Conflicts with other existing or proposed utilities shown.
_____4. Dimensions from lot lines to service lines if service line is not in standard location (10- feet downstream of midpoint of the front lot line).
_____5. Location of existing and proposed water mains (dimensioned from right-of-way).
_____6. Location of existing and proposed storm drainage inlets and lines.
_____ 7. All lot and block numbers shown.
_____8. Location, width, and type of easements.
_____9. Sanitary sewer mains stubbed out to the common property line with undeveloped property and developed property not served by the City of Madisonville.
_____10. Proposed sanitary sewer lines dimensioned to street centerline.
_____11. Centerline stationing shown and related to profile.
_____12. Manholes and cleanouts stationed.
_____13. Legend.
_____14. Manholes located at 400-feet maximum spacing and at all sewer line intersections, grade changes, and alignment changes.

_____15. Call out all drop connections or diaphragm locations.
_____16. Benchmarks shown on each sheet.
_____17. 100-Year flood elevation shown (if applicable).

C. Profile

_____1. Proposed line grades are greater than the minimum established and velocity in line does not exceed 15 fps.
_____2. Elevation of existing and proposed ground at centerline of pipe.
_____3. Rim and flow line elevations at each manhole. Give flow direction for all pipes.
_____4. Flowing at 100-feet intervals.
_____5. Fill areas noted.
_____6. Length, type, and size of pipe between manholes.
_____7. Inside diameter of proposed manholes.
_____8. Location and elevation of water mains crossing sanitary sewer line.
_____9. Location and elevation of storm drainage lines crossed by sanitary sewer lines.
_____10. Locations of concrete encasements and concrete caps.
_____11. Location and elevation of existing and proposed pavement sections crossed.
_____12. Vertical scale of drawings.
_____13. Vertical and horizontal clearance between utilities meets DOW requirements.
_____14. Drop assemblies shown on outside of manholes.
_____15. Show 100-year water surface elevation for ultimate conditions located in flood prone areas.

D. Details

_____1. The City of Madisonville Standard Details for sanitary sewers included.
_____2. Special provisions to the City of Madisonville details shown.

The City of Madisonville **EXHIBIT 10-3**
Development Review Application

The City of Madisonville Engineering Department **Effective Date: June 16, 2003**

Owner/Applicant

_____
Name

_____
Address

_____
City, State, Zip

_____
Phone/Fax

Design Engineer

_____
Name

_____
Address

_____
City, State, Zip

_____
Phone/Fax

Location of Property (complete as appropriate)
If located in a subdivision:

_____

Name of Subdivision
No. of Lots

If **NOT** located in a subdivision:

_____
Location Description
Acreage

Nature of Proposed Construction (check and complete as appropriate)

( ) Residential ( ) Commercial ( ) Industrial

( ) Other (specify_____

Present status of property plat (check and complete as appropriate)

( ) Preliminary Plat approved, Date:_____

( ) Record Plat approved, Date:_____

The City of Madisonville USE ONLY: Date Received:_____ Received By:_____

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SEWAGE PUMPING STATION

CHAPTER 11
SEWAGE PUMPING STATIONS
Foreword:

Prior to the planning or design of any sewage pumping station, the Developer should arrange a meeting with the City of Madisonville, City Engineer to determine alternatives for providing sanitary sewer service. The City of Madisonville will not allow the construction of localized sewage pumping stations within proposed developments when the property will gravity flow to an existing City of Madisonville system. All offsite development cost will be the responsibility of the Developer.

11.1 PURPOSE

This Chapter:

A. Identifies the planning and design approach to be used for sewage pumping stations.

B. Define specific criteria by which sewage pumping stations will be designed.

C. Delineates submittal requirements required by the City of Madisonville for review and approval of sewage pumping stations.

D. Delineates requirements for estimates of construction and operating costs.

11.2 SUBMITTAL REQUIREMENTS

The Design Engineer shall submit to the City of Madisonville for review and approval, a Preliminary Design and Final Design. Approval by the City of Madisonville will be required prior to authorization of any succeeding design phase.

11.2.1 PRELIMINARY DESIGN SUBMITTAL

The purpose of the Preliminary Design Plan is to provide the City of Madisonville with Preliminary Design Data for the proposed facilities (sanitary sewers, pump station, force main) to determine the compatibility of proposed facilities with the approved 201 Facilities Plan for Wastewater Treatment Works, and to justify alternatives recommended for providing

sanitary sewer service.

Preliminary Design Plan submittals relating to pump stations shall include the following elements:

A. The designated land use for the proposed service area and drainage areas.

B. Population and flow projections for the proposed service area and drainage areas.

C. A description of how and when the pump station will be eliminated if the pump station is proposed as temporary.

D. Construction phasing to accommodate the proposed development, if applicable.

E. Availability and description of existing utilities.

11.2.2 FINAL DESIGN SUBMITTALS

Design elements related to pump stations shall include the following:

A Construction Plans and Technical Specifications modified to specific project needs with any additional diagrams and technical data as necessary to construct the proposed installation.

B. Population and flow projections and calculations.

C. Wetwell calculations.

D. Force main calculations.

E. Pump curve/system curves in feet of total dynamic head versus flow in gpm for the following labels: Pump Curve; Single Pump Operation Curve; Two Pump Operation Curves; Design Point(s); and Operating Point(s) and Operating Envelope. Shut-Off head should be included where it will be a controlling point.

F. Total hydraulic efficiency at operating point(s).

G. Pump cycle time.

H. Valve configurations.

I. Float setting calculations.

J. Buoyancy calculations.

K. Force main pressure and water hammer calculations.

L. Determinations for air release and/or air/vacuum release valves.

M. Odor control calculations and/or assumptions.

N. Electrical calculations and/or power requirements.

O. Estimates of capital and operation and maintenance expenses.

P. Site plan showing details of site access, landscaping, and electrical utility pole.

11.3 DESIGN APPROACH

11.3.1 APPROVALS

Prior to construction of a sewage pumping station, the Design Documents must receive the approval of the following agencies:

A. The City of Madisonville
B. Kentucky Division of Water

All submittals must be signed and sealed by a Professional Engineer currently registered in the Commonwealth of Kentucky.

11.3.2 JUSTIFICATION

The need for a sewage pumping station must be justified to one or more of the following criteria:

A. The elevation of a proposed service area is too low to be served by existing, on-or-off-site gravity sewers; OR

B. The proposed sewage pumping station has been determined to be a cost-effective alternative to an on-or-off-site gravity sewer. The costs of the proposed pumping station shall include construction, maintenance, and operational costs.

11.4 DESIGN CRITERIA

11.4.1 DEFINITIONS

A. Residential Equivalent Population. The Engineer should develop the average daily flow based on the population per unit and the type of development, from Table 8-1.

B. The Engineer should determine the appropriate peaking factor based on the average daily flow, from Table 8-2.

C. Average Flow: Residential equivalent population x 100-gpcd.

D. Peak Flow: Average flow x peaking factor.

E. Initial Average Flow: Initial residential equivalent population x 100-gpcd.

F. Initial Peak Flow: Initial residential equivalent population x 100-gpcd x peaking factor.

G. 20-Year Peak Flow: 20-year residential equivalent population x 100-gpcd x peaking factor.

H. Ultimate Average Flow: Ultimate residential equivalent population x 100-gpcd. Ultimate residential equivalent population is defined as a population halfway between 10-year population and watershed saturation population.

I. Ultimate peak flow: Ultimate residential equivalent population x 100-gpcd x peaking factor.

J. Watershed Saturation Population: The maximum projected population for the watershed based on present zoning that is equated to equivalent residential units.

11.4.2 GENERAL

A. Pump Stations shall operate automatically under normal conditions but be capable of manual control. Pump stations shall be planned and designed to include provisions for ease of future elimination.

B. The floor or top slab of the pump station shall be designed to an elevation at least two (2) feet above the 100-year flood elevation.

C. All gate and check valves shall be installed horizontally in a shallow concrete valve vault to be located next to the wetwell. The arrangement shall provide for easy access to the equipment to simplify maintenance. Valve vaults are confined spaces requiring adequate means of egress, including a hatch of sufficient size. Each valve vault shall have a minimum six (6) inch diameter vent.

D. All pump stations must have a minimum of two (2) pumps, with one pump provided as a standby unit.

E. The wetwell shall be sized and floats set so that, based on the average flow, the pump cycle time shall not exceed 30-minutes.

F. Any deviations from the specified design criteria must be approved in writing by the City of Madisonville.

G. To ensure uniformity and City of Madisonville system compatibility, standards have been developed based on pump station size (see sections 11.4.4 and 11.4.5). Specifications for sewage pumping stations are included in Chapter 12 of this Manual.

11.4.3 CLASSES OF PUMPING STATIONS

Sanitary sewage pumping stations shall be divided into two (2) classes based on the pumping capacity, as follows:

Class A - 1,000-gpm and greater
Class B - less than 1,000-gpm

11.4.3.1 GENERAL REQUIREMENTS FOR CLASS A PUMPING STATIONS

Class A pumping stations shall be designed to pump the ultimate design capacity of the drainage area. Class A pumping stations may be submersible or dry-pit pumping stations. Class A pumping stations shall have the following components:

1) Building.
2) Three-fourths inch (¾") open, mechanically cleaned bar screen if influent sewer is 30-inch diameter or larger.
3) Flow measurement and recording.
4) Odor Control.
5) Emergency Power Generator.
6) Telemetry System.
7) Concrete, cast-in-place wetwell.
8) Cast-in-place valve vault.
9) Minimum of three (3) pumps and pumping compartments.
10) Fencing as required.
11) Landscaping as required.
12) Access Roads and Turnarounds.

Class A pumping stations generally will be planned, designed, and constructed by contract with the City of Madisonville. Additional information on the required components is provided in section 11.4.3, Class A Pumping Station Details.

11.4.3.2 General Requirements for Class B Pumping Stations

Requirements for Class B pumping stations are considerably different from Class A pumping stations. Class B pumping stations shall have the following components:

1) Emergency Power Portable Hookup.
2) Telemetry System.
3) Precast Concrete Components.
4) Minimum of two (2) submersible pumps required, and "can" type buried

pumping stations not permitted.

5) Fencing.
6) Landscaping as required.
7) Access Roads and Turnarounds.
8) Odor control, if necessary.

11.4.3.3 Pumping Stations Permanent

All pumping stations are considered permanent and shall be designed to these standards.

11.4.3.4 Pumping Station Class Requirements

Table 11-1 summarizes the various requirements of Class A and B pumping stations.

TABLE 11-1
REQUIREMENTS FOR PUMPING STATIONS

Components	Class A P.S. 1,000 < gpm & greater	Class B P.S. >1,000 gpm
Building – 2 Room Min.	Yes	No
Bar Screen	Yes[1]	No
Flow Meter	Yes	No
Elapsed Time Meters	Yes	Yes
Odor Control	Yes	Possible
Emergency Power Generator	Yes	No
Emergency Power Portable Hookup	No	Yes
3 Phase Electrical Power Required	Yes	Yes
Telemetry System	Yes	Yes
Cast in Place Concrete Required	Yes	No
Precast Concrete Allowed	No	Yes
Submersible Pumps Allowed	Yes	Yes
Dry Pit Pumps Allowed	Yes	No
3 Pumps Minimum	Yes	No
Multiple Wetwells Required	Yes	No
Fencing	Yes	Yes

Paved Access & Turnarounds	Yes	Yes
Potable Water Service	Yes	Yes

[1] Required if influent sewer is 30" in diameter or larger.

11.4.4 CLASS A PUMPING STATION DETAILS

11.4.4.1 Buildings

Buildings shall have separate rooms for the electrical equipment (including pump control panel and telemetry panel), bar screen, and odor control equipment. Standby power generators may be located in a separate room in the building or may be housed in a manufacturer's pad-mounted, outdoor generator enclosure. The electrical room shall be air conditioned for equipment cooling. All rooms shall have appropriate forced ventilation and humidity control. The building shall be constructed such that it is architecturally compatible with the surrounding area, including houses and buildings.

11.4.4.2 Bar Screen

A bar screen is required if the influent sewer is 30-inch diameter or larger. The bar screen shall be housed in a separate room in the building. The bar screen shall be mechanically cleaned with three-fourths (3/4) inch openings. Controls shall be located in the electrical room and housed in a NEMA four (4) control panel, and shall operate based on a variable timer or channel flow level sensor. Auxiliary contracts shall be provided so the screen can be monitored by the telemetry system. All equipment in this room shall be explosion proof in accordance with NFPA 820.

11.4.4.3 Flow Measurement

Sewage flow shall be measured with a Parshall flume and recorded utilizing a circular chart recorded located in the electrical room of the building. Auxiliary contacts shall be provided so the flow can be monitored by the telemetry system. When excessive depth is involved, an ultrasonic (Doppler) flow meter or a magmeter may be used on the effluent force main.

11.4.4.4 Odor Control

Required odor control measures will vary depending on the installation and its location. Consideration should be given to systems for local odors, such as Sodium Hypochlorite Systems, as well as force main discharge manhole odors, which may require a Bioxide System.

11.4.4.5 Emergency Power

Full emergency power generation equipment shall be provided. This equipment may be housed in a separate room in the building or in a manufacturer's pad-mounted, outdoor generator enclosure. Consideration shall be given to the noise levels in the surrounding areas. Fuel tanks may be integral to the generator enclosure. Fuel tanks shall be sized to permit approximately 24-hours of run time.

11.4.4.6 Telemetry System

Class A sewage pumping stations shall be provided with telemetry equipment sensors compatible with the City of Madisonville's existing telemetry system.

Table 11-2 provides the signals required to be monitored at each pumping station.

TABLE 11-2
CLASS A TELEMETRY REQUIREMENTS

Monitoring Point	Submersible Pumping Station		Dry Pit Pumping Station	
	Monitor	Required Signals	Monitor	Required Signals
Pump Run for Each Pump	Yes	3 min.	Yes	3 min.
Power Failure	Yes	1	Yes	1
Generator Run	Yes	1	Yes	1
High Wetwell	Yes	1	Yes	1
Telemetry Fail	Yes	0	Yes	0
Water on the Floor	No	0	Yes	1
Building Intrusion	Yes	1	Yes	1
Telemetry Panel & Control Panel Intrusion	No	0	No	0
Combustible Gas Detection	Yes	1	Yes	1
Overflow	Yes	1	Yes	1

These status signals shall be monitored as described below.

1) Pump run shall be monitored utilizing an auxiliary contact from the pump motor starter.

2) Power failure shall be monitored using a three-phase power monitor. The power monitor shall provide a closed contact output upon detecting a power failure.

3) Generator run shall be monitored off an auxiliary contact in the generator

control panel.

4) High wetwell level shall be monitored utilizing a mercury float switch mounted in the wetwell. The float shall be mounted at an elevation to provide a closed contact output when the wetwell water level is approximately one (1) foot below the overflow. The actual float elevation shall be field-determined by the City of Madisonville. The float cable shall be sufficient length to terminate wiring in the control panel without splicing.

5) Telemetry failure is internal to the communication equipment and shall be monitored at the master station.

6) Water on the floor shall be detected utilizing a bracket-mounted float switch mounted on the wall just above the floor. The switch shall provide a closed-contact output, if water on the floor raises the float switch.

7) Building intrusion shall be monitored by a limit switch mounted on the interior doorframe that provides a closed contact when the building door(s) is open.

8) Combustive gas shall be monitored by a contact in the combustive gas detection system panel.

9) Overflow shall be by a float switch in the same manner as the high wetwell level.

The radio communications equipment and the monitor/control unit shall be housed in a NEMA four (4) enclosure suitable for outdoor use. The telemetry system shall be provided complete with antenna, coaxial cable, conduit wire, and miscellaneous appurtenances necessary to provide a complete, functioning system.

11.4.4.7 Wetwells

Wetwells, flow measurement channels and Parshall flume (with fiberglass insert), building foundation, and other structural components of Class A pumping stations shall be cast-in-place concrete. Precast concrete components are not acceptable. Concrete flow channels and aluminum gates shall direct the sewage flow to the wetwells. Piping and valves are not acceptable.

All hardware in the wetwells including but not limited to guide rails, anchor bolts, chains, cables, mounting brackets, hinges, hinge pins, and other hardware on aluminum hatches, etc. shall be stainless steel or other approved non-corrosive material. Galvanized or coated steel is not acceptable.

Combustible gas monitoring equipment shall be mounted in a location convenient for maintenance purposes and consistent with the manufacturer's recommendations.

The wetwell shall be sized to provide adequate storage time for the alternate power

source to be activated in the event of power failure. Each wetwell shall have a minimum six (6) inch diameter vent.

11.4.4.8 Pumps

A minimum of three (3) pumps is required. Two (2) pumps shall be capable of pumping the design flow, and the third pump shall be standby. Depending on the size of the pumps compared to the ultimate pumping station capacity, additional pumps may be required. In a submersible pumping station with three (3) pumps, each pump shall be located in an individual wetwell. Four (4) pumps may be located with two (2) in each wetwell.

Controls for the pumps shall utilize an ultrasonic level control system.

11.4.4.9 Fencing

Fencing is required for Class A pumping stations. Depending on the location of the pumping station, the surrounding area, potential for damage to outside equipment, and other factors, the Engineering Department may waive this requirement or allow a residential treated wood fence around selected outdoor components and equipment but not the entire site.

11.4.4.10 Landscaping

Landscaping may be required based on the surrounding area.

11.4.4.11 Access Roads & Turnarounds

Access roads and turnarounds shall be constructed of asphalt. Appropriate drainage, consisting of ditches, cross-drains, headwalls, catch basins, and the like shall be included in the design. The access road shall have a minimum width of 12-feet with a turnaround to accommodate an AASHTO SU design vehicle. The access road shall be designed to an elevation of at least two (2) feet above the 100-year flood elevation and have a maximum grade of seven percent.

11.4.4.12 Potable Water Service

The pump station shall be provided with a potable water service consisting of a one (1) inch freeze-less flushing hydrant. The copper service line shall have a backflow preventer and/or a pressure vacuum breaker to prevent possible cross-connection to the potable water supply.

11.4.4.13 Buffer Zones

The pump station structure shall be located at a minimum of 300-feet from any existing or future residential structure.

11.4.5 CLASS B PUMPING STATION DETAILS

11.4.5.1 Building

A building is not required.

11.4.5.2 Bar Screen

A bar screen is not required.

11.4.5.3 Flow Measurement

Flow measurement and recording is not required. Elapsed time meters are required.

11.4.5.4 Odor Control

Odor control provisions shall be required if the Engineering Department determines that odors will be a problem.

11.4.5.5 Emergency Power

Emergency power generation equipment is not required. Provisions shall be made to allow a portable, trailer-mounted generator to be parked at the site and plugged in to power the pumping station.

Required components include:

1) Manual switch to disconnect from utility power supply and receptacle to plug in the portable generator.

2) Receptacle shall be in accordance with the latest City of Madisonville Standard for the class pumping station and the total horsepower to be installed.

11.4.5.6 Telemetry

Telemetry system requirements are generally the same as Class A pumping stations with the exception that building intrusion signals are not necessary, since a building will not normally be a component of a Class B pumping station. Table 11-3 summarizes the telemetry requirements for Class B pumping stations.

TABLE 11-3
CLASS B TELEMETRY REQUIREMENTS

Monitoring Point	Submersible Pumping Station	
	Monitor	**Required Signals**
Pump Run for Each Pump	Yes	2
Power Failure	Yes	1
Generator Run	No	0
High Wetwell	Yes	1
Telemetry Fail	Yes	0
Telemetry Panel & Control Panel Intrusion	Yes	1
Combustible Gas Detection	Yes	1
Overflow	Yes	1

11.4.5.7 Wetwells

Wetwells for Class B pumping stations may utilize precast concrete/pipe manhole sections. Class B pumping stations may have a single wetwell. Piping and valves are acceptable to direct sewage flow to the wetwells.

All hardware in the wetwells including but not limited to guide rails, anchor bolts, mounting brackets, hinges, hinge pins, and other hardware on aluminum hatches, etc. shall be stainless steel or other approved non-corrosive material. Galvanized or coated steel is not acceptable.

Combustible gas monitoring equipment shall be mounted in a location convenient for maintenance purposes and consistent with the manufacturer's recommendations.

Wetwells shall be sized to provide a minimum of two (2) hours detention time, based on average design flow above the high-level alarm elevation. Each wetwell shall have a minimum six (6) inch diameter vent.

11.4.5.8 Pumps

A minimum of two (2) pumps is required for Class B pumping stations. One (1) pump shall be capable of pumping the design flow, and one (1) pump will be standby.

11.4.5.9 Control Enclosure

The control enclosure shall be aluminum or stainless steel and shall include a hasp for a padlock.

11.4.5.10 Fencing

Fencing requirements are the same as Class A pumping stations.

11.4.5.11 Landscaping

Landscaping requirements are the same as Class A pumping stations.

11.4.5.12 Access Roads & Turnarounds

Access road requirements are the same as Class A pumping stations. Common driveways with adjacent property owners will not be allowed.

11.4.5.13 Potable Water Service

Potable water service requirements are the same as Class A pumping stations.

11.4.6 FORCE MAIN DETAILS

11.4.6.1 Force Main Size and Blocking

The minimum allowable force main size is four (4) inch diameter. All fittings along the route of the force main shall be blocked or restrained as shown on the detail sheets to prevent joint separation during operation.

11.4.6.2 Force Main Air Releases

Automatic air release valves shall be installed at each major high point along the route of the force mains. These shall be shown on Record Drawings with accurate measurements for location.

11.4.6.3 Force Main Markers

Force mains installed in fields or other undeveloped areas should be sufficiently marked to adequately locate the main for future reference. Markers shall be shown on the Record Drawings. Magnetic tape located above the force main is required for locating non-metallic force mains.

11.4.6.4 Force Main Discharge Point

The discharge point of a force main (particularly long and/or large force mains) should be checked to determine if problems might arise from the discharge of septic sewage. Hydrogen sulfide (sewer gas) will be generated inside the force main and will be expelled at the discharge point.

If this appears to be a consideration, special treatment should be given to the design of the receiving manhole. Items such as underground venting, submerging the discharge, and preventing turbulence will help to prevent a nuisance at the discharge point.

The receiving manhole shall be epoxy coated on all inside surfaces to protect against corrosion.

In some situations it may be necessary to aerate, chlorinate, use hydrogen peroxide or provide other means to prevent or minimize the formation of the hydrogen sulfide gas.

11.4.6.5 Force Main Materials

PVC (SDR 21 minimum wall thickness), and ductile iron (Class 50 minimum) pipe shall be allowed for use in force main construction, dependent on specific conditions.

11.4.6.6 Force Main Isolation Valves

Where force mains tie into existing force mains, a gate valve and check valve shall be provided in the new force main at a point near the connection to the existing force main. The valves are to provide a means of isolating the existing force main in the case of a force main break.

If this appears to be a consideration, special treatment should be given to the design of the receiving manhole. Items such as underground venting, submerging the discharge, and preventing turbulence will help to prevent a nuisance at the discharge point.

The receiving manhole shall be epoxy coated on all inside surfaces to protect against corrosion.

In some situations it may be necessary to aerate, chlorinate, use hydrogen peroxide or provide other means to prevent or minimize the formation of the hydrogen sulfide gas.

11.5 ELECTRICAL

This section provides guidelines for the electrical design and preparation of Construction Plans and Specifications as related to sewage pumping stations. All electrical documents must be signed and sealed by a Professional Engineer currently registered in the Commonwealth of Kentucky.

All systems, designs, and procedures are to meet or exceed the requirements of the latest issue of the following codes or standards:

Kentucky Building Code	KBC
National Electrical Code	NEC
Underwriters Laboratories, Inc.	UL
National Fire Protection Association	NFPA
Occupational Safety and Health Administration	OSHA
Kentucky Occupational Safety and Health Administration	KYOSHA
National Electrical Manufactures Association	NEMA

Exhibit 11-1
Pumping Station Plans Checklist

_____ 1. Plans are stamped by a Licensed Professional Engineer in the Commonwealth of Kentucky.
_____ 2. Flow determinations consistent with Chapter 8 requirements have been made.
_____ 3. Class of the pumping station is indicated.
_____ 4. Design criteria for the class of the pumping station are followed.
_____ 5. Wetwell sizing is consistent with Chapter 11 requirements.
_____ 6. Force main sizing is consistent with Chapter 11 requirements.
_____ 7. Pump rate (gpm) and total dynamic head (TDH) are given.
_____ 8. All geographical features shown.
_____ 9. Subsurface information, as appropriate, is provided.
_____ 10. Topography and elevations of all existing features shown.
_____ 11. Topography and elevations of all proposed features shown.
_____ 12. Contours at two (2) ft. intervals.
_____ 13. Direction of flow in streams indicated.
_____ 14. 100-year flood elevation shown.
_____ 15. Existing pumping stations, force mains, and trunk sewers within one (1) mile radius of the proposed pumping station shown.
_____ 16. Size, minimum grade of sewer at discharge point of force main is given.
_____ 17. Location, size, and direction of existing sewers shown.
_____ 18. Location, size, and direction of proposed sewers shown.
_____ 19. Location, size, and direction of existing force mains shown.
_____ 20. Location, size, and direction of proposed force main shown.
_____ 21. Manhole numbers shown.

_____ 22. Manhole stations shown.

_____ 23. Deflection angles shown.

_____ 24. Coordinates of manholes and pumping stations shown.

_____ 25. Distance between manholes, pipe size, and slope shown on each line segment.

_____ 26. Benchmarks are shown.

_____ 27. Elevations confirm to acceptable datum.

_____ 28. Elevations shown at manhole inverts and rims.

_____ 29. All existing utilities and structures, (above and below ground) shown.

_____ 30. Property lines for the proposed pumping station property are indicated.

_____ 31. All easements indicated on plans.

_____ 32. All utilities shown in the easements.

_____ 33. Legends, vicinity map, north arrows etc. shown.

_____ 34. Access roads, parking, turnarounds are shown.

_____ 35. Regrade and drainage are shown.

_____ 36. Fencing of the site is shown.

_____ 37. Landscaping is shown.

_____ 38. Plan and section views sufficient to indicate what is to be built and what equipment is to be furnished.

_____ 39. All equipment to be furnished is approved by the City of Madisonville.

_____ 40. Elevations given for all structural and operational points.

_____ 41. Painting is defined and/or specified.

_____ 42. Appropriate details for all miscellaneous items.

_____ 43. Telemetering system consistent with Chapter 8 requirements to operate with existing City of Madisonville system.

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CHAPTER 12
CONSTRUCTION MATERIALS AND METHODS

12.1 SHOP DRAWING, PRODUCT DATA, AND SAMPLE SUBMITTALS

PART 1 - GENERAL

1.01 DESCRIPTION OF REQUIREMENTS

A. This section specifies the general methods and requirements of submissions applicable to Shop Drawings, product data, and samples. Detailed submittal requirements are specified in the following sections of this document.

B. Shop Drawings shall be submitted by the Developer or the Developer's representative.

1.02 SHOP DRAWINGS AND PRODUCT DATA

A. Submittal of these items shall comply with requirements listed in this section and in individual sections.

B. Shop Drawings

1. Shop Drawings include, but are not necessarily limited to, custom-prepared data such as fabrication and erection/installation drawings, scheduled information, setting diagrams, actual shopworn manufacturing instructions, custom templates, special wiring diagrams, coordination drawings, individual system of equipment inspection, and test reports including performance curves and certifications, as applicable to the work.

2. All details on Shop Drawings submitted for review shall show clearly the relation of the various parts to the main members and lines of the structure, and where correct fabrication of the work depends upon field measurements, such measurements shall be made and noted on the Shop Drawings before being submitted for review.

C. Product Data

1. Product data as specified in individual sections include, but are not necessarily limited to, standard prepared data for manufactured products (sometimes called catalog data), such as the manufacture specification and installation instructions, availability of colors and patterns, manufacturer's printed statements of compliance and applicability, roughing-in diagrams and templates, catalog cuts, product photographs, standard wiring diagrams, printed performance curves and operational-range diagrams, production or quality control inspection and test reports and certifications, mill reports, product operating and maintenance instructions and recommended spare-parts listing, and printed product warranties, as applicable to the work.

1.03 CONTRACTOR'S RESPONSIBILITY

A. The Contractor shall review Shop Drawings, product data, and samples before submission to determine and verify the following:

1. Field measurements.
2. Field construction criteria.
3. Catalog numbers and similar data.
4. Conformance with the Specifications.

B. All Shop Drawings submitted by Sub contractors for review shall be sent directly to the Contractor for preliminary checking. The Contractor shall be responsible for their submission at the proper time to prevent delays in delivery of materials.

C. The Contractor shall check all Sub contractors' Shop Drawings regarding measurements, size of members, materials, and details to satisfy the Contractor that they conform to the intent of the Drawings and Specifications. Drawings found inaccurate or otherwise in error shall be returned to the Sub contractors for correction before submission thereof.

D. Each Shop Drawing, Working Drawing, sample, and catalog data submitted by the Contractor shall have the following certification statement, signed (not initialed) by the Contractor:

"By this submittal, I represent that I have determined and verified all field measurements, field construction criteria, materials, dimensions, catalog numbers, and similar data; and I have checked and coordinated each item with other applicable reviewed Shop Drawings and all project requirements".

E. The Developer is responsible for submitting approved Shop Drawings to the City. The Developer shall notify the City of deviations from the Construction Plans or approved Shop Drawings.

F. The Contractor should include the notation "Critical Path" on critical path submittals.

G. The review of Shop Drawings, samples, or catalog data by the Engineer shall not relieve the Contractor from his responsibility to complete the work according to the Construction Plans and Specifications.

H. No portion of the work requiring a Shop Drawing, Working Drawing, sample, or catalog data shall be started nor shall any materials be fabricated or installed before the review or qualified review of such items. Fabrication performed, materials purchased, or on-site construction accomplished, which does not conform to reviewed Shop Drawings, and data shall be at the Contractor's risk. The Engineer or the City of Madisonville will not be liable for any expense or delay due to corrections or remedies required to accomplish conformity.

I. Project work, materials, fabrication, and installation shall conform to reviewed Shop Drawings, Working Drawings, applicable samples, and catalog data.

1.04 SUBMISSION REQUIREMENTS

A. The Contractor shall make submittals in such sequence as to cause no delay in the work or in work of any other Contractor.

B. Number of submittals required:

1. Submit six (6) copies of approved Shop Drawings and product data to the City of Madisonville.

2. The Developer's Engineer shall review and approve Shop Drawings and product data prior to submittal to the City.

C. Submittals shall contain:

1. The date of submission.

2. The project title and submittal number.

3. The names of:

a. Contractor
b. Supplier
c. Manufacturer

4. Identification of the product, with the specification section number.

5. Field dimensions, clearly identified as such.

6. Relation to adjacent or critical features of the work or materials.

7. Applicable standards, such as ASTM or Federal Specification Numbers.

8. Identification of deviations from Contract Documents.

9. Identification of revisions on resubmittals.

10. An 8" x 3" blank space for Contractor and Engineer's stamps.

11. Critical path notation as required.

D. The Contractor shall make submittals to the Engineer. The Engineer shall check all

Shop Drawings product data, and samples for conformance with the individual sections and provide the City of Madisonville two copies of each transmittal with approved or rejected Shop Drawings, product data, or samples attached. If an item is not covered on the Construction Plans, in this Manual, or the Special Provisions, the Engineer should notify the City of Madisonville of the discrepancy and make a recommendation to the City of Madisonville for judgment.

1.05 RESUBMISSION REQUIREMENTS

A. The Contractor shall make any corrections or changes in the submittals required by the Engineer and resubmit until accepted, according to the following:

1. Shop Drawings and product data:

    a. Revise initial drawings or data, and resubmit as specified by the initial submittal.
    b. Indicate any changes made other than those requested by the Engineer.

1.06 GENERAL PROCEDURES FOR SUBMITTALS

A. Coordination of Submittal Times: The Contractor shall prepare and transmit each submittal sufficiently in advance of performing the related work or other applicable activities, or within the time specified in the individual work section of the Specifications, so that the installation will not be delayed by processing times including disapproval and resubmittal (if required), coordination with other submittals, testing, purchasing, fabrication, delivery, and similar sequenced activities.

12.2 CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 - GENERAL

1.01 UTILITIES

A. The obtaining of all utilities for construction, including power and water, shall be the responsibility of the Contractor, and he shall bear the cost of all utilities used for construction. Cost of all connections and facilities for use of utilities shall be borne by the Contractor.

1.02 MAINTENANCE OF SERVICE IN EXISTING UTILITIES

A. Where the existing utilities must be disturbed during construction, their operation and function shall be maintained by the Contractor to such a degree that service to customers will be interrupted for minimum times only. Such disturbances and any maintenance of these lines shall be at no cost to the City of Madisonville. The City of Madisonville shall be notified of water or sewer service interruptions in sufficient time to prepare for them and shall agree to the hour, date, and duration of them before they are undertaken.

B. Should shutdowns in service be greater than the time of duration agreed upon, and such excessive shutdown time is due to the Contractor's negligence, faulty work and/or inability to perform, then and in that event, the Contractor shall be held liable to the City of Madisonville for all damages that may result to the City of Madisonville, because of such excessive shutdown periods.

C. Digging through services with trenching machines will not be permitted. Upon damage to utility services, such services shall be repaired immediately and tested to the satisfaction of the Engineer. The Contractor shall notify all utility users of impending interruption of service and shall be responsible for all damage resulting from same.

D. The Contractor shall always maintain on hand an adequate supply of repair materials and tools with which to make repairs to damaged water, gas, and sewer lines. Should the Contractor inadvertently damage existing utilities, he shall make immediate repair thereto and in no event shall the Contractor leave the site before such repair has been made and proven to be successful.

E. Exact locations of existing utilities cannot be guaranteed. It shall be the responsibility of the Contractor to locate and uncover existing lines, to which new mains are to be connected, and provide all connecting fittings of the correct site and type for each connection.

1.03 PROPERTY PROTECTION

A. Care is to be exercised by the Contractor in all phases of construction, to prevent

damage and/or injury to property other than that provided for the construction of the work.

B. The Contractor shall avoid unnecessary injury to trees and shall remove only those authorized to be removed by written consent of the Developer or Engineer. Fences, gates, and terrain damaged or disarranged by the Contractor's forces shall be immediately restored in their original condition or better.

1.04 CONSTRUCTION WARNING SIGNS

A. The Contractor shall provide construction-warning signs for each location where he is working within the State Highway right-of-way and/or in City Streets. He will further provide flagmen as required and shall abide by all Kentucky Transportation Cabinet, Department of Highways safety rules, including size, type, and placement of construction signs. All signs shall be of professional quality. The Engineer shall be responsible for the enforcement of this activity. Contractor shall abide by all provisions of the Manual of Uniform Traffic Control Devices, Part VI, latest edition.

1.05 RESPONSIBILITY FOR TRENCH SETTLEMENT.

A. The Contractor shall be responsible for any settlement caused by the construction that occurs within one year after the Final Acceptance of this work.

12.3 SPECIAL PROVISIONS FOR MATERIAL AND EQUIPMENT

PART 1 - GENERAL

1.01 SERVICES OF MANUFACTURER'S REPRESENTATIVE AND OPERATING MANUALS

A. The Engineer shall furnish written Operation and Maintenance Instructions for the City of Madisonville's operating personnel on operation and maintenance of submersible sewage pumping station or other items requiring daily operation and maintenance.

B. Two (2) complete sets of Operation and Maintenance Instructions covering all equipment furnished on the project shall be delivered directly to the City of Madisonville.

1. The manual for each piece of equipment shall be a separate document with the following specific requirements:

Contents:

a. Table of contents and index.

b. Brief description of each system and components.

c. Special operating instructions.

d. Routine maintenance procedures.

e. Manufacturer's printed Operating and Maintenance Instructions, parts list, illustrations, and diagrams. These shall be specific to the material supplied under the contract, and not a manufacturer general brochure.

f. One (1) final accepted copy of each Shop Drawing.

g. List of spare parts, manufacture's price, and recommended quantity.

h. A manufacturer's name, address, and telephone number.

i. Name, address, and telephone number of manufacturer's local representative.

12.10 SITE CLEARING AND GRUBBING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The Contractor shall furnish all labor and equipment required to perform all clearing, grubbing, and stripping of topsoil as shown on the Construction Plans and as specified herein.

1.02 RELATED WORK

Not applicable.

1.03 SUBMITTALS

None required for this Section.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

3.01 GENERAL

A. The proposed areas designated for water mains, gravity sewer lines, force mains, and sewage pumping stations, etc., shall be cleared of all trees, timber, brush, stumps, rubbish, and other debris. All this material, unless otherwise specified, shall be removed and disposed of away from the site in accordance with all applicable laws and ordinances. Should the Developer request that the City of Madisonville provide the labor and materials to install the water distribution system, the Developer's Contractor shall clear all rights-of-way and utility easements before construction by the City of Madisonville employees.

B. No debris will be allowed to be left under or in trench line.

C. In removing trees near tracks, structures, and wire lines, necessary precautions must be exercised to prevent damage to wire lines, structures, the facilities of others, or obstruct tracks.

12.11 DEWATERING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The Contractor shall furnish all labor and equipment required to dewater all trench excavations. Dewatering of all excavations shall be the responsibility of the Contractor.

1.02 RELATED WORK

A. Crushed stone and DGA is included in Section 12.12.

1.03 SUBMITTALS

None required.

PART 2 - PRODUCTS

None in this Section.

Part 3 - EXECUTION

1.01 GENERAL

A. Dewatering equipment shall be of adequate size and quantity to assure maintaining proper conditions for installing pipe, concrete, backfill, or other material or structure in the excavation. Dewatering shall include proper removal of all liquid, whatever the source, from the excavation and the use of all practical means available to prevent surfaces runoff from entering any excavation. No pipe shall be laid when the surface elevation of ground water is above the proposed bottom of pipe elevation.

Water removed in these operations shall be discharged in such a manner that silt does not enter the waterways. Silt protection devices, such as straw bales with silt fences shall be employed at the discharge of the hose.

12.12 CRUSHED STONE AND DENSE GRADED AGGREGATE (DGA)

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish and install crushed stone aggregates and DGA as indicated on the Construction Plans and/or required in the Specifications for such uses as temporary and permanent traffic bound surfacing over trenches; and other miscellaneous applications required in the work.

B. Various sizes, types, and quality of crushed stone aggregates are specified in this section depending on applicability that may be specified in detail in other sections of these specifications.

1.02 SUBMITTALS

Not required.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Crushed stone aggregate shall meet the applicable requirements for the intended use according to Section 805 of the Kentucky Transportation Cabinet, Department of Highways, and Standards Specifications for Road and Bridge Construction, 2000 edition.

B. Unless otherwise referred to on the Construction Plans or in these Specifications, crushed stone aggregate shall be graded size No. 57 according to the table below.

C. When referred to on the Construction Plans or in these Specifications, dense graded aggregate (DGA) shall have a sand equivalent value of not less than 25 and shall be graded according to the table below.

D. Coarse aggregate gradations referred to by number size on the Construction Plans or in these Specifications shall conform to the following table (as copied from the above Kentucky Transportation Cabinet Specifications, Table 805.07):

SIZES OF COARSE AGGREGATES																	
	Sieve	**AMOUNTS FINER THAN EACH LABORATORY SIEVE (SQUARE OPENINGS) PERCENTAGE BY WEIGHT**															
Size	**Size (mm)**	**4-in**	**3 ½--in**	**3-in**	**2 ½-in**	**2-in**	**1 ½-in**	**1-in**	**¾-in**	**½-in**	**3/8-in**	**No. 4**	**No. 8**	**No. 16**	**No. 30**	**No. 100**	**No. 200**
1	3 ½--in	100	90-100		25-60		0-15		0-5								
2	2 ½-in			100	90-100	35-70	0-15		0-5								
23	2 ½-in			100		40-90		0-15		0-5							
3	2-in				100	90-100	35-70	0-15		0-5							
357	2-in				100	95-100		35-70		10-30		0-5					
4	1 ½-in					100	90-100	20-55	0-15		0-5						
467	1 ½-in					100	95-100		35-70		10-30	0-5					
5	1-in						100	90-100	20-55	0-10	0-5						
57	1-in						100	95-100		25-60		0-10	0-5				
610	1-in						100	85-100		40-75		15-40					
67	¾-in							100	90-100		20-55	0-10	0-5				
68	¾-in							100	90-100		30-65	5-25	0-10	0-5			
710	¾-in							100	80-100		30-75	0-30					
78	½-in								100	90-100	40-75	5-25	0-10	0-5			
8	3/8-in									100	85-100	10-30	0-10	0-5			
9-M	3/8-in									100	75-100	0-25	0-5				
10[1]	No. 4										100	85-100				10-30	
11[2]	No. 4										100	40-90	10-40			0-5	
Dense Graded Aggregate	¾-in							100	70-100		50-80	30-65			10-40		4-13
Crushed Stone Base	2-in				100		90-100		60-95		30-70	15-55			5-20		0-8

[1] Gradation performed by wet sieve KM 64-420

[2] Sizes shown for convenience and are not to be considered as coarse aggregates.

Note: The Department will allow blending of same source/same type aggregate when precise procedures are used such as cold feed, belt, or equivalent and combining of sizes or types of aggregate using the weigh hopper at concrete plants or controlled feed belts at the pugmill to obtain designated sizes.

E. Testing:

1. Unless otherwise required in this Section, the Engineer shall determine the tests required for crushed stone aggregates according to Section 805. The Contractor shall be responsible for delivering materials proposed for use or being used in the work to a testing laboratory selected by the Engineer. This provision shall apply to any other aggregate tests required in this section.

2 The Developer shall be responsible for paying the laboratory testing costs. Once a material has been tested and accepted for use, the Contractor shall be responsible throughout the job to use materials that are equal in all respects and from the same source as that accepted material delivered to the testing laboratory.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Compacted Crushed Stone Aggregate

1. Crushed stone shall be placed in uniform layers not greater than six (6) inches deep and shaped by power equipment to required lines, grades, cross connections, and depths. No minimum compacted density, method of compaction, or compaction equipment is required since a nominal amount of compaction effort with vibration can establish the desired intergranular locking of the aggregate under controlled placement depth. Acceptable compaction can be achieved with pneumatic-tired and tracked equipment and rollers.

2. All compaction operations shall be performed to the satisfaction of the Engineer.

3. Crushed stone shall be placed in those areas as shown on the Construction Plans and as may be directed by the Engineer.

B. Compacted Dense Graded Aggregate (DGA)

1. DGA shall be plant mixed with water, transported in a way that delivers the mix to the project without loss or segregation, spread, and compacted to produce a density throughout not less that 84-percent of solid volume.

   Minimum dry density for compacted limestone DGA shall be 139-pounds per cubic foot when the specific gravity (S.G.) of limestone is 2.65. Construction requirements shall be according to Section 302 of Kentucky Transportation Cabinet, Department of Highways, and Standard Specifications for Road and Bridge Construction, 2000 edition (KTCSSRBC).

2. Density tests shall be required in such number as determined by the Engineer. Density tests shall be made using a nuclear density meter, or other method referenced in Section 302 of the Standard Specifications for Road and Bridge Construction. The Contractor shall furnish all necessary labor, equipment, and materials for making the density tests under observations of the Engineer.

3. Compacted material that does not meet density requirements shall be removed. The Engineer shall determine if removed material can be remixed and used again for fills.

12.13 STEEL CASING PIPE

PART 1- GENERAL

1.01 SCOPE OF WORK

A. Steel casing pipe shall be furnished and installed as shown on the Construction Plans and specified herein.

1.02 RELATED WORK

A. Water pipe is specified in Section 12.16.
B. Gravity sewer and sanitary force main pipe is specified in Section 12.17.

PART 2 - PRODUCTS

2.01 STEEL CASING PIPE

A. Steel casing or jack pipe shall be plain end steel pipe with minimum yield strength of 35,000 p.s.i. and tensile strength of 60,000 p.s.i. per API-5L Grade B material. The steel pipe supplied shall be manufactured by the seamless, electric-weld, submerged-arc weld, or gas metal-arc weld process as specified in API-5L. Certification of 35,000 p.s.i. minimum yield strengths shall be furnished by the supplier through the Engineer in sufficient copies before pipe is shipped to job to permit the City of Madisonville to retain two copies.

B. The inside diameter of steel casing pipe shall be at least four (4) inches greater than the largest outside diameter of the bell of the carrier pipe, joints, or couplings.

C. Casing pipe shall have a minimum wall thickness as shown in the following table.

Nominal Diameter Inches	Nominal Wall Thickness Inches	Nominal Diameter Inches	Nominal Wall Thickness Inches
Under 10	0.188	18	0.312
10 & 12	0.250	20	0.344
14 & 16	0.281	22	0.375

PART 3 - EXECUTION

3.01 TUNNELING, BORING, OR JACKING

A. Boring or jacking as specified herein will be allowed at locations other than those noted on the Construction Plans, where advantageous to lay pipe under streets, driveways, and sidewalks without their monolithic structure being destroyed.

B. Tunneling under paving, railroads, buildings, and underground structures is included as an alternate to boring or repaving required by open cut trenching. Bore and casing pipe is also included as an alternate to tunneling. Backfilling of tunnels shall be mechanically tamped in not more than three (3) inch layers and with materials rendered suitable for tamping before being placed in tunnels unless otherwise shown on the Construction Plans.

C. In tunneling under buildings, the Contractor will be held responsible for all damage by his operations and methods of excavation and backfilling.

D. Boring and jacking under highways, railroads, sidewalks, pipelines, etc., shall be done at the locations shown on the Construction Plans. It shall be performed by mechanical means and accurate vertical and horizontal alignment must be maintained. When shown on the drawings, casing pipe shall be used and shall be installed inside bored holes concurrently with boring, and jacking.

3.02 STEEL CASING PIPE INSTALLATION

A. Steel casing pipe shall be of the size and wall thickness as shown on the Construction Plans.

B. When casing pipe is jacked, concurrent with boring, all joints shall be solidly welded. The weld shall be such that the joint shall be of such strength to withstand the forces exerted from the boring and jacking operation and the vertical loading imposed on the pipe after installation. The weld shall also be such that it provides a smooth, non-obstructing joint in the interior of the pipe that will allow easy installation of the carrier pipe without hanging or abrasion to the carrier pipe upon installation.

C. When casing pipe is installed in an open trench, it shall be bedded and backfilled per the Specifications applying to sewer pipe in such locations. When casing pipe is installed in an open trench, it shall be laid accurately to alignment of the proposed sewer and at an elevation below sewer necessary to support it at the planned elevation.

D. Casing pipe in an open trench, a permanent tunnel, and temporary tunnel shall be joined in such manners that they will not be moved out of alignment or grade and that will prevent backfill material from entering joint.

3.03 CARRIER PIPE IN CASING PIPE INSTALLATION

A. Pipeline Spacers

1. Pipes installed inside casing pipes shall be centered throughout the length of the casing pipe. Centering shall be accomplished by the installation of heavy-duty stainless steel pipeline spacers, with two (2) inches wide glass reinforced plastic runners, attached to the pipe in such manners as to prevent the dislodgement of the spacers as the carrier pipe is pulled or pushed through the casing pipe. Spacers shall be of such dimensions to provide (1) full supportive

load capacity of the pipe and contents, (2) of such thickness to allow installation and/or removal of the pipe, and (3) to allow no greater than one (1) inch movement of the carrier pipe within the casing pipe after carrier pipe is installed. All attachment hardware shall be stainless steel.

2. Spacers shall be located immediately behind each bell and at a maximum spacing distance as follows:

Pipeline Diameter (in.)	Maximum Spacing (ft.)
8" to 12"	7'
15" to 27"	4.3'

The materials and spacing to be used shall be approved by the Engineer and the City of Madisonville before installation. The pipeline spacers shall be manufactured by PowerSeal, Model 4810 (stainless steel, center restrained) of Wichita Falls, Texas, or the City of Madisonville approved equal. Installation shall be according to manufactures' recommendations.

3. Upon completion of installation of the carrier pipe, the annular space at the ends of the casing pipe shall be sealed to prevent the entrance of groundwater, silt, etc., into the casing pipe. The seal shall be a manufactured product specially made for this purpose. The seal shall be Link Seal - PL, or approved equal.

12.14 STREETS, ROADS, AND PARKING AREAS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall provide all labor, materials, equipment, and services required to construct access roads and parking areas as shown on the Construction Plans and as specified herein.

1.02 RELATED WORK

A. Crushed stone, DGA, paving, and concrete are specified in Sections 12.12, 12.15, and 12.20 of this chapter.

1.03 SUBMITTALS

A. Shop Drawings, manufacture's data, and other items needed to establish compliance with the Construction Plans and these Specifications shall be submitted to the Engineer according to Section 12.1 - Shop Drawings, Product Data, and Samples.

1.04 WARRANTY

A. The Contractor shall warrant all work performed for one (1) year after issuance of the "Notice of Acceptance."

PART 2 - PRODUCTS

2.01 CONSTRUCTION MATERIALS

A. Concrete materials and methods of installation are specified in Section 12.20.

B. Crushed stone and dense graded aggregate materials are specified in Section 12.12.

C. Bituminous paving materials and methods of placement are specified in Section. 12.15.

D. Seeding materials and methods of construction are specified in Section 12.18.

PART 3 - EXECUTION

3.01 DELIVERY, STORAGE, AND HANDLING

A. Clearing and Grubbing.

1. Clearing and grubbing requirements shall be as stated in Section 202 of KTCSSRBC except that the method of payment as stated therein shall not

apply.

B. Erosion Control

1. The requirements for erosion control shall be per KTCSSRBC - Section 212.

C. Water Pollution control

1. The requirements for water pollution control shall be per KTCSSRBC Section 213.

12.15 BITUMINOUS PAVING

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall be required to supply all materials and equipment and perform all work for the placement of the base and/or surface course for restoring to the preconstruction condition the surface of the existing streets, roads, drives, and parking areas to the depths as shown in the Construction Plans and as specified herein.

1.02 REFERENCES

A. Unless noted, all Specifications designations denoted KTCSSRBC refers to the Kentucky Transportation Cabinet Department of Highways Standard Specification for Road and Bridge Construction. Appropriate technical portions of the referenced section of the Specifications shall apply, but all work shall be as described herein unless otherwise specified or shown on the Construction Plans.

1.03 RELATED WORK

A. Special requirements for materials and equipment are given in Sections 12.1 and 12.3.

B. Crushed stone surfacing requirements, temporary and permanent replacement, are specified in Section 12.12 of these Specifications.

1.04 WORK DESCRIPTION

A. Bituminous concrete shall be used for replacement of city streets, drives, parking areas, and state highways of bituminous construction and for resurfacing existing roads and state highways at locations shown on the drawings or specified.

1.05 QUALIFICATIONS

A. The pavement design mixture shall be used as determined by local plant mix availability. The design mixture shall be of the current standard approved recently by the Kentucky Transportation Cabinet Department of Highways and used recently on a state-paving project.

B. The design mix shall be submitted to the Engineer for review and acceptance. The submittal shall include the following.

1. The last date the mixture was approved by the Kentucky Transportation Cabinet Department of Highways for use on a state road project.

2. The location where the mixture was recently used, and the name and address of the paving Contractor.

1.06 SUBMITTALS

A. Shop Drawings, manufactures' data, and other items needed to establish compliance with the drawings and specifications shall be submitted to the Engineer according to Section 12.1.

PART 2 - PRODUCTS

2.01 BITUMINOUS CONCRETE PAVING

A. Mixture

1. Bituminous concrete mixture shall conform to the applicable requirements of KTCSSRBC Section 401, Bituminous Plant Mixed Pavements-General, and Section 402, Bituminous Concrete Surface and Binder. The pavement mixture shall meet the requirements of Sections 401.02 through 401.05 and conform to the requirements below when tested according to ASTMD 1559-76:

Stability, minimum pounds	750	
Flow, 0.01 inch	Min .8; Max. 16	
Percent air voids	Min .3; Max. 5	
Minimum voids in the mineral.		
Aggregate, percent	3/4 in.	14
1 in.		13
Voids filled, percent	Min. 75; Max. 85	

B. Fine aggregates shall meet the requirements of KTCSSRBC Section 804

C. Coarse aggregates shall meet the requirements of KTCSSRBC Section 805.

D. Bituminous materials shall meet the requirements of KTCSSRBC Section 806.

E. Bituminous materials for tack coats shall be one of the following: SS-1, SS-1h, CSS-1, CSS-1h, AE-60, RS-1, CRS-1, RC-70, or RC-250.

PART 3 - EXECUTION

3.01 GENERAL

A. Construction requirements shall conform to applicable requirements of Section 401, 402, and 407 of KTCSSRBC.

B. A tack coat shall be required to bond new paving to the surface of concrete or brick pavements and bases or existing bituminous surfaces. It shall be applied at the rate of 0.8 pounds (0.1 gallons) per square yard at the following range of application temperatures:

SS-1, SS-1h, CSS-1, CSS-1h, AE-60	21-71ºC (70-160ºF)
RS-1, CRS-1	21-60ºC (70-140ºF)

C. When SS1, SS1h, CSS1, CSS1h, or AE60 is furnished for tack material, it shall be diluted with an equal quantity of water conforming to Section 803, shall be thoroughly mixed before application, and shall be applied a sufficient time ahead of the paver to ensure that all water has evaporated before the bituminous concrete mixture is placed. The application rate shall be 0.8 pounds (0.1 gallons) per square yard of the diluted SS1, SS1h, CSS1, CSS1h, or AE60

D. Where bituminous paving is placed against vertical surfaces such as curbs, gutters, manhole frames, valve boxes, etc., the vertical face shall be tack coated to seal the surface. Where these surfaces are inaccessible to pressure distributors, the tack coat may be brushed or broomed into place. The tack coat shall not be allowed to spill over onto any horizontal surface outside the area to be paved.

E. Unless otherwise indicated on the drawings or in these specifications, the compacted thickness of the bituminous concrete paving shall be a minimum of two (2) inches (minimum size roller shall be 10-tons) and the minimum ambient temperature for placing shall be 40ºF. Mixing and laying temperatures shall be as follows:

Aggregates	Min. 116ºC (240ºF)-Max. 163ºC (325ºF)
Asphalt Cement	Min. 107ºC (225ºF)-Max. 163ºC (325ºF)
Mixture at Plant (measured in truck)	Min. 116ºC (240ºF)-Max. 163ºC (325ºF)
Mixture When Placed (measured in truck when discharging)	Min. 225ºF

F. Trucks for hauling bituminous mixtures shall have tight, clean, and smooth metal beds that have been sprayed with a minimum amount of soap emulsion, paraffin oil, or other approved material that is not detrimental to the mixture to prevent the mixture from adhering to the beds. All trucks shall be equipped with covers of sufficient size to cover the loaded material completely, and all covers shall be securely fastened in place before the truck leaves the plant. Truck beds shall be insulated, when necessary, to maintain the specified temperature to the point of delivery. Any truck causing excessive segregation of material by its spring suspension or other factors shall be discharged from the work, until such conditions are corrected.

G. The Contractor shall have an accurate thermometer on the job at all times for verifying all temperature requirements and for taking temperature measurements whenever requested by the Engineer or the City of Madisonville. The Contractor shall closely control temperature and compaction requirements to achieve quality bituminous paving and related work.

H. Bituminous paving that fails as the result of not meeting the requirements of these Specifications shall be removed and replaced as directed by the Engineer and/or the City of Madisonville.

3.02 TRENCH WIDTH REPAVING - CITY AND COUNTY STREETS, ROADS, AND PARKING AREAS

A. The cut edges of the existing paving surface shall be saw cut to a depth of at least four (4) inches to straight lines, 12-inches on each side of trench for uniform appearance and clean surfaces at joints. The area between the cut edges of the paving shall be removed to a depth of two (2) inches (minimum) or to the bottom of the existing paving. All unstable material in the trench shall be removed and replaced with mechanically compacted dense graded aggregate and dense graded aggregate added as needed to bring the base surface to the bottom of existing paving or two (2) inches below the existing surface, whichever is the lower.

B. The paving subgrade shall be compacted under the wheel of a steel roller or asphalt compactor, until there is no observed settlement of the subgrade.

C. The sides of existing pavements shall be covered with a tack coat and bituminous paving shall be hot applied as previously described. Final surfaces shall be finished to one-fourth (1/4) inch above existing paving surfaces at edges and crowned to one-half (1/2) inch above existing surfaces at the center.

D. The Contractor shall maintain such repaving up to grade of existing street surface until completion and acceptance of work. During the guarantee period of one (1) year, the Contractor will be responsible for defective materials or construction, and settlement.

E. If additional bituminous paving is to be added due to settlement, surface to be built up shall have all dirt removed and such surface swept clean with a stiff wire brush or broom. A tack coat shall be applied to the clean surface and additional paving placed in quantity required. Traffic shall be prevented from passing over the treated surface before the additional paving materials are placed.

3.03 TRENCH WIDTH REPAVING - STATE MAINTAINED STREETS AND HIGHWAYS

A. Streets, roads, and highways maintained by the Kentucky Transportation Cabinet Department of Highways shall be repaved according to details shown on the Department of Highways Drawing No. TD99-13, latest revision.

B. Concrete base slabs shall be cleaned and tack coated, and bituminous paving shall be hot applied as previously described.

C. Widths, depths, and other details and methods of application shall be as shown on attached drawing and as required by the Kentucky Transportation Cabinet, Department of Highways.

D. The Contractor shall maintain the bituminous surface of all state highways and state maintained streets to grade during the entire guarantee period of the work.

12.16 WATER PIPE AND FITTINGS

PART 1 - GENERAL

1.01 SUMMARY

A. Water pipe shall be furnished and installed as planned and specified herein for proposed water mains, service lines, force mains, and related appurtenances.

1.02 RELATED WORK

A. For casing pipe and boring and jacking see Section 12.13.

B. For valves and fire hydrants see Section 12.62.

C. For miscellaneous water appurtenances see Section 12.63.

1.03 SUBMITTALS

A. Submittal Requirements

1. Shop Drawings are required.

2. All testing and certification requirements for descriptive literature remain as described herein.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Ductile Iron Pipe - Mechanical and Rubber Slip Joint Type

1. Pipe

a. General

(1) Ductile iron pipe shall be furnished for all piping three (3) inches and over in size designated "D.I." on Drawings and shall be designed according to ANSI/AWWA C150/A21.50-91 and ANSI/AWWA C151/A21.51-91 specifications and supplements thereto, and for pressures and conditions as stated in Article b below.

b. Design Conditions

(1) Pressure: Minimum 250 p.s.i. operating pressure, as shown in Table below, plus 100 p.s.i. water hammer allowances.

(2) Trench Loading: Laying Condition Type 3, depth of cover as shown on Drawings.

c. Metal Design Strength (Minimum)

Tensile Strength	60,000 p.s.i.
Yield Strength	42,000 p.s.i.
Percent Elongation	10 percent

d. Minimum Nominal Thickness

(1) Minimum design thicknesses for 200 through 350 p.s.i. operating pressure, depths of cover, trench loading, and other conditions per ANSI/AWWA C150/A21.50-91 specifications shall be as shown in the following table:

TABLE OF THICKNESSES
FOR DUCTILE IRON PIPE

Size	Outside Diameter Bell (in.)	Standard Thickness Class (p.s.i.)	Standard Wall Thickness (in.)	Laying condition Type 3 Trench Maximum Depth of Cover (ft.)
4"	4.80	51	0.26	
6"	6.90	50	0.25	44
8"	9.05	50	0.27	36
10”	11.10	50	0.29	29
12"	13.20	51	0.34	27

(2) For depths of cover exceeding those in the above table, refer to ANSI/AWWA C150/A21.50-91.

e. Lengths

(1) Pipe may be furnished in 18 or 20-foot nominal laying lengths.

f. Marking

(1) The net weight, class or nominal thickness, and casting period shall be shown on each pipe. The manufacturer’s mark, the year in which the pipe was produced, and the letters “DI” or “DUCTILE” shall be cast or stamped on the pipe.

g. Weighing

(1) Each pipe shall be weighed before application of lining or

coating other than standard coating and the weight shown on the outside or inside of the bell or spigot end.

h. Spigot End of Pipe

(1) The spigot end of the pipe shall be free of blemishes and defects that, in the opinion of the Engineer or the City of Madisonville, might be responsible for a poor fit with the rubber ring gasket and result in leakage.

2. Fittings

a. General

(1) Ductile iron compact fittings, meeting the requirements of ANSI/AWWA C153/A21.53-94, shall be used through 12-inch diameter.

(2) Fittings shall be 350 p.s.i. pressure rating for sizes through 12-inch.

(3) Fittings shall be furnished complete with all joint accessories.

b. Lining and Coating

(1) All fittings shall be lined and coated the same as adjacent pipe.

3. Joints

a. General

(1) Pipe joints shall be a mechanical joint, rubber ring slip joint, or locked mechanical joints as shown on the Construction Plans.

(2) All items used for jointing pipe shall be furnished with the pipe. The joints shall be made with tools and lubricant in strict conformity with the manufacturer's instructions. Copies of the instructions shall be delivered to the Engineer and the City of Madisonville at the start of construction in sufficient numbers that will permit the City of Madisonville to retain two (2) copies.

b. Mechanical Joints

(1) Mechanical joints are to be furnished according to ANSI/AWWA C111/A21.11-90. All pipe joints must be furnished complete with all accessories. Mechanical joint bolts and nuts shall be of alloy cast iron or alloy steel (Corten

type such as U.S. Alloy) or equal. Rubber gaskets shall be made of plain, first grade rubber, free of imperfections, and porosity. Hardness shall be 75 ± 5 durameter.

c. Rubber Ring Slip Joint (Push on)

(1) Rubber ring slip joint shall be equal to ANSI/AWWA C111/A21.11-90. The joints shall be of the following materials and assembled in the sequence outlined below:

a. Rubber ring gasket compressed in groove in the bell of pipe.

b. Beveled spigot end of pipe for initial centering into rubber gasket in the bell.

4. Lining and Coating for Water Service

a. Water Service

(1) All ductile iron pipe and fittings for water service shall have manufacturer's standard outside bituminous or asphaltic base coating and a cement lining and a bituminous seal coat on the inside. Cement mortar lining and bituminous seal coats inside shall conform to ANSI/AWWA C104/A21.4-90.

b. Bitumastic Finish Coat

(1) Only a coal tar outside coating, or other compatible coating, hall be applied to pipe, which is to receive a bitumastic finish coating.

B. Copper Pipe and Fittings

1. Outside, Underground Tubing

a. Small water piping up to and including two (2) inch size in the ground shall be of standard soft copper tubing for water service pipe, ASTM Specification B 99-81, Type " K ", with bronze fittings, stops, and valves having connections for flared copper tubing.

C. Polyvinyl Chloride (PVC) Pipe (ASTM)

1. Pipe

a. This Specification covers rigid polyvinyl chloride pipe and fittings, hereinafter called PVC pipe and PVC fittings, for sizes three-fourths 2

inch through 12-inch.

b. PVC pipe shall be extruded from Class 12454-B polyvinyl chloride material with a hydrostatic design stress of 2000 psi for water at 73.4ºF, designated as PVC 1120, meeting ASTM Specifications D 1784-81 for material 40 as specified in ASTM D 1785-76.

c. The pipe shall be homogeneous throughout and free from cracks, holes, foreign inclusions, or other defects. The pipe shall be uniform as commercially practical in color.

d. The workmanship, pipe dimensions and tolerances, outside diameters, wall thickness, eccentricity, sustained pressures, burst pressures, flattening, extrusion quality, marking, and other requirements of ASTM D 2241-80 shall be conforming with all respects.

e. Pipe shall be furnished in 20-foot lengths. The pipe shall have a bell on one end. Male end of the pipe shall be beveled on the outside.

f. Pipe shall be furnished from the manufacturer with a ring painted around the male end as to allow field checking of setting depth of pipe in the socket. This requirement is made to assist construction superintendents and inspectors in visual inspection of the pipe installation.

g. Pipe must be delivered to the job site by means that will adequately support it, and not subject it to undue stresses. In particular, the load shall be so supported that the bottom rows of pipe are not damaged by crushing. Pipe shall be unloaded carefully and strung or stored as close to the final point of placement as is practical.

h. Pipe must not be exposed to the direct rays of the sun for extended periods of time. If pipe is not installed within 15-days after delivery to the job site, it shall be covered with black plastic.

2. Fittings

a. Ductile Iron

(1) Ductile iron mechanical joint type fittings with appropriate adapters shall be used with PVC pipe. All such fittings shall be approved by the pipe manufacturer. The use of transition gaskets will not be allowed unless specifically approved by the pipe manufacturer.

3. Joints

a. Exterior Buried Pipe - Slip Joint Type

(1) Exterior buried pipe shall be jointed with slip-type joints with rubber gaskets.

(2) Pipe with bells shall have all the parts of the bell, including the gasket groove, made from the same extruding piece, integral with the pipe, and shall be thickened to meet standard dimension ratios of wall thickness to outside diameter. The gasket groove shall be constructed such that gasket roll out will not occur. Rubber gaskets shall conform to ASTM D 3139-77.

b. Couplings

(1) Coupling shall be same material as ductile iron pipe as specified in this section.

2.03 SOURCE QUALITY CONTROL

A. Ductile Iron Pipe (Mechanical Joint and Rubber Slip Joint Type)

1. Hydrostatic and physical properties' acceptance tests shall be according to ANSI/AWWA Specification C151/A21.51-91 for ductile iron pipe centrifugally cast in metal molds or sand lined molds for water or other liquids.

2. The Engineer and the City of Madisonville shall be provided with sufficient copies of each test to permit the City of Madisonville to retain two (2) copies.

3. All items used for jointing pipe shall be tested before shipment.

PART 3 - EXECUTION

3.01 TRENCH EXCAVATION

A. General

1. Trenching shall include all clearing and grubbing, including all weeds, briars, trees and stumps encountered in the trenching, regardless of size. The Contractor shall dispose of any such material by burning, burial or hauling away or as noted on the Construction Plans.

2. Trenching also includes such items as railroad, street, road, sidewalk, pipe, small creek crossings, including cutting, moving or repairing damage to fences, poles or gates, and other surface structures, regardless of whether shown on the drawings. The Contractor shall protect existing facilities against danger or damage while the pipeline is being constructed and backfilled or

from damage due to settlement of the backfill.

3. Materials encountered in excavation will be divided into only two (2) classes: solid rock excavation and other materials. Pipe must not be laid upon rock or other unyielding surface.

4. All excavations shall be open trenches, except where the Construction Plans call for tunneling, boring, or jacking under structures, railroads, sidewalks, roads, or highways.

B. Trees and Shrubs

1. Where pipelines run through wooded terrain, cutting of trees within limits of the rights-of-way or easement, as set forth in this article, will be permitted. However, cutting of additional trees on sides of the rights-of-way or easement to accommodate operation of trenching machines will not be permitted. The Contractor shall obtain specific written permission of the property owner before cutting any tree on property other than the Developer's property.

C. Highways, Streets and Railroads

1. Construction equipment damaging to paving encountered shall not be used. Curbs, sidewalks, and other structures shall be protected by the Contractor from damage by his construction equipment.

2. Where trenching is cut through paving which does not crumble on edges, trench edges shall be cut to at least two (2) inches deep to straight and neat edges, before excavation is started, and care taken to preserve the edge to facilitate neat repaving.

3. The Contractor shall so coordinate his work as to produce a minimum of interference with normal traffic on highways and streets. He may, with the approval of the governing agency, close a street to traffic for such length of time considered necessary, provided persons occupying property abutting the street have an alternate route of access to the property that is suitable for their needs during the time of closure. It shall be the responsibility of the Contractor to give 24-hours advance notice to fire and Police Departments and to occupants of a street that will be closed, in a manner approved by the governing body.

4. The Contractor shall maintain all road crossings.

5. Railroad and Highway Department requirements in regard to trenching, tunneling, boring, and jacking shall take precedence over the foregoing specifications and the following tunneling and boring or jacking specifications, where they are involved. Where work is within railroad right-of-way, Railroad Protective Insurance shall be carried by the Contractor in the

amounts required by the Railroad Company.

6. The insurance policy shall name the Railroad as the insured and the original policy shall be delivered to the Railroad after submitting same to the City of Madisonville for review.

7. Uneven surfaces or bumps in the ground encountered and high driveways and road crossings shall be dug through to such depths that pipe may be laid to a reasonably even grade and have minimum cover at the low places.

D. Existing Utilities

1. The Contractor shall determine, as far as possible in advance, the location of all existing sanitary sewer, storm drainage facilities, water mains, underground electric conduit, telephone cables, gas pipelines, and other subsurface structures and avoid disturbing same in opening trenches. In case of sanitary sewer, water, and gas services and other facilities easily damaged by machine trenching, same shall be uncovered without damage ahead of trenching machine and left intact or removed without permanent damage ahead of trenching and restored immediately after trenching machine has passed. The Contractor shall protect such existing facilities, including power and telephone poles and guy wires, against danger or damage while the pipeline is being constructed and backfilled, or from damage due to settlement of his backfill. It shall be the responsibility of the Contractor to inform the customers of utilities of disruption of any utility service when it is known that it has been or will be cut off.

2. The Contractor shall, at all times during trenching operations, carry a stock of pipe, and fittings likely to be needed for replacement of pipelines to facilitate immediate repair.

E. Location of Proposed Pipelines

1. The locations of pipelines and their appurtenances as shown on the drawings are those intended for the final construction. However, conditions may present themselves before construction on any line is started that would indicate desirable changes in location. Also, development of property traversed may require location changes. In such cases, the Engineer and the City of Madisonville reserves the right to make reasonable changes in line and structure locations. The Engineer and the City of Madisonville are under no obligation to locate pipelines so that they may be excavated by machine.

F. Trench Requirements

1. All trenches must be dug neatly to lines and grades.

2. The opening of more than 500-feet of trench ahead of pipe laying and more

than 500-feet of open ditch left behind pipe laying, before backfilling, will not be permitted. No trench shall be left open or work stopped on same for a considerable length of time, which constitutes a danger to person and/or property.

3. Where subgrade of the trench has insufficient stability to support the pipeline and hold it to its original grade, the Engineer or the City of Madisonville may order stabilization by various means (i.e., extra excavation, crushed rock for pipe bedding, concrete cradle or piling, etc.).

4. Excavation for pipe laying must be made of sufficient width to allow for proper jointing and alignment of the pipe, but not greater than the maximums permitted in the following table:

MAXIMUM TRENCH WIDTH AT TOP OF PIPE

Nominal Pipe Size	Trench Width
4	28
6	30
8	32
10	34
12	36
14	38
16	40

5. Trenches in earth or rock shall be dug as shown on the Construction Plans and be sufficiently deep to insure a 36-inch minimum cover over pipelines in developed rights-of-ways and a 36-inch minimum cover in utility easements. Depths of trenching shall also be adequate for at least one (1) foot minimum cover over valve nuts. To eliminate the necessity for digging bell holes into the trench subgrade by hand and to insure an earth cushion under the pipe for uniform bearing, trench depth shall be the cover requirement plus outside diameter of the barrel of pipe plus the required bedding cushion. The cushion construction requirement shall also apply to tunnels.

6. Trench line stations and locations of accessories will be set ahead of the trenching. These will be set at least each 100-feet of pipeline. Trenches must be dug true to alignment of stakes. Alignment of trenches or pipes in the trench must not be changed to pass around obstacles such as poles, fences, and other evident obstructions without the permission of the Engineer. Lines will be laid out to avoid obstacles as far as possible, contingent with maintenance of alignment necessary to finding the pipeline in the future and avoiding obstruction to future utilities.

G. Damage to Existing Structures

1. Hand trenching is required where undue damage would be caused to existing structures and facilities by machine trenching.

2. In case of damage to any existing structures, repair and restoration shall be made at once and backfill shall not be replaced until this is done. In all cases, restoration, and repair shall be such that the damaged structure will be in as good condition and serve its purpose as completely as before, and such restoration and repair shall be done. Where there is the possibility of damage to existing utility lines by trenching machine, the Contractor shall make hand search excavation ahead of machine trenching, to uncover same.

H. Dewatering of Trenches

1. Dewatering of trenches shall be considered a part of trenching. Dewatering of trenches shall include groundwater and stormwater. Suitable pumping and other dewatering equipment are to be provided by the Contractor, to insure the installation of the pipeline structure in a dewatered trench and under the proper conditions. Dewatering shall include all practical means available for prevention of surface runoff into trenches and scouring against newly laid pipe. No pipe shall be laid when the elevation of groundwater or storm water is above the invert elevation of the pipe.

   No sewage shall be discharged into streams, ditches, or on the ground. Any discharge of sewage into streams, ditches, or on the ground should be reported to the Kentucky Division of Water, Madisonville Office at (270) 824-7529 and the City of Madisonville at (270) 824-2187, immediately.

2. Piles of excavated materials shall be trenched or temporarily piped to prevent, as far as practical, blockages of drainage ditches and gutters, and water carriage of excavated materials over street and highway surfaces.

3.02 LAYING WATER PIPE

A. General

1. Inspection of Materials

   a. All pipe, fittings, and accessories shall be subject to an inspection by the Engineer at the job site. Any damaged materials shall be repaired or replaced to the satisfaction of the Engineer. Should repairs to the piping materials be necessary, then same shall be made in the presence of the Engineer using proven methods prescribed by the pipe manufacturer.

   b. The City of Madisonville's inspection of materials shall in no way relieve the Contractor or the Engineer of this responsibility.

2. Laying Requirements

a. Water pipe shall be laid to lines, cover, or grades shown on the drawings.

b. Pipes must be swabbed out before lowering into the trench. In the case of pipelines three (3) inch through 16-inch, a swab must also be dragged through the pipe after it is in place. Larger size pipe shall be visually inspected for cleanliness and proper jointing.

c. The points insisted upon in the laying of pipe will be: proper alignment, evenness of width and depth of joints, perfection in jointing, and care of the pipe in handling.

d. Precautions must be taken to prevent flotation of the pipe should water enter the trench before putting the pipeline into operation.

e. In wet, yielding, and mucky locations where pipe is in danger of sinking below grade or floating out of grade or alignment, or where the backfill materials are of such a fluid nature that such movements of the pipe might take place during the placing of the backfill, the pipe must be weighted or secured permanently in place by such means as will prove effective.

f. Whenever pipe laying is stopped, the end of the pipe shall be securely plugged with the manufacturer's standard plug held in place by jute packing, caulked into place.

g. Elbows, plugs, dead end valves, and tees shall be firmly blocked, as shown on the Construction Plans, to prevent internal pressure from springing the pipe from the intended alignment, with permanent materials solidly placed without covering pipe joints. Restrained type pipe joints can be substituted for thrust locks with the Engineer's and the City of Madisonville's written permission. Pipe shall be free of all 0structures, other than manholes.

h. No pipe shall be laid resting on solid rock, blocking or other unyielding objects. Jointing before placing in the trench and subsequent lowering of more than one section jointed together will not be allowed.

3. Installing Water Pipe in Casing pipe

a. See Section 02326 for installation of carrier pipe in casing pipe.

B. LAYING WATER PIPE

1. Water Pipe Bedding

   a. Piping for water mains shall be supported as follows:

      1) The trench bottom for water main piping shall be stable, continuous, relatively smooth and free of frozen material, clodded dirt, foreign material and rock or granular material larger than one-half (1/2) inch in diameter. The foundation for water main piping shall be prepared so that the entire load of the backfill on top of the pipe will be carried uniformly on the barrel of the pipe. Any uneven areas in the trench bottom shall be shaved-off or filled-in with Class I granular bedding. When the trench is made through rock, the bottom shall be lowered to provide six (6) inches of clearance around the pipe. Class I granular bedding shall be used to bring the trench bottom to grade.

      2) After each pipe has been brought to grade, aligned, and placed in final position, earth material for water main piping shall be deposited and densified under the pipe haunches and on each side of the pipe up to the spring line of the pipe to prevent lateral displacement and hold the pipe in proper position during subsequent pipe jointing, bedding, and backfilling operations.

      3) In wet, yielding and mucky locations where pipe is in danger of sinking below grade or floating out of grade or line, or where backfill materials are of such a fluid nature that such movements of pipe might take place during the placing of the backfill, the pipe must be weighted or secured permanently in place by such means as will prove effective.

      4) Where an unstable (i.e., water, mud, etc.) trench bottom is encountered, stabilization of the trench bottom is required. This is to be accomplished by undercutting the trench depth and replacing to grade with a foundation of crushed stone aggregate.

      5) The depth of the foundation is dependent upon the severity of the trench bottom. The size of stone aggregate used in the foundation will be determined by the condition of the unstable material. Once the trench bottom has been stabilized, the required Class I bedding material can be placed.

      6) It should be noted that no pipe shall be laid on solid or blasted rock.

      7) Pipe bedding as required in Paragraphs a, b, and d of this Section is **not** considered a separate pay item.

C. INSTALLATION OF PIPE

Ductile iron pipe shall first be thoroughly cleaned at joints, and then joined according to instructions and with tools recommended by the pipe manufacturer. Sufficient copies of the manufacturer's installation instructions shall be furnished the Engineer and the City of Madisonville to permit the City of Madisonville to retain two (2) copies. One (1) copy, in the possession of the Contractor, shall be available at all times at the site of the work.

All pipes must be forced and held together or "homed" at the joints before bolting. Pipe must be aligned as each joint is placed, to present as nearly true, straight lines and grades as practical, and all curves and changes in grades must be laid so that one-half (1/2) of the maximum allowable deflection shown in the pipe manufacturers catalog is not exceeded. Concrete blocking of fittings shall be as specified hereinafter in this section.

Cutting of pipe may be done by power driven pipe saw or special pipe cutters. Cut edges of the pipe shall be made smooth and bevel formed on the exterior of the pipe barrel when using rubber gasket type pipe.

D. WATER PIPE BACKFILLING

a. Initial Backfill:

1) This backfill is defined as that material which is placed over the pipe from the spring line to a point six (6) inches above the top of the pipe. For water main piping, initial backfill material shall be earth material free of rocks, acceptable to the Engineer or with Class I material when a condition exists mentioned in Paragraph a.3) below.

2) Material used, whether earth or Class I, in the initial backfilling is **not** a separate pay item. Payment for the material is included in the unit price per linear foot of water main.

3) In areas where large quantities of rock are excavated and the available excavated earth in the immediate vicinity is insufficient for placing the required amount of backfill over the top of the pipe as set forth in Paragraph
a.1), the Contractor shall either haul in earth or order Class I material for backfilling over the pipe. Neither the hauling and placement of earth nor the ordering and placement of Class I material to fulfill the backfill requirements set forth herein is considered a separate pay item.

b. Final Backfill:

1) There are (2) two cases where the method of final backfilling varies. The various cases and their trench situations are as follows:

a. Case I - Areas not subject to vehicular traffic.

b. Case II - Paved areas including streets, drives, parking areas, and walks.

2) In all cases, walking or working on the completed pipelines, except as may be necessary in backfilling, will not be permitted until the trench has been backfilled to a point six (6) inches above the top of the pipe. The method of final backfilling for each of the above cases is as follows:

a. Case I - The trench shall be backfilled from a point six (6) inches above the top of the pipe to a point eight (8) inches below the surface of the ground with earth material free from large rock (over one-half (1/2) cubic foot in volume), acceptable to the Engineer. The remainder of the trench shall be backfilled with earth material reasonably free of any rocks.

b. Case II - The trench shall be backfilled from a point six (6) inches above the top of the pipe to a point 12-inches below the existing pavement surface with Class I (No. 9 crushed stone aggregate) material. The backfill shall be mechanically tamped in approximately six (6) inch layers to obtain the maximum possible compaction. The remaining backfill shall be Class II (dense graded aggregate) material mechanically tamped to maximum possible compaction. The trench may be left with a slight mound if permitted by the Engineer. Where required by State or Local Regulations, a bituminous binder coarse shall be incorporated in the final backfill.

E. Laying Copper Pipe and Fittings

1. Bedding and Backfilling

a. The pipe shall be bedded in four (4) inches minimum of loose soil and the hand placed backfill lightly consolidated to a depth of 12-inches above the top of the pipe. "Loose soil" or "select material" is defined as native soil excavated from the trench, free of rocks, foreign materials, and frozen earth. The machine placed backfill may contain rock no larger than four (4) inches in any dimension and to an extent no greater than one-half (1/2) the volume of backfill materials used. The top 12-inches of backfill shall contain no rocks.

2 Installing Copper Pipe and Fittings

a. Exterior copper pipe shall be laid with brass fittings. Joints shall be neatly reamed and flared and joints drawn up firmly. Pipe shall have at least 36-inch cover. Joints shall be tested and all leakage stopped

before backfilling the pipe trench.

b. All copper pipes shall be installed by experienced workers.

F. Installation of Air Release Valves

1. Air Release Valves and Corporation Stops

a. The location of air release valve assemblies, while being noted on Construction Plans, could possibly be shifted in actual construction. For this reason, the same statements relative to the methods of installation of meters and water service connections apply to the installation of air valve assemblies. Air release valve assembly boxes shall be installed with the assembly box located slightly off center of the air release valve, to give better access to the stopcock between the valve and water main.

b. Corporation stops and curb stops, as shown on the Construction Plans, are required between the water main and the air release valve assembly.

G Installation of Fire Hydrants

1. Fire hydrants shall be installed in the general location as shown on the Construction Plans. Exact locations shall be determined in the field. Hydrants shall be set such that the lowest nozzle shall be high enough above the ground to allow the uninhibited 360 swing of an 18-inch hydrant wrench. Hydrants shall be set such that the bury line shall be correct for finish grade. Fire hydrants installed at an incorrect bury shall be adjusted at the Developer's expense.

2. Hydrant drainage pits shall be excavated below the hydrant to the depth shown on the Construction Plans. Crushed stone drainage media shall be of the size shown on the Construction Plans. Hydrants shall be set vertical and anchored as hereinafter specified.

3. Hydrants shall be anchored to prevent the hydrant from blowing off the branch line when suddenly opened or closed. Likewise, the hydrant branch valve shall be anchored to prevent blow-off when the hydrant is removed. The Contractor shall anchor the hydrant and pilot valve utilizing the following procedure:

a. Provide a ductile iron full body swivel hydrant tee (MJ x MJ x
i. swivel).

b. Provide a six (6) inch resilient wedge gate valve with MJ x MJ ends. Install Meg-A-Lug® joint restraint on each end of the pipe lead

between the gate valve and the hydrant.

H. Blocking of Pipe at Bends and Ends

1. General

a. All ductile and fittings shall be double polywrapped prior to the placement of concrete. Care shall be taken to avoid damage to the polywrap.

b. Concrete thrust blocking must be allowed to cure, or protected as approved by the City of Madisonville, before backfilling.

2. Horizontal Bends

a. Concrete thrust blocking required at bends in the horizontal plane shall be accomplished per the City of Madisonville Standard Details for Construction of New Water Mains.

b. The Contractor shall install concrete thrust blocking at each bend in the pipeline of five (5) degrees or greater to withstand maximum test pressure. The Contractor shall provide all material and labor to construct the concrete thrust blocking.

c. Concrete thrust blocks shall be minimum dimension and size as indicated on the City of Madisonville Standard Details for Construction of New Water Mains.

d. Concrete used for thrust blocking shall have 3000-p.s.i. compressive strength at 28-days.

3. Vertical Bends

a. The use of vertical bends in lieu of extra depth trenching shall be subject to permission by the Engineer and the City of Madisonville.

b. Where the Contractor elects to use vertical bends, or where vertical bends are called for on the Construction Plans, the Engineer shall submit the blocking design, including calculations, to the City of Madisonville for review and acceptance. Anchorages shall be designed to resist thrust caused by the internal test pressure in the pipe. Protection against corrosion shall be inherent in the design.

I. Supplemental Backfilling Information

1. General

a. Excavated materials from trenches and tunnels, in excess of quantity required for trench backfill, shall be disposed of by the Contractor. It shall be the responsibility of the Contractor to obtain location or permits for its disposal.

b. Where sod is destroyed in areas maintained equivalent to residential yards, it shall be replaced on slightly ridged backfill on the trench, and where destroyed in areas adjacent to the trench, it shall be replaced by the Contractor with fresh sod. The timing of resodding shall be controlled by the Engineer. Ground shall be prepared and fertilized as herewith specified for seeded areas. In small patches, supplying of three (3) inches of topsoil and raking may be substituted for disking.

c. Where pastures, thin grass, or cover crops are destroyed by trenching, laying, backfilling, or tunneling operations, surfaces shall be prepared by disking, fertilizing, and seeding as specified in Section 12.18. The timing of this operation shall be controlled by the Engineer. Requirements of the Department of Highways for reseeding shall take precedence over these Specifications.

d. Before completion of the project, all backfills shall be reshaped, holes filled, and surplus materials hauled away and all permanent walks, streets, driveways, and highway paving and sod replacement (if such surface replacement items are included in the project) and reseeding performed.

e. Backfill material must be uniformly ridged over the trench, and excess hauled away. Ridged backfill shall be confined to the width of the trench and not allowed to overlap onto firm original earth, and its height shall not be in excess of material needed for replacement of settlement of backfill.

f. All rock, including crushed rock or gravel from construction, must be removed from yards and fields. Streets and walks shall be broomed to remove all earth and loose rock immediately following backfilling.

2. Special Requirements

a. In case of street, highway, railroad, sidewalk, and driveway crossings or within any roadway paving, or about manholes, valve and meter boxes in such paving, the following backfill material and procedure are required.

b. Fill the trench to within six (6) inches of the surface with one of the following materials of limited compressibility, uniformly disturbed

without mechanical compaction.

(1) Kentucky Department of Highways Class II DGA, or other gradation acceptable to the Engineer. In order to accommodate compacted temporary surfacing it may be necessary to bulkhead or otherwise confine the stone fill at the open end of the trench.

c. Railroad Company and Department of Highways requirements concerning backfilling will take precedence over the above general specifications where they are involved.

J. Tie-ins

1. A tie-in defined as the removal of an existing plug or cap and the connecting of the new pipeline into the existing pipeline or fitting or valve at the joint opened by such removal.

3.03 FIELD QUALITY CONTROL

A. Testing Water Pipe for Leakage

1. The Contractor will be required to test all pipelines and appurtenances with water after backfilling. The maximum test pressure, measured at the lowest elevation of the pipeline being tested, shall be 200-p.s.i. or the pressure class of the pipe (to be determined by the City of Madisonville).

2. Backfilling before testing will be allowed, in the case of slip type or bolted joint pipe and at points where dangers to the public or other hazards demand that such be done immediately after pipe is laid.

3. When the line or section being tested is pumped up to the required pressure, it shall be valved off from the pump and a pressure gauge placed in the line. All sections shall be tested individually between mainline and branch valves to assure each valve has been tested and is capable of holding the required pressure. Branch valves to fire hydrants shall be opened, with the test pressure operating against the fire hydrant's valve. The pressure drop in the line, if any, shall be noted. If no pressure drop is noted in six (6) hours, the Engineer and the City of Madisonville, at their discretion, may accept the line or section as tested, or may require the test run the full 24-hours.

4. At the end of the 24-hour test period, the pressure shall be recorded. If there is a drop in pressure, the Contractor will be required to pump the section being tested up to initial test pressure and maintain that pressure for 24-hours, measuring the amount of water required to accomplish this. The line will not be accepted until the leakage shall prove to be in compliance with AWWA C600, Section 4, or by the following formula.

$$\text{Allowable Leakage} = L = \frac{S \cdot D \cdot P^{1/2}}{133{,}200}$$

In which: L = Allowable Leakage, gallons per hour
S = Length of Pipe being tested, in feet
D = Nominal Diameter of the pipe in inches
P = Average Test Pressure during leakage test, in psi

At the 200 psi required for the test, the following table may be used as an approximation, assuming joints on 18' intervals.

Pipe Diameter (inches)	Maximum Allowable Leakage Rate (gallons per hour per 1000 feet of pipe)
4	0.42
6	0.64
8	0.85
10	1.06
12	1.27
16	1.70
18	1.91
20	2.12
24	2.55

The pressure test shall be conducted over a six (6) hour period.

5. Should there be leakage over the allowable amount, the Contractor will be required to locate and repair the leaks and retest the section.

6. If the leakage of a section of pipeline being tested is below the allowable amount, but a leak is obvious, in the opinion of the Engineer or the City of Madisonville, due to water at the surface of the ground, or by listening, the leak can be heard underground with the geophone, or any other means of determining a leak the Contractor will be required to repair those leaks.

   (a) The Contractor shall furnish meter or suction tank, pipe test plugs, and bypass piping, and make all connections for conducting the above tests. The pumping equipment used shall be centrifugal pump, or other pumping equipment that will not place shock pressures on the pipeline. Power plunger or positive displacement pumps will not be permitted for use on closed pipe system for any purpose.

   (b) Inspection of pipe laying shall in no way relieve the Contractor of the responsibility for passing tests or correcting poor workmanship.

B. Disinfection

1. Upon completion of the work and cleaning up, and before Final Acceptance, the Contractor shall disinfect all water lines constructed which are to carry treated water.

2. Prior to starting disinfection, all water mains must be thoroughly flushed to remove mud, rocks, etc. This activity shall be coordinated with the City of Madisonville to eliminate the possibility of creating excessive turbulence with the water distribution system. Disinfection will then be accomplished by the adding of a chlorine solution while filling the main to obtain the initial 50 parts per million of chlorine. The Contractor shall supply all equipment, labor, etc., necessary for flushing and disinfecting the mains. The Contractor shall submit, in writing, to the City of Madisonville, the method he proposes to use for adding the chlorine.

3. The calcium hypochlorite tablet or powder method may be used with the permission of the City of Madisonville.

4. Disinfection shall be accomplished by filling the new and/or repaired portions of the system with water having a chlorine content of at least 50 parts per million and at the end of a 24-hour contact time a residual of at least 25 parts per million shall remain. At the end of the 24-hour contact period, all the sterilized surfaces and areas shall be thoroughly flushed from the water system. Chlorinated water shall be disposed of according to 401 KAR 5:031 and 8:020, which state that the allowable in stream concentration of chlorine are 10 ug/I, which is equal to 0.01 mg/I. The Contractor shall submit, in writing to the City of Madisonville, the method he proposes for dechlorinating. Recommended chemicals, as given in AWWA C651-92, are sulfur dioxide, sodium bisulfate, sodium sulfite, and sodium thiosulfate.

5. For tie-ins to an existing system such as tapping sleeves and valves where keeping the main out of service would restrict service to existing customers, disinfection shall, at the City of Madisonville's discretion, consist of thoroughly cleaning the new part with a solution containing not less that 200 mg/l (ppm) chlorine.

6. After initial disinfection and flushing, the City of Madisonville will collect water samples for bacteriological testing. A core zone, which includes up to the first one-half (1/2) mile, shall be established. Two (2) samples shall be taken from the core zone. Additionally, one (1) sample taken from each mile of new distribution main shall be submitted to the Kentucky Division of Water. A new or routine replacement main shall not be placed in service until negative laboratory results are obtained on the bacteriological analyses. Sample bottles shall be clearly identified as "special" construction tests. If any of the samples are found positive or contain confluent growth, the Contractor shall repeat the disinfections procedure until the required numbers of negative

samples are obtained.

12.17 GRAVITY SEWER PIPE AND SANITARY FORCE MAIN PIPE

PART 1 - GENERAL

1.01 SUMMARY

A. All pipe and accessories supplied for use on projects within the City of Madisonville's service area shall be as specified herein.

B. Where a specific type of pipe or pipe material is called for on the Construction Plans, substitute materials may not be furnished and installed at that location without specific written acceptance of the Engineer and the City of Madisonville.

C. The sewer main shall be constructed of ductile iron pipe under the following conditions:

- In areas where the sewer main or laterals are subjected to extraordinary earth loads (<12') (See 3.02 A.1.a., Page 120).
- In areas where the sewer line is positioned either in an area of high ground water levels or other proposed or existing storm water detention/retention ponds.
- When encroaching on the minimum limits set forth in 8.5.3.1, page 46

1.02 RELATED WORK

A. For casing pipe and boring and jacking see Section 12.13.

1.03 REFERENCES

A. Where referenced specifications (ASTM, AWWA, etc), are mentioned, these standards are deemed to be the minimum standards of quality of materials or methods to apply to this project.

1.04 SUBMITTALS

A. Copies of the manufacturer's directions for handling and installing the particular pipe supplied and accepted by the Engineer shall be furnished to the Engineer and the City of Madisonville at the first delivery of pipe to the project in numbers that will permit the City of Madisonville to retain two copies.

B. The manufacturer's instructions shall be strictly followed unless a conflict exists between the manufacturer's instructions and those contained herein. In such cases, the Engineer shall determine which methods are to be followed and no pipe shall be installed until the Contractor has received written instruction from the Engineer which procedure to follow.

1.05 QUALITY ASSURANCE

A. Where pipe enters manholes, the pipe manufacturer shall certify that their pipe is compatible with the watertight, flexible seal to be used at manhole openings as specified in Section 12.21 of these Specifications, and that their combined use will produce a flexible watertight installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. All pipe, fittings, and jointing materials shall be of one manufacturer unless different types are shown on the drawings or otherwise accepted by the Engineer and the City of Madisonville.

2.02 MATERIALS - GRAVITY SANITARY SEWER PIPE

A. Sewer Transition Joints

1. Where sewer pipes of different materials are to be jointed, i.e., PVC pipe to DI pipe, PVC pipe to PVC pipe, or another combination, an adapter made for this purpose shall be used. The adapter shall be made of polyurethane or polyvinyl chloride with stainless steel clamps and shall be a Ferrnco Adapter by Fernco Joint Sealer Company, Ferndale, Michigan, or an approved equal.

A. PVC (Polyvinyl-Chloride) Sewer Pipe

1. Pipe

a. PVC pipe four (4) inch through 15-inch diameter supplied for use on this project shall be Type PSM Polyvinyl Chloride (PVC) Sewer Pipe as specified per ASTM D 3034-81. PVC pipe 18-inch through 27-inch diameter shall be as specified in ASTM F 679-80.

b. The pipe shall be made of PVC plastic having a cell classification of 12454-B or 12454-C as defined in ASTM D 1784-81. Compounds having different cell classifications due to one or more properties being superior to those of the specified compound are acceptable.

c. The pipe shall be homogeneous throughout, free of cracks, holes, foreign inclusions, or other damaging defects. The pipe shall be uniform in color, wall thickness, density, and other physical properties. Wall thickness shall be SDR-35 per ASTM D 3034-81 or wall thickness T-1 per ASTM F 679-80. Marking and identification of pipe shall be per ASTM D 3034-81 or ASTMF 679-80 as applicable.

d. The maximum laying length for all PVC pipe supplied shall be 13.0± feet.

2. Fittings

a. PVC fittings supplied for use on this project shall meet all the physical and quality requirements as herein before specified for PVC pipe.

b. Where 45d and 30d bends are used, they shall be the long radius type. 90d bends are not permitted in gravity sewer lines.

c. PVC fittings for four (4) inch through 15-inch diameter pipes shall meet the dimensional requirements of the tables as shown in ASTM D 3034-81 except that saddle type wyes or tee branches shall not be allowed for use on new sewer mains. PVC fittings for 15-inch through 27-inch diameter pipes shall conform to the requirements of ASTM F 679-80.

3. Joints - Exterior Piping

a. Joints for PVC pipe and fittings for sewer mains shall be "Push-On Type" composed of an elastomeric ring gasket compressed in the annular space between a bell end or socket and spigot end of the pipe.

b. All surfaces of the bell, socket, or spigot end of the pipe against which the ring gasket may bear shall be smooth, free of cracks, or other imperfections that could adversely affect the sealing capacity of the joint.

c. Lubricant for use in assembling joints shall be supplied with the pipe or be of the specific manufacturer as recommended by the pipe manufacturer for use with the specific pipe supplied. The lubricant shall not cause deterioration of either the elastomeric ring gasket or pipe material.

d. Where PVC pipe and fittings are connected to piping of other materials, the manufacturer's standard adapters or transition pieces shall be used. Should the manufacturer not produce an adapter for a specific pipe of other material, the adapters or transition fittings as specified shall be used.

C. Ductile Iron Sewer Pipe

1. Pipe

a. This specification cover four (4) to 54-inch ductile iron gravity sewer pipe designated "DI" on the drawings. Pipe furnished under this

Specification shall comply with all provisions of ANSI/ASTM A746-77. Maximum design thickness shall be based on depth of cover, trench loadings, and other conditions per ANSI/AWWA C150/A21.50-81.

b. Metal Design Strength p.s.i. (Minimum)

Tensile Strength	60,000
Yield Strength	43,000
Percent Elongation	10

c. The net weight, class or nominal thickness, and casting period shall be shown on each pipe. The manufacturer's mark, the year in which the pipe was produced, and the letters "DI" or "DUCTILE" shall be cast or stamped on the pipe.

2. Fittings

a. Fittings for ductile iron sewer pipe shall be mechanical joint.

b. Ductile iron mechanical fittings shall conform to ANSI/AWWA C110/A21.10-82 for gray iron and ductile iron fittings. Mechanical joints shall also conform with all respects to ANSI/AWWA C111/A21.11-80.

c. All fittings shall be manufactured for the size and pressure class of the pipeline in which they are to be used. All fittings shall be furnished complete with all joint accessories.

3. Joints

a. Pipe joints shall be mechanical joint or rubber ring slip joints.

b. Mechanical joints are to be furnished according to ANSI/AWWA C111/A21.11-80. All pipe joints must be furnished complete with all accessories. Mechanical joint bolts and nuts shall be of alloy steel cast iron or alloy steel (Corten type such as U.S. Alloy) or equal. Rubber gaskets shall be made of plain, first grade rubber, free of imperfections, and porosity. Hardness shall be 70 to 75 urometer.

c. Rubber ring slip joints shall be equal to ANSI/AWWA C111/A21.11-80. The joints shall be of the following materials and assembled in the sequence outlined below:

(1) Rubber ring gasket compressed in groove in the bell of pipe.

(2) A beveled spigot end of pipe for initial centering into a rubber

gasket in the bell.

d. All items used for jointing pipe shall be furnished with the pipe and tested before shipment. The joints shall be made with tools and lubricant in strict conformity with the manufacturer's instructions. Manufacturers' instructions shall be delivered to the City of Madisonville before the start of construction in numbers that will allow two (2) copies to be retained by the City of Madisonville.

e. The type of joint for ductile iron sewer pipe shall be as shown on the drawings. Where no specific type joint is shown, the joint shall be the slip joint with a rubber ring gasket.

4. Coating and Linings

a. All ductile iron pipe and fittings for gravity sewer service shall be bituminous coated outside according to ANSI/AWWA C151/A21.51-81 for pipe and ANSI/AWWA C110/A21.10-82 for fittings.

b. All ductile iron pipe and fittings for gravity sewer service shall be cement-mortar lined with a seal coat according to ANSI/AWWA C104/A21.4-80).

2.03 MATERIALS – SANITARY FORCE MAIN PIPE

2.03.1 SOURCE QUALITY CONTROL

A. PVC Polyvinyl-Chloride Sewer Pipe

1. Pipe shall be tested and inspected at the factory and inspected at the job site. Testing shall be accomplished in conformance with the following ASTM specifications utilizing the test methods specified therein:

Dimensions	ASTM D 3034-81 or ASTM F 679-80 and D 2122-81
Extrusion Quality	ASTM D 2152-80
Pipe Stiffness (5%)	ASTM D 2412-77
Impact Resistance	ASTM D 2444-80
Chemical Resistance	ASTM D 1784-81

2. In addition, a typical joint assembly, both gasket type joint and solvent weld joint, shall be tested by a qualified independent laboratory per test requirements of ASTM D 3212-81. The manufacturer shall submit through the Engineer sufficient copies of certification and test results for each lot of material represented by shipment to the job site that will permit the City of Madisonville to retain two copies.

PART 3 - EXECUTION

3.01 TRENCH EXCAVATION - GRAVITY SANITARY SEWER PIPE

A. General

1. All excavations shall be open trenches, except where the Construction Plans call for tunneling, boring and jacking under structures, railroads, road, or highways.

B. Trees and Shrubs

1. Trenching shall include all clearing and grubbing, including all weeds, briars, trees and stumps encountered in the trenching, regardless of size. The Contractor shall dispose of any such material by burning, burial, or hauling away or as noted on the Construction Plans.

C. Highways, Streets, and Railroads

1. Trenching also includes such items as railroad, street, road, sidewalk, pipe, small creek crossings, cutting, moving or repairing damage to fences, poles or gates and other surface structures, regardless of whether shown on the Construction Plans.

2. The Contractor shall so coordinate his work as to produce a minimum of interference with normal traffic on highways and streets. He may, with the approval of the governing agency, close a street to traffic for such length of time considered necessary, provided persons occupying property abutting the street have an alternate route of access to the property that is suitable, for their needs during the time of closure. It shall be the responsibility of the Contractor to give 24-hours advance written notice to Fire and Police Departments and to occupants of a street that will be closed, in a manner approved by the governing body.

3. The opening of more that 500-feet of trench ahead of pipe laying and more than 500-feet of open ditch left behind pipe laying, before backfilling, will not be permitted, except upon written consent of the Engineer. No trench shall be left open or work stopped on same for a considerable length of time. In case of an objectionable delay, the trench shall be refilled according to backfill specifications.

4. Construction equipment will not be approved for use where trends are damaging to paving encountered. Curbs, sidewalks, and other structures shall be protected by the Contractor from damage by his construction equipment.

5. In case of damage to any existing structures, repair and restoration shall be made at once and backfill shall not be replaced until this is done. In all cases,

restoration and repair shall be such that the damaged structure will be in as good condition and serve its purpose as completely as before.

6. When trenching is cut through paving which does not crumble on edges, trench edges shall be saw cut to at least two (2) inches deep to straight and neat edges, before excavation is started, and care taken to preserve the edge to facilitate neat repaving.

7. The Contractor shall maintain road crossings in a passable condition for traffic until the Final Acceptance of the work.

8. Railroad company and Department of Highways requirements concerning trenching, tunneling, boring and jacking shall be implemented into the project.

D. Existing Utilities

1. The Contractor shall determine, as far as possible in advance, the location of all existing sanitary sewers, culverts, storm drainage systems, water mains, electric conduits, telephone conduits, gas pipes, and other subsurface structures and avoid disturbing same in opening his trenches. In case of sanitary sewer, water, gas services and other facilities easily damaged by machine trenching, same shall be uncovered without damage ahead of trenching machine and left intact or removed without permanent damaged ahead of trenching and restored immediately after the machine has passed. The Contractor shall protect such existing facilities, including power, telephone poles and guy wires, against danger or damage while the pipeline is being constructed and backfilled, or from damage due to settlement of his backfill. It shall be the responsibility of the Contractor to inform the customers of utilities of disruption of any utilities service as soon as it is known that it has been or will be cut off.

2. Where there is the possibility of damage to existing utility lines by trenching machine, the Contractor shall make hand search excavation ahead of machine trenching, to uncover same. Hand trenching is required where undue damage would be caused to existing structures and utilities by machine trenching.

E. Location of Proposed Pipelines

1. The location of pipelines and their appurtenances, as shown on the Construction Plans, is those intended for the final construction. However, conditions may present themselves before construction on any line is started that would indicate desirable change sin location. Also, development of property traversed may require location changes. In such cases, the City of Madisonville reserves the right to make reasonable changes in line and structure locations. The City of Madisonville is under no obligation to locate pipelines so they can be excavated by machine.

F. Construction Stakeout – Gravity Sewers

1. Offset line and grade stakes shall be set and Cut Sheets prepared before trenching work is started. All stakeout work and Cut Sheet preparation shall be accomplished by the Engineer. The Engineer being responsible for established field location of manholes and control points, including the review and checking the finished Cut Sheets. The Engineer shall provide all material and labor for the construction stakeout work. Cut Sheets shall be prepared on forms supplied by the Engineer.

2. The Cut Sheets shall contain the following minimum information:

   (a) Manhole station numbers.
   (b) Grade of pipeline between manholes.
   (c) Centerline and offset stations.
   (d) Distance and direction of offset.
   (e) Centerline elevation of ground over the pipeline.
   (f) Centerline cut (Vertical distance from top of ground to the invert of the gravity sewer).
   (g) Offset hub elevation.
   (h) Offset cut (vertical distance from the top of the offset hub to the invert of the gravity sewer).
   (i) Location and elevation of benchmarks.
   (j) Utilities information and depths and/or any other pertinent information.

3. Where the Contractor elects to use grade (batter) boards for sewer construction, offset hubs shall be set perpendicular to each 25-foot centerline station. Where laser beam equipment is to be used, the offset line shall be set perpendicular to each 100-foot centerline station. In either case, the Contractor shall be required to maintain all offsets until the sewer main has been constructed.

4. Grades shown on the Construction Plans or as revised on the Cut Sheets are invert of pipe and not trench subgrade. No adjustment of planned or Cut Sheet grades shall be made without approval of the Engineer.

H. Trench Requirements

1. All trenches must be dug neatly to lines and grades as shown on the Construction Plans, as established in the field and/or as established on the Cut Sheets. Trenches shall be of sufficient width to properly assemble or bolt joints.

2. For maximum permissible trench depth per width of the trench at top of pipe, for various pipe sizes, side support, classes of pipe, their reinforcing and bedding refer to tables for the several pipe materials under this Section of

these Specifications. If the excavated trench width up to the top of the pipe is greater than the numerical maximum permissible trench width, as first set forth in the tables of this Section, then the Contractor shall furnish pipe or reinforce pipe, lay and backfill pipeline, as set forth herein for such wider trenches.

3 Trenching shall be completed between one (1) grade control point and the next in advance of the laying of pipe, where pipes, culverts, or other structures may be encountered whose grade cannot reasonably be determined ahead of trenching. Should the Contractor lay pipe closer to the opening of the trench ahead, he shall bear cost of any removal and relaying which may be required to avoid location conflict.

4. Where grade (batter) boards are used to establish a finish grade, they shall be set by the Contractor, with at least three (3) boards set at all times where installation is in progress. These will be set each 25-feet or less and will be set perpendicular to and spanning the centerline of the trench, such that the grade string is in the vertical plan of the pipe flow line. Grade boards shall be supported by stakes driven firmly on each side of the trench. Where laser beam equipment is used, the set up shall be per the laser manufacturer's instructions and/or the permission of the Engineer and the City of Madisonville.

5. Where laser beam equipment is used, the Contractor shall submit copies of a "Certificate of Equipment Calibration" to the Engineer before beginning construction. All laser beam equipment must be calibrated within six (6) months of the date of use. The Engineer shall furnish the City of Madisonville two (2) copies of the certificate before construction.

6. Grades shown on the Construction Plans and/or profiles, Cut Sheets, cases and excavation in open trench or tunnel must be made of sufficient depth to take care of required bedding of pipe and bells below these lines.

7. Where bottoms of the trench are in or on solid rock or where concrete cradle or arch is to be used, trenches or tunnels shall be dug to a depth of at least six (6) inches below bottom of barrel of pipe. Where in earth, they shall be dug to at least four (4) inches below bottoms of pipe barrels and bells.

8. When trench or tunnel is dug below required grade, the pipe must be brought to grade by filling with crushed rock for pipe bedding as specified in Section 12.12 of these Specifications. Fill for pipe support shall not be made with material excavated from trench or bell holes.

I. Dewatering of Trenches

1. Dewatering of trenches shall be considered a part of trenching. Dewatering of trenches shall include groundwater and storm or sanitary sewage. Suitable

pumping and other dewatering equipment are to be provided by the Contractor, to insure the installation of the pipeline structure in a dewatered trench and under the proper conditions. Dewatering shall include all practical means available for prevention of surface runoff into trenches and scouring against newly laid pipe.

2. Piles of excavated materials shall be trenched or temporarily piped to prevent, as far as practical, blockages of drainage ditches and gutters, and water carriage of excavated materials over street and highway surfaces.

3. Where subgrade of the trench has insufficient stability to support the pipeline and hold it to its original grade, the Engineer or the City of Madisonville may order stabilization by various means.

3.02 LAYING GRAVITY SEWER PIPE

A General

1. Checking of pipe

a. The selection of pipe strength class shall be based on earth weight of 130 pounds per cubic foot and a safety factory of 1.50.

b. All pipes and fittings must be tested for uniform diameter, straightness and defects by the Contractor before being lowered into the trench. Rejected pipe must be separated from accepted pipe and removed from the project. The Engineer and the City of Madisonville will make periodic observations of pipe in storage and/or incorporated into the work. Pipe found defective shall be rejected and replaced.

2. Alignment and Grade

a. All pipe, after being inspected and accepted, shall be laid to correspond with lines and grades staked out by the Engineer. All sewer lines shall be laid to constant grades between invert elevations shown on the Construction Plans. Grades shown on the Drawings are invert of pipe and **NOT** trench subgrade. The pipe lengths shall be fitted together and matched, so that they will form a sewer with a smooth and uniform invert, visible as a full circle from manhole to manhole. Gravity sewers within the City of Madisonville service area shall not be laid on curves.

The following table will establish alignment and grade tolerances to be used in the installation of gravity sewer mains:

ITEM	Allowance

Alignment	No tolerance shall be allowed for pipe out of the designed alignment. Pipe sections found out of the designed alignment shall be rejected.
Grade	A deviation of 0.02' from the designed elevation of the invert of the gravity sewer will be allowed. Gravity sewers found not within the 0.02' tolerance of the designed pipe elevation shall be rejected.

Note - These tolerances are established for gravity lines only. The Engineer shall verify the pipe elevations at all locations throughout the system. The Final Record Drawings shall reflect the results of this verification. In addition to the Engineers' verification, the City of Madisonville shall perform a field survey to confirm as-built elevations of the gravity sewer at the completion of construction.

3. Unstable Subgrade

   a. In wet, yielding, and mucky locations where pipe is in danger of sinking below grade or floating out of grade or line, or where backfill materials are of such a fluid nature that such movements of pipe might take place during the placing of the backfill, the pipe must be weighted or secured permanently in place by such means as will prove effective.

4. Bedding of Pipe

   a. Pipe shall be laid with the bottom quadrant of the barrel and bells of pipe bedded in at least four (4) inch depth of stone when on earth subgrade and at least six (6) inch depth of stone, below the bottom of the barrel of pipe when on solid rock subgrade. Stone for bedding of six (6) inch through 16-inch pipe shall be No. 8 Kentucky Department of Highways crushed rock as specified in Section 02235 of this manual, spaded into place.

   b. In case of pipe sizes 18-inch through 72-inch in both earth and rock trenches, the subgrade shall be shaped to provide for a No. 8 to three-fourths (3/4) inch crushed stone pad, Kentucky Department of Highways Size 68, for a depth under the pipe barrel at least one-fourth (1/4) the outside diameter of the pipe, with a minimum of six (6) inch depth and a maximum of nine (9) inch depth. The bedding material shall be thoroughly spaded into place, in order to give a uniform bearing for at least the bottom quadrant of the pipe.

   c. No filling of the trench with earth to bring pipe to grade will be permitted. If trenches are dug too deep, they must be brought to grade and supported by crushed rock for pipe bedding (No. 8 to one-half

(1/2) inch or No. 8 to three-fourths (3/4) inch) as specified in Section 02235 of this Manual. No pipe shall be laid in the trench until the subgrade is inspected and found correct.

5. Laying of Pipe (Mains)

a. The Contractor's laying crew supervisor shall direct subgrade preparation and plumbing and leveling invert of pipe to grade and line, the pipe layer following his directions in placing the pipe. The pipe layer will be responsible for pipe bedding, cleaning joint, proper placement of joint annual ring or gasket, tight jointing, and homing pipe, securing pipe against settlement or other movement, and inspecting and swabbing out any jointing material from inside pipe.

b. No joints will be accepted that show leakage after backfilling and inspection, any joints that are found allowing groundwater to enter the sewer must be excavated and corrected.

c. Plugs in branch fittings to future building sewers shall be protected from excavators by the method as shown on the Construction Plans for protecting the ends of laterals and shall be so constructed and joined in the bell of pipe that they will be watertight, yet removable without breaking the bell or coupling when removed.

6. Laying of Laterals

a. Laterals shall be laid to serve the abutting property at points shown on the Construction Plans. Such pipes shall be connected to sewer mains through tees or Y-branches of size of running sewer barrel and six (6) inch side opening, with six (6) inch 30-degree or 45-degree bends (if required due to deep sewers) Branch fittings in the sewer and the connected bend, shall be supported from bottom of the trench per the Construction Plans.

b. Laterals shall be laid to the right-of-way or property line as shown on the Construction Plans. The end openings shall be plugged with appropriate watertight plugs of permanent materials in the bell of the sewer pipe, removable without breakage of pipe bells. Dead ends of sewers shall be plugged similarly.

c. Laterals shall be laid on not less than a one-fourth (1/4) inch per foot slope (2.083%, or 0.37' per 13' joint). Where laterals are laid at or near minimum grades, the Contractor shall install batter boards of use a pipe laser, same as specified for gravity mains.

d. In the case of deep sewers, laterals may be brought up to a depth of approximately five (5) feet below ground level with suitable bends and

sewer pipe. These pipes shall be laid on a slant outside sewer trench, not to exceed a 45-degree angle, so they will be supported or original earth and not dragged down and cracked by backfill settlement.

e. All lateral installed shall have a two way clean out at the right-of-way line. The clean out shall be construction so that the top of the clean out is three (3) feet above existing ground elevation. The timber shall be installed as shown on the Construction Plans. Consider installing cleanout at property line.

7. Piping Connections at Structures

a. Lines

(1) Pipes shall be laid free from all structures other than manholes. Any pipe entering structures underground unsupported by original earth shall be supported by Class 2,000 concrete, brick and mortar masonry, or Class 4,000 concrete beams and columns as shown on Construction Drawings.

(2) Pipe shall be connected to manholes by fabricated manhole entry seals, specified in Section 12.21 of these Specifications.

(3) Pipe stubbed out of manholes for future connections shall be plugged and tightly sealed with same jointing material used to plug laterals.

8. Installing Sewer Pipe in Casing pipe

a. Pipes installed inside casing pipes shall be centered throughout the length of casing pipe. Centering shall be accomplished by the installation of heavy-duty, stainless steel pipeline spacers attached to the pipe in such a manner as to prevent the dislodgement of the spacers as the carrier pipe is pulled or pushed though the casing pipe. Pipeline spacers shall be of such dimensions to provide (1) full supportive load capacity of the pipe and contents; (2) of such thickness to allow installation and/or removal of the pipe; and (3) to allow no greater than one (1) inch movement of the carrier pipe within the casing pipe after carrier pipe is installed.

b. Pipeline spacers shall be located immediately behind each bell and at the midpoint of each length of pipe installed or a minimum of seven (7) feet spacing, whichever distance is the lesser. The materials used and methods of centering shall be acceptable to the Engineer and the City of Madisonville before installation. All clamps or attachment bands shall be stainless steel.

c. Upon completion of installation of the carrier pipe, the annular space at the ends of the casing pipe shall be sealed to prevent the entrance of groundwater, silt, etc., into the casing pipe. The seal shall be a manufactured product specifically made for this purpose. The seal shall be Link Seal - Series 500 as manufactured by the Thunderline Corporation, Wayne, Michigan, or approved equal.

9. Protection of Pipe in Trench

a. No walking upon the completed pipelines will be permitted until trench has been backfilled to a depth of at least six (6) inches over the top of the pipe. The interior of the pipe shall, as the work progresses, be cleaned of all dirt, jointing materials, and superfluous materials of every description. When laying of pipe is stopped for any reason, the exposed end of such pipe shall be closed with a suitable plug fitted into the pipe bell, to exclude earth and other material, precautions being taken to prevent flotation of pipe by runoff into the trench.

10. Observation of Pipeline

a. No backfilling (except securing pipe in place) over pipe will be allowed until the Engineer has had an opportunity to observe the joints, alignment, and grade in the section laid, but such observation shall not relieve the Contractor of further liability in case of defects occurring during or after placement of backfill.

B. Laying Gravity Sewer Pipe

1. PVC Pipe

a. PVC sewer pipe laying shall comply with the requirements of ASTM D 2321-74 (1980) and the additional requirements of this Manual and the Construction Plans.

b. Article 3.02 A of this Section 12.17 shall apply to the installation of PVC sewer pipe. The pipe shall be bedded true to line and grade with uniform and continuous support from a firm base. The bedding material shall conform to that specified in Article 3.02 A of this Section 12.17.

c. All PVC sewer pipe shall be installed in a manner to limit deflection of the pipe to less than five (5) percent. A deflection test shall be performed on all flexible pipe. The test shall be conducted after the final backfill has been in place at least 30-days. No pipe shall exceed a deflection of five (5) percent the deflection test shall be run using a rigid mandrel having a diameter equal to 95% of the inside diameter of the pipe. The test shall be performed without mechanical pulling

devices.

d. Pipe deflection tests shall be measured and recorded by the Contractor in the presence of the Engineer and the City of Madisonville.

e. When laser equipment is being used for laying PVC sewer pipe, the Contractor shall provide adequate ventilation through the pipe to prevent distortion of the beam.

3.03 LAYING SANITARY FORCE MAIN PIPE

3.04 TRENCH BACKFILL – GRAVITY SEWER AND SANITARY FORCE MAIN PIPE

A. General

1. Excavated materials from trenches and tunnels, in excess of quantity required for trench backfill, shall be disposed of by the Contractor. It shall be the responsibility of the Contractor to obtain location and/or permits for its disposal.

2. Railroad company and Department of Highways requirements concerning backfilling will take precedence over the above general Specifications where they are involved.

3. Before completion of the project, all backfills shall be reshaped, holes filled, and surplus materials hauled away.

B. Haunching

1. Upon completion of bedding and laying the sewer pipe, the Contractor shall place crushed stone, Kentucky Department of Highways No. 8 dependent on size of pipe, or the same material used for pipe bedding on both sides simultaneously to the top of the pipe. This material shall be hand placed using shovels to work the haunching material completely under the bottom quadrant and around the sides of the pipe to assure the maintenance of alignment of the pipe. No compaction of this material is required other than that obtained by the workers walking on the material during placement.

2. The haunching material is required for all sewer pipe installed in open trenches.

C. Initial Backfill

1. Upon completion of the haunching material to the top of the pipe, initial backfill shall be placed as hereby specified. This material shall serve as protection for the top of pipe reducing the possibility of damage to the pipe during the placement of backfill for the remainder of the trench depth.

2. When sewer pipe is located outside traffic areas, the initial backfill material shall be No. 8 crushed stone placed above the pipe to the level hereinafter stated.

3. When the sewer pipe is located within traffic areas, the initial backfill shall be crushed stone of the same gradation of the pipe bedding material. Other alternate materials may be used only with the specific written permission of the Engineer when the work is located inside traffic areas.

4. In the case of ductile iron pipe, the initial backfill shall be hand placed to a point six (6) inches above the barrel of the pipe. In case of plastic pipe, the initial backfill shall be hand placed and evenly spread to a point 12-inches above the pipe barrel for up to four (4) feet cover, to a point 18-inches above the barrel for four (4) feet to 10-feet cover, and 24-inches for more than 10-feet cover.

5. The initial backfill material is required over sewer pipe in all open trenches.

D. Final Backfill

1. Outside Traffic Areas

a. After the above-specified initial backfill is hand placed, rock may be used in machine placed backfill in pieces no larger than six (6) inches in any dimension and to an extent not greater than one-half (1/2) the volume of the backfill materials required to backfill the trench. If additional earth is required, it must be obtained and placed by the Contractor. Filling with rock and earth shall proceed simultaneously, in order that all voids or pockets, created by rock backfill, may be filled with earth. Machine backfilling may be employed with tamping, except as hereinafter restricted, provided caution is used in quantity per dump and in uniformity of level of backfilling. Backfill material must be uniformly ridged over the trench, and excess hauled away, with no excavated rock over one-half (1/2) inch diameter or pockets of crushed rock or gravel in top 12-inches of backfill, the top 12-inches reserved for topsoil or material more suited to sustain surface growth. Ridged backfill shall be confined to the width of the trench and not allowed to overlap onto firm original earth, and its height shall not be greater than that required to provide for settlement of backfill.

2 Inside Traffic Areas

a. Where sewer pipe is located in existing or proposed street, highway, railroad, sidewalk, and driveway crossings or within any roadway paving, or about manholes, valve and meter boxes located in such paving, the following backfill material and procedure are required.

(1) Fill the trench to the surface with one of the following materials of limited compressibility, uniformly distributed without mechanical compaction.

(a) Dense graded aggregate (Kentucky Department of Highways Class A, Grading D).

(b) Kentucky Department of Highways No. 78 crushed stone.

3.05 FIELD QUALITY CONTROL

A. Testing Gravity Sewers for Leaks and Infiltration

1. General

a. All gravity sewers constructed within the City of Madisonville's service area shall be tested for leaks and infiltration using methods as hereinafter specified. The sequence and methods of tests shall be as follows.

b. The Contractor shall furnish all materials, equipment and labor required for all types of tests and the Engineer being responsible for directions, recording data and calculating air losses and/or infiltration rates.

2. Sequence

a. Testing

(1) As soon as it is practicable after installing and backfilling sewers, and before putting new sewers into service, low pressure air tests shall be made from manhole to manhole, or up to a maximum of 400-feet of sewer main and 400-feet of sewer laterals at a time, as directed by the Engineer. The maximum allowance for air loss during testing shall be determined by tables of minimum holding time for a pressure drop of 1.0 p.s.i. and are based on an average loss of 0.003 cubic-feet of air per minute per square foot of internal pipe surface, when tested at an average pressure of 4.0 p.s.i. greater than the average back pressure of any groundwater present. These tables may be obtained from the National Clay Pipe Institute (NCPI), and must be furnished in at least two (2) copies for the City of Madisonville by the Engineer.

(2) Upon completion of installation and backfilling of all sewers

constructed, the low-pressure air test is required for all sewers so constructed.

b. Additional Testing

Upon completion of the required low pressure air testing, and before placing the sewer into operation, if ground and/or surface water flow is observed in the completed sewer, the Contractor shall locate the source of the infiltration and seal the source point. The Engineer or the City of Madisonville may order infiltration tests at his discretion. Additional testing may be required even through the results of the initial low pressure air testing indicate the sewers are watertight. The infiltration tests shall be conducted, on order of the Engineer or the City of Madisonville, as hereinafter specified.

3. Equipment

a. Low Pressure Air Testing

(1) Air test equipment shall be equal to Cherne Air-Loc Equipment, as manufactured by Cherne Industrial, Inc., Hopkins, Minnesota.

(2) Equipment used shall meet the following minimum requirements:

(a) Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be inspected.

(b) Pneumatic plugs shall resist internal test pressures without requiring internal bracing or blocking.

(c) All air used shall pass through a single control panel.

(d) Three (3) individual hoses shall be used for the following connections:

(i) From control panel to pneumatic plugs for inflation.

(ii) From control panel to sealed line for introducing the low-pressure air.

(iii) From sealed line to control panel for continually monitoring the air pressure rise in the sealed line.

4. Procedures

a. Safety Precautions

(1) The air test may be dangerous if a line is improperly prepared. It is extremely important that the various plugs be installed and braced in such a way as to prevent blowouts.

(2) As a safety precaution, pressurizing equipment shall include a regular set at 10 p.s.i. to avoid over-pressurizing and damaging an otherwise acceptable line. No one shall be allowed in the manholes during testing.

b. Low Pressure Air Test

(1) All pneumatic plugs shall be seal tested before being used in the actual test installation. One length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be checked. Air shall be introduced into the plugs to 25 psig. The sealed pipe shall be pressurized to 5 psig. The plugs shall hold against this pressure without bracing and without movement of the plugs out of the pipe.

(2) Clean pipe to be tested by propelling snug fitting inflated rubber ball through the pipe with water.

(3) Plug all pipe outlets with suitable test plugs.

(4) Add air slowly to the portion of the pipe installation under test until the internal air pressure is raised to 4.0 psig.

(5) After an internal pressure of 4.0 psig is obtained, allow at least two (2) minutes for air temperature to stabilize, adding only the amount of air required to maintain pressure.

(6) When pressure decreases to 3.5 psig, start the stopwatch. Determine the time in seconds required for the internal air pressure to reach 2.5 psig. Minimum permissible pressure holding times for runs of single pipe diameter and for systems of four (4) inch, six (6) inch, or eight (8) inch laterals in combination with trunk lines are indicated in the NCPI tables in seconds.

B. Testing Sanitary Force Mains for Leakage

1. The Contractor will be required to test all pipelines and appurtenances with water after backfilling. The maximum test pressure, measured at the lowest elevation of the pipeline being tested, shall be 200-p.s.i. or the pressure class of the pipe (to be determined by the City of Madisonville).

2. Backfilling before testing will be allowed, in the case of slip type or bolted joint pipe and at points where dangers to the public or other hazards demand that such be done immediately after pipe is laid.

3. When the line or section being tested is pumped up to the required pressure, it shall be valved off from the pump and a pressure gauge placed in the line. All sections shall be tested individually between mainline and branch valves to assure each valve has been tested and is capable of holding the required pressure. The pressure drop in the line, if any, shall be noted. If no pressure drop is noted in six (6) hours, the Engineer and the City of Madisonville, at their discretion, may accept the line or section as tested, or may require the test run the full 24-hours.

4. At the end of the 24-hour test period, the pressure shall be recorded. If there is a drop in pressure, the Contractor will be required to pump the section being tested up to initial test pressure and maintain that pressure for 24-hours, measuring the amount of water required to accomplish this. The line will not be accepted until the leakage shall prove to be in compliance with AWWA C600, Section 4, or by the following formula.

$$\text{Allowable Leakage} = L = \frac{S \cdot D \cdot P^{1/2}}{133{,}200}$$

In which: L = Allowable Leakage, gallons per hour
S = Length of Pipe being tested, in feet
D = Nominal Diameter of the pipe in inches
P = Average Test Pressure during leakage test, in psi

At the 200 psi required for the test, the following table may be used as an approximation, assuming joints on 18' intervals.

Pipe Diameter (inches)	Maximum Allowable Leakage Rate (gallons per hour per 1000 feet of pipe)
4	0.42
6	0.64
8	0.85
10	1.06

12	1.27
16	1.70
18	1.91
20	2.12
24	2.55

The pressure test shall be conducted over a six (6) hour period.

5. Should there be leakage over the allowable amount, the Contractor will be required to locate and repair the leaks and retest the section.

6. If the leakage of a section of pipeline being tested is below the allowable amount, but a leak is obvious, in the opinion of the Engineer or the City of Madisonville, due to water at the surface of the ground, or by listening, the leak can be heard underground with the geophone, or any other means of determining a leak the Contractor will be required to repair those leaks.

(a) The Contractor shall furnish meter or suction tank, pipe test plugs, and bypass piping, and make all connections for conducting the above tests. The pumping equipment used shall be centrifugal pump, or other pumping equipment that will not place shock pressures on the pipeline. Power plunger or positive displacement pumps will not be permitted for use on closed pipe system for any purpose.

(b) Inspection of pipe laying shall in no way relieve the Contractor of the responsibility for passing tests or correcting poor workmanship.

12.18 SEEDING AND MULCHING

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, materials, equipment, and services required to perform seeding as shown on the Construction Plans and as specified herein.

B. All areas disturbed by construction operations shall receive a protective cover of vegetation. The work shall consist of preparing the area for treatment, furnishing, and placing soil amendments, fertilizer, sod, seed inoculants, mulch, and plantings as specified in the designated areas.

1.02 RELATED WORK

Not applicable.

1.03 QUALIFICATIONS

A. The work shall be done by a provider who is experienced, reputable, and qualified in the tasks required.

1.04 SUBMITTALS

None required.

1.05 WARRANTY

A. Refer to Section 12.3.

PART 2 - PRODUCTS

2.01 SEED

A. All seed shall conform to the current rules and regulations of the State where it is being used and from the latest crop available. It shall meet or exceed the standards for purity and germination listed herein.

B. Seed shall be labeled according to the State Laws and the U.S. Department of Agriculture Rules and Regulations under the Federal Seed Act in effect on the date of invitations for bids. Bag tag figures will be evidence of purity and germination No seed will be accepted with a date of tests of more than nine months before the date of delivery to the site.

C. The seed for use on this project shall be of the type as listed below with the listed germination and purity qualifications.

Species	% Purity	% Germination
Tall fescue (KY-31) *(Festuca arundinacea)*	98.5	80
Ryegrass *(Lolium multiflorium)*	98.0	90
Oats (Avena sativa)	98.0	90
Rye, grain *(Secale cereale)*	97.0	85
Redtop *(Agrostis alba)*	90.0	80

2.02 FERTILIZER

A. Unless otherwise specified the fertilizer shall be a commercial grade fertilizer or as specified herein. The fertilizer shall meet the standard for grade and quality specified by state law.

2.03 INOCULANTS

A. The inoculants for treating legume seeds shall be a pure culture of nitrogen-fixing bacteria prepared specifically for the species and shall not be used later than the date indicated on the container or as otherwise specified. A mixing medium, as recommended by the manufacturer, shall be used to bond the inoculants to the seed. Twice the amount of the inoculants recommended by the manufacturer shall be used, unless seed is applied by use of a hydraulic seeder, in which case four times the amount of inoculants recommended by the manufacturer shall be used. Seed shall be sown within 24-hours of treatment and shall not remain in the hydraulic seeder longer than four (4) hours.

2.04 SOIL AMENDMENTS

A. Lime shall consist of standard ground agricultural limestone, or equal. Standard ground agricultural limestone is ground limestone meeting current requirements of the State Department of Agriculture. Agricultural lime or other needed soil amendments will be uniformly applied at the rate specified herein.

2.05 ASPHALT EMULSION

A. Asphalt emulsion shall conform to the requirements of ASTM D 977-80, “Emulsified Asphalt.” The emulsified asphalt may be rapid, medium, or slow cure material.

2.06 STRAW MULCH MATERIALS

A. Straw mulch materials shall consist of wheat, oat, or rye straw, hay grass clippings cut from any native grasses, or other plants acceptable to the Engineer. The mulch material shall be air dry, reasonably light in color, and shall not be musty, moldy, caked, or otherwise of low quality. The use of mulch that contains noxious weeds will not be permitted. The Contractor shall provide a method satisfactory to the Engineer for determining weight of mulch furnished.

2.07 OTHER MULCH MATERIALS

A. Mulching materials, such as wood cellulose fiber mulch, emulsion type, synthetic fiber mulch, netting, mesh, and other mulching materials that may be required for specialized locations and conditions, when specified, must be accompanied by the manufacturer's recommendations for methods of application.

PART 3 - EXECUTION

3.01 EXTENT

A. Seeding

1. Where lawns, pastures, thin grass, or cover crops are destroyed by trenching, laying, backfilling, or tunneling operations, the surface shall be prepared by disking, fertilizing, and seeds. Seeding, fertilizing, and mulching shall be included in the price for trenching and backfilling. The timing of this operation shall be controlled by the Engineer. Requirements of the Department of Highways for reseeding shall take precedence over these Specifications where they are involved.

2. When the construction project is located on privately owned property on easements acquired by the City of Madisonville or the Developer and the individual landowner requires the cover grass to be the same as present at the beginning of construction, the Contractor shall supply the seed required by the landowner. Seedling and fertilizing in such instances shall be at the rate as recommended by the seed producer with soil preparation and mulching as stated herein.

3. When the construction project encroaches within the rights-of-way of the Department of Highways, the seed mixture, application rate, and method of mulching shall be as required by the Department of Highways.

B. Contractors' Options

1. Where surface grasses and cover is similar in nature throughout the length of the project, the Contractor may provide seed of one type or mixture for the entire project provided there are not objections by individual landowners

involved and with permission of the City of Madisonville and Engineer. In such cases, the seed type and/or mixture shall be that specified for lawn areas. Pasture and/or cover crop mixtures shall not be used for lawn application for any reason.

2. When construction facilities or construction operations are located on or encroach on privately owned properties, the Contractor may, at his election, negotiate with the individual landowners for restoration of the surface. This negotiation and settlement may be for materials or labor or both as agreeable to the individual property owner. In such cases, the Contractor shall obtain from the individual landowner a "Release of Claims" releasing the City of Madisonville from any further liability for surface restoration, a copy of which shall be provided for the City of Madisonville and Engineer. This option shall apply to surface restoration only. The Contractor shall be responsible for cleanup and regarding work and for any settlement of the trench or graded area within the one-year guarantee period.

3.02 SOIL PREPARATION

A. All areas to be seeded shall be thoroughly cleaned, removing all debris of whatever nature. After the area has been cleaned, the soil for seeding shall be prepared as follows:

1. Loosen the soil to a depth of not less than four (4) inches.

2. Work the soil until it is in good condition, raking with hand rakes to complete the soil preparation and make final finished grade.

3. Broadcast 15-pounds of 8-8-8 or better fertilizer on each 1,000 square-foot of area.

4. Rake area to receive sod, to spread fertilizer and work into soil.

5. On areas to be seeded, the raking in of fertilizer may be done concurrently with raking in of seed as hereinafter specified.

3.03 SEEDING

A. Temporary Cover (All Areas)

1. This item shall consist of seeding a temporary cover of grass, or grass and small grain, on areas disturbed on the construction site that will not be redisturbed within a 60-day period. The determination of the area to be temporarily seeded and the time of seeding shall be controlled by the Engineer.

2. The seed mixtures to be used for temporary cover will be governed by the time

of year the seeding is accomplished. The mixtures and time of seeding shall be as follows:

a. Time of Seeding - 2/15 to 6/1

(1) Rye 1-1/2 bushels and Ryegrass 25-pounds per acre; or tall fescue 30-pounds and Ryegrass 20-pounds per acre.

b. Time of Seeding - 6/2 to 8/15

(1) Tall fescue 30-pounds and Ryegrass 20-pounds per acre; or spring oats two (2) bushels and Ryegrass 30-pounds per acre.

c. Time of Seeding - 8/16 to 2/14

(1) Rye two (2) bushels and Ryegrass 20-pounds per acre; or tall fescue 30-pounds and Ryegrass 20-pounds per acre.

d. Lime will not be required for temporary seeding.

e. Fertilize at the rate of 400-pounds per acre of 10-10-10 fertilizers, or equivalent, broadcast uniformly on the area to be seeded.

f. All seed shall be broadcast evenly over the area to be seeded and cultipacked or otherwise pressed into the soil. Seed and fertilizer may be mixed together and applied after the seedbed has been prepared.

g. Mulch for temporary seeding will not be required except on those areas, in the Engineer's opinion, too steep to hold the seed without protective cover.

B. Seeding (Permanent Cover)

1. This item consists of seeding all areas disturbed during construction. All grading and/or filling of rills and gullies to a cross section acceptable to the Engineer shall be included in the seedbed preparation.

a. Pastures and Cover Crops

(1) All areas to be seeded shall be seeded with 50-pounds of tall fescue (KY-31) per acre, subject to the provisions hereinbefore stated in this specification group.

(2) Prepare seedbed as specified in Article 3.02 of this specification section unless instructed otherwise by the

Engineer, apply two (2) tons of lime per acre.

(3) No mulch will be required except when seeding is done during the period October 16 through January 31, or May 2 through July 31, tall fescue straw shall be used at the rate of two (2) tons per acre.

b. Lawns and Yards

(1) This item consists of seeding all areas equivalent to residential lawns or yards disturbed during construction. All grading and filling shall be accomplished in a manner acceptable to the Engineer before the placement of seed and materials. Seed shall consist of a mixture of one part Red Top and three parts high grade Kentucky Bluegrass seed mixed together and broadcast at the rate of two (2) lbs. to each 1,000-square-foot of surface, to be seeded. Apply two (2) tons of lime per acre. Apply 1500- pounds of 10-20-20 fertilizers per acre. Apply mulch at the rate of two (2) tons per acre. Mulch shall be applied to all lawn areas regardless of the time seeded.

3.04 MULCHING

A. Mulch materials, meeting the requirements of Part 2 of this Specification Section, shall be applied at the rate of two (2) tons per acre.

B. The mulch shall be stabilized by running a "weighted" disk harrow with disks set straight, over the area on the contour, after the mulch has been applied, to imbed or press a part of the straw into the soil sufficiently to hold it in place. On earth embankments or areas too steep for use of mechanized equipment, the mulch shall be held in place by using small stakes and twine or other method acceptable to the Engineer. The blown-on bituminous-treated straw mulch method of placing the mulch, as specified in Section 212.06.03, Method 2 of the Standard Specifications for Road and Bridge Construction of the Kentucky Transportation Cabinet Department of Highways, will be an acceptable placing method.

C. Mesh, netting, or other special protective cover shall be at locations as shown on the Construction Plans and shall be installed according to the manufacturer's recommendations.

12.20 CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 WORK INCLUDED

A. This section includes cast-in-place concrete, formwork, reinforcing steel, and related accessories in conformance with the requirements of ACI 301-84 (Rev. 1988), Specifications for Structural Concrete for Buildings that is hereby made a part applicable projects except as modified by the Supplemental Requirements under PART 3 - EXECUTION, this Section.

B. ACI 301-84 (Rev.1988) is the latest consensus standard publication on concrete work and, as modified by the Supplemental Requirements in PART 3 - EXECUTION, this Section, is a complete specification ACI 301-84 (Rev. 1988) is part of Field Reference Manual ACI Publication SP-15 (1988) which includes pertinent ACI and ASTM standards considered helpful and necessary job-site reference. The Supplemental Requirements can easily be noted or clipped and taped in SP-15 (1988) for ready referral. The Contractor shall keep at least one copy of SP-15 (1988) on the job site at all times.

C. PART 2 - PRODUCTS, this Section, includes the common concrete ingredients of cement, aggregate and water plus admixture and grout and other concrete relaxed items such as reinforcing steel, water stop, and joint materials. These products are also generally addressed under PART 3 - EXECUTION in ACI 301-84 (Rev. 1988) with modifications.

D. The work also includes furnishing all labor, materials, equipment, and incidentals required to place anchor bolts, inserts, reglets, flashing, pipe sleeves, conduits, and other items to be embedded or passed through the concrete as specified under other sections or as shown on the Construction Plans.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General

1. Before construction, the Engineer shall submit in writing to the City of Madisonville the name, address, and qualifications of the ready-mix supplier who will furnish concrete for the project. The testing laboratory shall also receive a copy of this Section 12.20, this Division, of the Project Specifications.

2. Also refer to ACI 301-84 (Rev. 1988) and Supplemental Requirements under PART 3 - EXECUTION, this Section.

B. Cement (ACI Section 2-1)

1. Portland cement for concrete and mortal shall conform to ASTM C150-86, Type 1.

2. The Engineer or the City of Madisonville may require the Contractor to deliver cement to a testing laboratory for tests according to ASTM Specification C 150-86 for Type I. Should cement fail the tests, the Contractor shall pay for the tests and the Engineer or the City of Madisonville shall have the right to reject the brand.

3. Cement for tests shall be delivered in four-ply paper bags with supplier and source identified in writing. Cement shall be stored in a dry location for not longer than 90-days after delivery from the mill.

C. Admixtures (ACI Section 2-2)

1. The air-entraining admixture for concrete shall conform to ASTM C 260-86, and shall be American Admixtures' AMEX, Master Builders' Micro-Air, W.R. Grace's Darex AEA, or equal.

2. The water-reducing admixture for concrete shall conform to ASTM C 494-86 for Type A (water-reducing admixtures) and shall be American Admixtures' Lubricon 300, Master Builders' Pozzolith 322 N or 344N, as recommended by Master Builders for the brand of cement to be used, or equal. The water-reducing, set-retarding admixture for concrete shall conform to ASTM C 494-86 for Type D (water-reducing and retarding admixtures) and shall be American Admixtures' Lubricon R, Master Builders' Pozzolith 300R, or equal.

D. Water (ACI Section 2.3)

1. Water shall be clean and free from harmful amounts of oils, acid, alkali, organic matter, or other deleterious substances.

2. When subjected to the mortar strength test described in ASTM C 87-83, the 28-day strength of mortar specimens made with the water under examination and normal Portland cement shall be at least 100-percent of the strength of similar specimens made with distilled water.

3. Potable water will normally fulfill the above requirements.

E. Fine Aggregate (ACI Section 2.4)

1. Fine aggregate shall consist of clean, well-graded particles of hard, durable sand, and shall contain limited amounts of deleterious substances. It shall be

washed Ohio, Scioto, or Cumberland River sand. Most Tennessee River sand, bank sands, and limestone fines are not acceptable.

2. Sand shall be graded according to Section 804 of the Kentucky Transportation Cabinet, Department of Highways Standard Specifications for Road and Bridge Construction, 2000 Edition.

	Percent
Passing 3/8-Inch Sieve	100
Passing No. 4 Sieve	90-100
Passing No. 16 Sieve	45-80
Passing No. 50 Sieve	5-25
Passing No. 100 Sieve	0-8

3. Sand shall meet the requirements of these Specifications and the specifications and tests listed below:

Deleterious Substances	-Par. 5 - ASTM Designation C 33-86.
Soundness	-Par 6 - ASTM Designation C 33-86.
Organic Impurities	-ASTM Designation C 40-88.

F. Coarse Aggregate (ACI Section 2.4)

1. Coarse aggregate shall be washed river gravel or crushed limestone of hard durable particles and shall contain limited amounts of deleterious substances. Crushed limestone shall come from ledges of a quarry approved by the Kentucky Transportation Cabinet, Department of Highways for use in reinforced concrete untreated bridge superstructures above the tops of the caps, excluding pedestals.

2. Coarse aggregate shall be either No. 57 or No. 67 graded according to Section 805 of the Kentucky Transportation Cabinet, Department of Highways Standard Specifications for Road and Bridge Construction, 1994 Edition. Refer to Section 3.6 of ACI 301.84 (Rev. 1988) for maximum size of coarse aggregate.

	Percent By Weight	
	No. 57	No. 67
Passing 1-1/2-Inch Square Sieve	100	
Passing 1-Inch Square Sieve	95-100	100
Passing 3/4-Inch Square Sieve	90-100	
Passing 1/2-Inch Square Sieve	25-60	
Passing 3/8-Inch Square Sieve	20-55	
Passing No. 4 Square Sieve	0-10	0-10

Passing No. 8 Square Sieve	0-5	0-5

3. Coarse aggregate shall meet the requirements of these specifications and the specifications and tests listed below:

Deleterious Substances	Par. 9 - ASTM Designation C 33-86.
Soundness	Par. 9 - ASTM Designation C 33-86.
Abrasion	Par. 9 - ASTM Designation C 33-86.

G. Reinforcing Steel (ACI Section 5.2)

1. Unless otherwise required or permitted, concrete reinforcing bars shall conform to grade 60 deformed bars and shall meet requirements of Deformed and Plain Billet-Steel Bars for Concrete Reinforcement (ASTM A 615-87a), Rail-Steel Deformed and Plain Bars for Concrete Reinforcement (ASTM A 616-87) or Axle-Steele Deformed and Plain Bars for Concrete Reinforcement (ASTM A 617-87). All other reinforcement and details shall conform to ACI Standard Building Code Requirements for Reinforced Concrete (ACI 318-83).

2 Before steel is shipped to job, the reinforcing steel supplier shall submit to the Engineer, two certified copies of mill tests on all steel to be used in the work. The tests shall prove that chemical and physical properties of the steel comply with the requirements of the governing specification.

3. The Engineer may require the Contractor to deliver samples of reinforcing steel to a testing laboratory, to determine compliance with governing specifications.

PART 3 - EXECUTION

3.01 Concrete work shall conform to all requirements of ACI 301-84 (Rev. 1988) Specifications for Structural Concrete for Buildings.

12.21 PRECAST CONCRETE SPECIALTIES

PART 1 - GENERAL

1.01 SUMMARY

A. All items supplied for use on this project shall be as specified herein.

1.02 RELATED WORK

A. Concrete specifications are included in Section 12.20.

B. Castings are specified in Section 12.31

C. Connecting piping is specified in Section 12.16 and Section 12.17.

1.03 REFERENCES

A. Where reference specifications (ASTM, ACI, PCI, etc.), are mentioned, these standards are deemed to be the minimum standard of quality of materials or methods to apply to this project.

1.04 SUBMITTALS

A. Shop Drawings shall be submitted according to Section 12.1.

1.05 QUALITY ASSURANCE

A. The precast fabricator shall be qualified according to PCIMNL-116-Manual for Quality Control for plants and production of precast concrete products.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Handle precast members in position consistent with their shape and design. Lift and support members only at manufacturer's designated lift points.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Concrete materials including cement, water, sand, and coarse aggregate shall conform to ACI 301-84- (Revised 1988).

B. Reinforcing steel, prestressing wire, and strand shall conform to ACI 301-84 (Revised 1988).

C. Initial Drawing shall be sent through the Contractor to the Engineer in three copies for checking and return to the Contractor in two copies.

D. Final Drawings shall be sent to the Engineer through the Contractor in six (6) copies for conformance and return in three (3) copies. The City of Madisonville shall be furnished two (2) copies of the Final Drawings.

2.02 PRECAST MANHOLES AND ACCESSORIES

A. Precast Reinforced Concrete Manhole Walls and Slabs

1. Precast reinforced concrete manhole walls and cone tops shall be of tongue-and-groove type conforming to ASTM C 478-80. Cone tops may be of an eccentric configuration. Top slabs for manholes shall conform to details on the City of Madisonville Standard Details and to ASTM Designation C 478-80. All precast slabs shall be clearly marked "TRAFFIC" or "NONTRAFFIC" and "TOP" or "BOTTOM." Before use of precast reinforced concrete wall sections and top and bottom slabs, Shop Drawings covering details of construction including accessories shall be submitted to the Engineer for review.

2. Precast manholes with "knock-out panels" for pipe entry are not acceptable.

B. Manhole Adjustment Rings

1. Manhole frame adjustment rings shall be precast concrete rings for use between the top slab or top of the cone and the manhole frame. Maximum allowable adjustment shall be 6-inches.

C. Mortar Materials

1. Portland Cement

a. Any standard brand, conforming to ASTM Specification C 150-81, Type 1, same as specified for concrete.

2. Sand

a. First quality, clean, natural Kentucky River, or Ohio River sand. When dry, 100-percent shall pass a No. 8 sieve and not more than 35-percent shall pass a NO. 50 sieve, and conforming to ASTM Standard Specification C 144-81.

D. Performed Elastic Rope Joint Fillers

1. Refer to Manhole Construction notes on Standard Details – Sanitary Sewer Construction.

E. Pipe Entry Seal

1. Pipes entering manholes shall be attached by a rubberized entry seal. The seal shall encircle the pipe snugly for the prevention of ground water leakage into or sewage leakage out of the manhole. The seal may be of the cast-in-place type or the boot type with stainless steel clamps. The manufacturer of the seal shall certify that the seal material is compatible with the pipe material used on the project.

2. Cast-in place seals shall be flexible, multi-finned, push-in type of premolded neoprene meeting ASTM C 443-79, Dura-Seal as manufactured by Dura-Tech Inc., Dayton, Ohio or equal.

3. Boot seals shall be flexible of premolded neoprene (ASTM C 923-79) with stainless steel expanding snap-ring inserted into a cored hole of manhole barrel and exterior stainless steel ring (minimum 2) to clamp the boot around pipe, Kor-N-Seal as manufactured by Reliance Universal, Inc., Knoxville, Tennessee or equal.

F. Steps

1. Manholes steps shall be cast into the manhole wall at intervals of not more than 12-inches where depths of manholes are greater than three (3) feet.

G. Interior Coating

1. For manholes that may be subject to corrosive atmospheres, such as the discharge manhole of force mains, a factory applied coating to protect the concrete and reinforcing steel from the corrosive atmosphere shall be applied. The coating shall be applied in two coats, with the first coat having a black color and the second, surface coat having a white color. Acceptable coating shall be as manufactured by TENEMC®, Series 66, or approved equal.

PART 3 - EXECUTION

3.01 PRECAST MANHOLE CONSTRUCTION

A. General

1. Manhole construction will not be permitted under conditions where there is danger of freezing or when materials are frozen. Manholes shall be protected from freezing weather for at least 48-hours after construction.

B. Excavation

1. Excavation for manholes, control chambers and interceptor structures shall be

made of sufficient width to accommodate all work and proper centering adequately. Depth of excavation shall extend sufficiently to accommodate the type of manhole provided. Where a poured concrete base is used, the excavation must be of sufficient depth to allow for a minimum of three (3) inches between the bottom of the lower pipe opening and bottom of manhole barrel and an eight (8) inch thickness for the poured concrete base. Where a precast concrete base is used, whether as a separate unit or integral with the bottom barrel section, the excavation shall be such to allow for a 12-inch depth crushed stone sub-base when in earth or a nine (9) inch depth crushed stone sub-base when in rock, below the bottom of the precast concrete base.

2. Where the manhole subgrade is in unstable material, the Engineer or the City of Madisonville may order various methods of stabilization such as extra depths of crushed stone, concrete, or other means as will prove effective.

C. Manhole Installation

1. Manhole Base

a. Poured floor slabs of manholes shall be of 3,000 P.S.I. concrete according to Section 12.20, and shall be placed ahead of sewer laying to avoid displacement of sewer ends while placing concrete. The part of the concrete slab under the manhole walls shall have a smooth trowel finish. Top of slab shall be three (3) inches (or as shown on manhole details) below the lowest sewer invert grade. In sandy soils, a six (6)-mil polyethylene film shall be used under manhole slabs to prevent loss of moisture in concrete during placement.

b. Precast concrete base slabs will be allowed based upon the City of Madisonville's acceptance of the particular base slab provided. The general requirements for poured slabs shall also apply to precast slabs. Precast base slabs shall be placed on a crushed stone subgrade leveled and compacted to the proper elevation. Crushed stone shall be Kentucky Department of Highways Size 57 and shall be 12-inches in depth when on earth and nine (9) inches in depth when on solid rock.

c. Precast concrete manhole bottoms with accurately formed channels will be allowed as alternate to standard design, provided smooth surfaces and accurate levels, widths and slopes are obtained. The forms shall be constructed according to the angles and invert elevations obtained from the "stakeout" operation, and variation of forms more than ±2°00' horizontally shall be cause for rejection. Changes in angles or elevations of manhole inverts, caused by relocation of a manhole after the original stakeout, shall be the responsibility of the Contractor if such relocation is required by conflict with water, gas, drain, or other utility lines or obstructions. Placement shall be as detailed for precast slabs above.

2. Manhole Barrel

a. Manhole structure walls shall be constructed of precast concrete as shown on the Construction Plans and as specified in this Section 12.21. Barrels shall be accurately centered on the base slab as staked in the field.

b. When poured or precast concrete base slabs are used, each barrel section shall be seated in and sealed with cement mortar. Rope joint filler is an acceptable alternative if the Contractor installs nonshrink construction grout on each joint in the interior of the manhole. Where rope joint filler is used, it shall be placed on the outside lip of the tongue and groove barrel section. Precast concrete frame adjustment rings and cast iron frames shall set in a full bed of cement mortar.

c. Precast barrel sections shall have steps cast in place or slots for steps left in place with steps to be located over the manhole outlet sewer pipe. Pipe openings shall be positioned to this arrangement. Likewise, eccentric cone sections and precast top slabs with offset entrance shall be positioned on the center with the manhole steps over the outlet sewer pipe.

3. Manhole Inverts

a. Channels through manholes shall be formed of either prefabricated forms, or hand finished of the same size as the sewer pipes connected.

b. After the first barrel section has been set, the floor shall be brought up to within one (1) inch of the top of the sewer channels with 3500 p.s.i. concrete that shall be shaped to provide a slope of at least three (3) inches from manhole sides to main sewer channels. One and one-half (1-1/2) inch thickness of mortar proportioned by volume, one part Portland cement and two parts concrete sand in a damp, loose condition (80-pounds per cubic foot dry basis), shall be placed over the ballast. This shall be steel trowel finished to provide a smooth and well-drained floor to the manhole channels.

c. The completed channels shall provide a smooth, steady transition between manhole inlet and outlet pipes. Any roughness or ragged edges within the completed channel shall be corrected before acceptance of the manhole.

4. Manhole Drops

a. For joining sewer lines at different levels, drop manholes shall be

provided. The drop inlets shall be as shown on the Construction Plans. A drop assembly shall be provided for a sewer entering a manhole at an elevation of 24-inches or more above the manhole invert.

D. Backfill

1. Backfill shall be accomplished per the requirements for sewer backfill as specified in Section 12.17.

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, materials, and equipment required to construct and install metal fabrications as shown on the Construction Plans and specified herein. Included in this section are grating, nuts, bolts, anchors, and hatches.

1.02 RELATED WORK NOT INCLUDED

A. Concrete work is included in Section 12.20 and Section 12.21.

B. Castings are included in Section 12.31.

C. Painting is included in Section 12.41.

1.03 QUALITY ASSURANCE

A. All Fabricated materials shall be of the highest quality, free of structural, handling, and workmanship defects.

B. Preassemble items in a shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

1.04 SUBMITTALS

A. Shop Drawings

1. The Contractor shall submit to the Engineer according to Section 12.1 detailed Shop Drawings of all materials to be fabricated, and shall receive the Engineer's certification of review before fabrication. Include plans, elevations, and details of sections and connections. Show anchorage and accessory items. Provide templates for anchor bolt installation by others. Include any requirements for surface preparation, paint products, or grout.

2. Where materials or fabrications are indicated to comply with certain requirements for design loadings, include structural computations, material properties and other information needed for structural analysis. This shall not relieve the Contractor of responsibility for all errors, omissions, and deviations of his shop drawing from the Construction Plans and Specifications and from requirements of final results called for in the Construction Plans and Specifications.

2.01 MATERIALS

A. Steel

1. Steel fabrication shall be done in conformity with the "AISC Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings," Eight Edition dated December, 1980, latest revisions and supplements.

2. Prime and paint according to Section 12.41, unless otherwise required or permitted.

3. Unless otherwise noted on the Construction Plans or in the Specifications, galvanizing shall be by hot dip process according to ASTM A 525-81, Coating Designation G90 (previous Coating Class Commercial 1.25 oz. per sq. ft.).

4. Damaged zinc coating shall be repaired according to Federal Specification DOD-21035A (Galvanizing Repair Spec.) And ASTM A 780-80 as follows:

   a. Remove foreign matter from both damaged and contiguous undamaged area by wire brushing and cleaning with a metal conditioner recommended by cold galvanizing coating manufactures.

   b. Apply two (2) coasts of cold galvanizing coating to damaged area, ensuring an overlap of the surrounding undamaged galvanizing for continuity of galvanic protection. Cold galvanizing coating shall be Z.R.C. Chemical Products Co., "Z.R.C. Cold Galvanizing" or Galvicon Corp., "Cold Galvanizing", or equal.

B. Aluminum

1. Aluminum shall have a high resistance to corrosion and shall be Alloys 6061-T6, 6062-T6, or 6063-T6 for wrought products such as rods, bars, standard structural shapes, extrusions, and forgings; and Alloys 214 castings, or equal.

2. Aluminum fabrication shall be according to ASCE the Aluminum Association "Specifications for Aluminum Structures," latest revision. Welding shall be done by the argon-shielded tungsten-arc method or the automatic or semiautomatic argon-shielded consumable-electrode method, or equal. Welding rods and electrodes shall be in strict accordance with above specifications.

3. Where anodic coating is required and type is not specified or shown on the Drawings, coating shall be No. 2 Clear. Anodic coatings shall conform to the following requirements:

   a. Clear Anodic Coatings

      (1) The exposed surfaces of aluminum shall be cleaned of all

fabricating oils and foreign matter, given a medium caustic etch pretreatment and shall receive the following clear anodized finish: A minimum coating thickness of 0.0004-inch (0.001 mm) and a minimum coating weight of 15.5 mg p.s.i. (204RI).

b. Color Anodic Coatings

(1) All aluminum parts (both extrusion and sheet stock) shall be of a controlled aluminum alloy and temper suitable for receiving an electrochemically produced hard anodic oxide coating. All aluminum parts (both extrusion and sheet stock) shall receive a caustic etch pretreatment to remove all surface foreign matter followed by an electrochemically produced anodic oxide coating having a minimum coating thickness of 0.0007-inch (0.0018 mm). Color shall be specified by the City of Madisonville and range samples shall be submitted to establish the upper and lower limits of color variations.

2.02 GRATINGS

A Gratings shall be the dimensions required on the Construction Plans and as required to meet the deflection specifications below, and of aluminum Alloy 6063-T5, 6063-T6, or 6061-T6, or equal. Gratings shall be designed for an allowable uniformly distributed load of 200 lbs./s.f. and a concentrated load of 400 lbs./ft. of width with less than 0.25-inch deflection. Gratings shall be IKG Industries "Ibar," Reliance "Ilok," or equal.

2.03 NUTS AND BOLTS

A. Unless otherwise shown on the Construction Plans or required in other parts of these Specifications, all nuts and bolts shall be according to ASTM A 307-83a, Grade A and shall be electrogalvanized according to ASTM B 633-79a.

B. All nuts, bolts, washers and accessories in contact with water or sewage, in vaults or any moist atmosphere or damp area such as occur above water, or embedded in concrete exposed to the weather, shall be Type 302 or 304 stainless steel. Stainless steel nuts, bolts, and washers shall be used to fasten aluminum to all materials including aluminum.

2.04 CONCRETE ANCHORS

A. Sizes and spacing or numbers of anchors shall be shown on the Construction Plans and materials shall comply with exposure requirements listed under Nuts and Bolts above. All anchors used for securing moving or vibrating equipment. (Pumps, motors, gears, sluice gates, conveyors, etc.), shall be of the cast-in-place type.

B. The size and number of anchors shall be approved by the equipment manufacturer.

C. Unless specifically noted otherwise on the Construction Plans or Specification concrete anchors for other applications shall be chemical grout-type anchors equal to Hilti "HVA Adhesive Anchor," or Ramset "Chemset Chemical Anchors." Installation shall be in strict accordance with the manufacturer's recommendations that shall be available on the job site.

2.05 HATCHES

A. Metal hatches shall be fabricated as detailed on the Construction Plans.

PART 3 - EXECUTION

3.01 GENERAL

A. The Contractor shall be responsible for all errors, omissions, and deviations of the Shop Drawings from the Construction Plans and Specifications. Any errors or omissions shall be brought to the attention of the Engineer whose interpretation and instructions shall be received before proceeding with the fabrication of that portion of the work.

B. Similarly, manufacturers' printed installation instructions shall be strictly followed and any conflicts with the Shop Drawings and/or Construction Plans shall be directed to the Engineer for resolution before proceeding with installation.

C. All base plates, inserts, and anchorages shown embedded in concrete shall be accurately placed and secured before placing concrete according to a manufacturer supplied template. All structural members and components shall be accurately leveled, plumbed, and secured at locations shown on the Construction Plans.

D. Painting

1. Cleaning and painting of all fabricated materials shall be in strict accordance with Section 12-41, of these Specifications.

E. Steel

1. All fabrication and erection shall be done in conformity with the "AISC Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings," English Edition dated December, 1980, latest revision.

2. Refer to Article 2.01 A. of this Specification Section for repair of galvanized surfaces.

F Aluminum

1. The contact surfaces of aluminum with steel, dissimilar materials, concrete and/or masonry shall be protected from corrosion by a thick coating of coal tar, Koppers Bitumastic No. 50, or equal.

2. Aluminum surface embedded in concrete shall be protected from corrosion by a tightly adherent coating of two applications of zinc chromate primer.

3.02 GRATINGS

A. Grating frames shall be installed flush with the floor surface. Adequate blocking shall be provided to hold corners square during placing concrete and exposed aluminum surfaces shall be protected to prevent pitting from the concrete. Surfaces embedded in concrete shall be protected as covered under Article 3.01, this Section.

3.03 NUTS AND BOLTS

A. Refer to Article 2.04, this Section, for material requirements.

B. Bolts embedded in concrete shall be secured with templates at the time of pouring concrete. Bolts shall be suitably protected from damage throughout the construction period.

C. Damaged galvanized surfaces on nuts and bolts shall be repaired according to Article 2.04, this Section.

3.04 CONCRETE ANCHORS

A. Refer to Article 2.07, this Section, for anchor specifications.

B. Concrete anchors shall be installed strictly according to manufacturers' printed instructions that shall be available on the job site.

C. Refer to Section 12.61 for supporting small pipe.

3.05 HATCHES

A. Install hatches as herein specified and as detailed on the Construction Plans.

12.31 CASTINGS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, materials, equipment required to install castings as shown on the Construction Plans and specified herein. Included in this section are valve boxes.

1.02 SUBMITTALS

A. Contractor shall submit to the Engineer, according to Section 12.1, copies of construction details of castings proposed for use.

PART 2 - MATERIALS

2.01 GENERAL

A. Casting shall be gray iron, conforming to the requirements of the ASTM Standards, Designation A 48-83, and Class 20 for valve boxes.

2.02 VALVE BOXES

A. Screw Type for Iron Body Gate Valves

1. Valve boxes for two (2) inch through 10-inch valves shall be the cast iron screw type of sufficient length to allow for 36-inches of cover over the top of the pipe (Tyler Pipe Coast Iron Valve Box, Two-Piece or equal). The inner section shall have a minimum inside diameter of five and one fourth (5-1/4) inches with a hood type base that will cover the packing gland on a two (2) inch through 10-inch valves (minimum of eight (8) inches inside diameter). The base of the top section shall be flanged at least one and one fourth (1-1/4) inches. The caps shall be circular with a corrugated surface and have pick holes in the periphery and be marked "Water." For 12-inch through 16-inch valves, the valve boxes shall be cast iron, Opelika Foundry Company No. 4907, or equal.

PART 3 - EXECUTION

3.01 The installation of castings is generally covered under specifications for pipe work. Castings shall be leveled, plumbed, and secured before pouring concrete or attaching to masonry with solid, watertight, cement mortar joints.

12.40 PAINTING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Paint shall be delivered to the job site in original and sealed containers plainly marked with the name brand, shelf life, and analysis of the product and the name of the manufacturer. The paint manufacturer's written instructions for proper surface preparation, mixing, thinning, application, and drying shall be furnished with the paint, available at all times at the job site, and strictly followed.

B. All Painting shall be done by skilled, experienced painters on properly prepared surfaces. All surfaces that paint could damage in function or appearance shall be protected. Drop cloths and maskings shall protect stationary surfaces. Hardware, accessories, fixtures, and similar items shall be removed and replaced after completion of painting or shall otherwise be protected. Spray painting shall not be permitted when it will cause damage to adjacent or otherwise located surfaces. Do not paint over any code-required labels, such as Underwriters Laboratories, or any equipment identification, performance rating, name, or nomenclature plates. Labels, nameplates, *et cetera*, should be masked and protected, not simply relying on "painted around" by the painter. Apply either approved masking type tape or a petroleum jelly type compound prior to paint application. Remove masking material immediately after painting has cured sufficiently.

C. The Contractor shall be responsible for the compatibility of all paints used in the work. It is essential that the paints applied in the shop and in the field be mutually compatible. A compatible paint shall be considered a paint that precludes adverse effects related to bonding, drying, delaminating, scaling, lifting, and bleeding. The Contractor shall verify compatibility of specified or acceptable paints with paints applied to materials and equipment furnished by suppliers. Verification shall be made by performing "lift" tests on small areas before complete painting or by other means acceptable to the paint manufacturer.

D. Thinning of paint for spraying shall be done strictly according to the paint manufacturer's instructions. If paints are thinned for spraying, additional coats of paint shall be applied as needed to build up the specified dry paint film thickness.

E. Paint shall not be applied when the ambient temperature or temperature of the surface to be painted is below 40° F, or the temperature required by the paint manufacturer, and when the relative humidity is such that the paint will not dry properly. Do not apply paint in snow, rain, fog, or mist, or to damp or wet surfaces, unless otherwise permitted by the paint manufacturer's instructions. Painting may be continued during inclement weather only if areas and surfaces to be painted are enclosed and heated within temperature and humidity limits specified by the paint manufacturer during application and drying periods.

F. Paint film thickness shall be subject to measurement by the Engineer with Elcometer® , wet film gauge, positector, and/or applicable measuring instruments. If dry film thickness is found to be less than specified, or coverage is not uniform, the Contractor shall apply additional paint to correct thickness or appearance.

1.02 DETAILED REQUIREMENTS

A. Excluded Surfaces

1. Specifically excluded from painting are the following surfaces:

a. All concrete inside liquid holding basins unless otherwise specified or noted on the Construction Plans to be painted.

b. All exterior concrete unless otherwise specified or noted on Construction Plans to be painted.

c. All aluminum except electrical conduits specified to be painted and except surfaces in contact with concrete, wood, masonry, dissimilar metals, or in the ground.

d. Undamaged high-grade shop finishes on equipment, if specifically accepted by the City of Madisonville as satisfactory and compatible with surrounding colors.

e. Parts of mechanisms where paint would be harmful to the operation of the mechanism.

f. Undamaged special shop furnishes or coatings specified in other sections of these Specifications or noted on the Construction Plans.

g. Gray and ductile iron underground piping other than factory coatings.

h Stainless steel, titanium, and similar corrosion resistant metals unless otherwise noted in the Construction Plans to be painted.

B. Painting Schedule

1. Schedule

		SYSTEMS		
	Location and/or Description	Sur. Prep. Paint		Color
1.	Piping and Equipment in Wet Well And Valve Vaults	1,2,3	C	Black
2.	Above Ground Equipment	1,2,3	A	Match Mfr's Colors

PART 2 - PRODUCTS

2.01 PAINT SYSTEMS

A To establish paint systems, quality and colors, all designations listed under this article are products of the following manufacturers:

1. Koppers Company, Inc., Pittsburgh, Pennsylvania

B. Painting systems shall conform to the following unless otherwise specified or noted on the Construction Plans.

1. SYSTEM A - ALKYD (Metal and Wood)

a. Pretreatment

(1) Galvanized Surfaces and Non-ferrous Metals - Degrease with Koppers Thinner 2000 followed with one (1) application of Koppers 40 Passivator (Coverage 0.3 mils min. to 0.5 mils max..)

(2) All Other Surfaces - None**.**

b. Primer

(1) Tar Dipped or Asphaltum Coated Surfaces (Interior Exposure Only) - Two (2) coast of Koppers Inertol Tar Stop (MDMTPC = 1.2).

(2) Undamaged, approved Baked-On Enameled Surfaced - None.

(3) All Other Metal Surfaces - One (1) coat of Koppers Rust Penetrating Primer No 622-LCF (MDMTPC - 1.5).

(4) Interior Wood Surfaces - One (1) coat of Koppers Interior Undercoater No. 625 (MDMTPC = 1.2).

(5) Exterior Wood Surfaces - One (1) coat of Koppers Glamortes 501 Enamel thinned 20 per cent (MDMTPC = 1.1).

c. Finish - Two (2) coats of Koppers Glamortes 501 Enamel (MDMTPC = 1.4)

2. SYSTEM C - COAL TAR (Metal)

a. Pretreatment

(1) Galvanized Surfaces - Degrease with Koppers Thinner 2000 followed with one (1) application of Koppers 40 Passivator (coverage 0.3 mils min. to 0.5 mils max.).

(2) All Other Surfaces - None.

b. Primer

(1) Surfaces To Be Primed In Shop - One (1) coat of Koppers Bitumastic Mill Undercoat in a shop (MDMTPC = 1.5).

(2) All Other Surfaces - None.

c. Finish

(1) Surfaces Exposed to Sun Light - Two (2) coats of Koppers Bitumastic No. 50 (MDMTPC = 15.0) and one (1) coat of Koppers Bituplastic No. 28 (MDMTPC = 12.0).

(2) All Other Surfaces - Two (2) coats of Koppers Bitumastic No. 50 (MDMTPC = 15.0).

Part 3 - EXECUTION

3.01 SURFACE PREPARATION

A. General

1. Surface preparation requirements listed below for various coating substrates shall be considered minimums except paint manufacturers' recommendations shall be strictly followed if they require a higher degree of cleaning.

B. Ferrous Metal Surfaces

1. General

a. Before any coating is applied, the surface shall be properly cleaned and free of all dirt, oil, grease, dust, moisture, mill scale, corrosion, welding slag, and splatter poorly bonded material including spray dust, paint splatter, and all other foreign matter and conditions detrimental to coating bond and life.

b. Dust from cleaning operations shall be properly removed by dry

methods such as vacuuming or dry-air blast, without reducing the quality of the cleaned surface.

c. In all case, surfaces shall be primed and/or treated, as specified, the same day they are prepared. A prepared surface, which becomes corroded or contaminated, shall be re-prepared before treating and/or priming.

2. Methods and Requirements

a. SSPC below refers to Steel Structures Painting Council specifications. Applicable visual standards consisting of color photographs according to SSPC - Vis 1-63T shall be used to supplement verbal description of the surface preparation specification.

(1) SYSTEM NO. 1 - SSPC-SP 1-63 Solvent Cleaning

(2) SYSTEM NO. 2 - SSPC-SP 2-63 Hand Tool Cleaning

(3) SYSTEM NO. 3 - SSPC-SP 3-63 Power Tool Cleaning

(4) SYSTEM NO. 4 - SSPC-SP 4-63 Flame Cleaning of New Steel

(5) SYSTEM NO. 5 - SSPC-SP 5-63 White Metal Blast Cleaning

(6) SYSTEM NO. 6 - SSPC-SP 6-63 Commercial Blast Cleaning

(7) SYSTEM NO. 7 - SSPC-SP Brush-Off Blast Cleaning

(8) SYSTEM NO. 8 - SSPC-SP 8-63 Pickling

(9) SYSTEM NO. 9 - SSPC-SP 9-63T Weathering Followed by Blast Cleaning

(10) SYSTEM NO. 10 - SSPC-SP 10 63T Near-White Metal Blast Cleaning

b. The Contractor shall have on the job at all times at least one (1) copy of the latest Steel Structures Painting Council Surface Preparation Guide including the pictorial standards that shall be followed.

c. For ferrous metals, surface preparation shall consist of one or more of the above SSPC systems according to Article 1.02, Detailed Requirements. However, in no case shall the surface preparation be less than the specific requirements of the paint manufacturer.

3. Shop Preparation

a. All ferrous metal surfaces to be primed which will be submerged, exposed to frequent spillage, or in a corrosive atmosphere shall be abrasive-blast cleaned to a near-white metal grade according to SSPC-SP 10-63T.

b. All ferrous metal exterior surfaces to be primed which will be normally exposed to the atmosphere or concealed in building construction such as lintels shall be abrasive-blast cleaned to a commercial grade according to SSPC-SP 6-63. All ferrous metal interior surfaces (not submerged or exposed to frequent spillage or in a corrosive atmosphere) to be primed which will be inside buildings shall receive a minimum power tool cleaning according to SSPC-SP 3-63 taking care not to burnish or shine the metal. Exceptions to these surface preparation requirements for exterior and interior atmospheric service conditions are the more strict requirements in connection with high grade finishes applied to pedestrian, service and garage steel doors, prefabricated steel building components, etc., as otherwise specified or noted on the Construction Plans.

4. Field Preparation

a. Uncoated ferrous metal surfaces and those with deteriorated primer (e.g., pinholes, rust, etc.), from improper handling, storage, and otherwise shall be cleaned according to 3.01.B.1 Surface Preparation, above for the listed service conditions.

b. Before painting, ferrous metal surfaces with the primer in good condition shall be solvent cleaned according to SSPC-SP 1-63 and the paint manufacturer's recommendations. Condition of primer may require interior and exterior surfaces normally exposed to the atmosphere to be smoothed by lightly rubbing with fine sandpaper before initial and subsequent coating applications as determined by the Engineer.

C. Galvanized and Non-ferrous Metal Surfaces

1. All galvanized and nonferrous metal surfaces shall be cleaned of corrosion, paint, cement, grease, and other detrimental foreign matter, washed thoroughly with an appropriate degreaser/solvent and dried strictly according to paint manufacturers' instructions.

D. Wood

1. Wood surfaces shall be thoroughly cleaned free of all detrimental foreign matter, sanded to a fine finish and cleaned of dust before first

coat application. Shellac, not more than 2-pound cut, shall be applied on all knots, pitch, and sapwood. After the prime coat has dried, all nail holes, cracks, open joints, and other small holes shall be neatly filled with acceptable filler. Surfaces shall be finely sanded between coats. Paint manufacturers' instructions shall be strictly followed.

E. Concrete and Masonry Surfaces

1. All non-submerged bituminous coated metal surfaces indicated to be painted shall be thoroughly cleaned of all dirt, grease, oil, and other foreign matter and painted with a barrier coat(s) to seal bituminous coating and prevent bleeding through and discoloration of the top coats.

F. Bituminous Coated Metal Surfaces (Non-Submerged)

1. All non-submerged bituminous coated metal surfaces indicated to be painted shall be thoroughly cleaned of all dirt, grease, oil, and other foreign matter painted with a barrier coat(s) to seal bituminous coating and prevent bleeding through and discoloration of the top coats.

G. High Grade Shop Finishes on Equipment That Requires Painting

1. Surfaces shall be cleaned of all detrimental foreign matter and lightly sanded or otherwise treated by methods assuring good bond and coating appearance. Paint manufactures' instructions shall be strictly followed.

12.50 SUBMERSIBLE SEWAGE PUMPS AND ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. Provide all labor, materials, equipment, and services required to furnish and install the submersible sewage pumps as shown on the Construction Plans and specified herein.

1.02 RELATED WORK

A. Special requirements for materials and equipment are given in Section 12.3.

B. Painting is included in Section 12.41 and shown on Construction Plans.

C. Motors and electrical work are specified in Section 12.70.

1.03 REFERENCES

A. Where referenced specifications (ASTM, ACI, PCI, etc.), are mentioned, these standards are deemed to be the minimum standards of quality of materials or methods to apply to this project.

1.04 SUBMITTALS

A. Shop Drawings, Control Drawings, and Operation and Maintenance Instructions shall be submitted according to Section 12.1 Refer to Section 12.3 for additional requirements.

1.05 QUALITY ASSURANCE

A. The pump manufacturer shall be Flygt or the City of Madisonville approved equal having a minimum number of not less than 100 units of the type specified and required installed and in operation handling sewage for no less than two (2) years in North America.

PART 2 - PRODUCTS

2.01 PUMPS AND MOTORS

A. Non-Clog Submersible Pumps

1. The pumps shall be capable of handling raw, unscreened sewage. The design of the connection between the pumps and the discharge piping shall be such that the pumps will be automatically connected to the discharge piping when lowered into place. The pumps shall be easily removable for servicing or inspection, requiring no bolts, nuts, or other fasteners to be removed for this

purpose, or need for personnel to enter the wetwell. The pumps shall be fitted with a stainless steel chain for each pump, of adequate strength and length to permit raising the pump for inspection and removal.

2. Casing and Impeller

a. The stator casing, oil casing, and impeller shall be of grey iron construction, with all parts coming in contact with sewage being protected by a coat of rubber-asphalt paint. All external bolts and nuts shall be stainless steel. The stationary cutter shall be mounted in an adjustable bottom plate. The bottom plate shall be cast with grooves threading outward from the center opening of the plate to the outer diameter. The impeller shall be a multiple vane centrifugal type. The cutter material shall be similar to an AISI 440C stainless steel with the addition of cobalt, vanadium, and molybdenum for superior abrasion resistance and a hardness of 58-62 Rockwell C.

3. Shaft Seal

a. Each pump shall be provided with a tandem double mechanical seal running in an oil reservoir, composed of two separate lapped face seals, each consisting of one stationary and one rotating ring with each pair held in contact by a separate spring. The lower seal shall be tungsten carbide on tungsten carbide or silicon carbide on silicon carbide. The upper seal shall be tungsten carbide, silicon carbide or tool steel on carbon. The compression spring shall be protected against exposure to the pumped liquid.

b. The pumped liquid shall be sealed from the oil reservoir by one face seal and the oil reservoir from the motor chamber by the other. The seals shall require neither maintenance nor adjustment, and shall be easily replaced.

c. Seal failure detection shall be provided and wired to an indicator light in the control panel.

B. Grinder Type Submersible Pumps

1. The pumps shall be capable of handling raw, unscreened sewage. The design of the connection between the pumps and the discharge piping shall be such that the pumps will be automatically connected to the discharge piping when lowered into place. The pumps shall be easily removable for servicing or inspection, requiring no bolts, nuts, or other fasteners to be removed for this purpose, or need for personnel to enter the wet well. The pumps shall be fitted with a stainless steel chain for each pump, of adequate strength and length to permit raising the pump for inspection and removal.

2. Casting and Impeller

a. The stator casing, oil casing, and impeller shall be of grey iron construction, with all parts coming in contact with sewage being protected by a coat of rubber-asphalt paint. All external bolts and nuts shall be of stainless steel. The stationary cutter shall be mounted in an adjustable bottom plate. The bottom plate shall be cast with grooves threading outward from the center opening of the plate to the outer diameter. The impeller shall be a multiple vane centrifugal type. The cutter material shall be similar to an AISI 440C stainless steel with the addition of cobalt, vanadium, and molybdenum for superior abrasion resistance and a hardness of 58-62 Rockwell C.

b. The common pump and motor shaft shall be 420 stainless steel supported by a heavy duty lower double row ball bearing and an upper sealed single row ball bearing.

3. Shaft Seal

a. Each pump shall be provided with two (2) seals running in an oil reservoir and one (1) rotating ring with each pair held in contact by a separate spring. The lower seal shall be tungsten carbide on tungsten carbide or silicon carbide on silicon carbide on silicon carbide. The upper seal may be either a mechanical type or a lip seal. The pumped liquid shall be sealed from the oil reservoir by one seal and the oil reservoir from the motor chamber by the other. An electronic probe shall be provided in the oil chamber to detect the leakage of water into the chamber. The seals shall require neither maintenance nor adjustment, and shall be easily replaced.

4. Pump Mounting and Removal Facilities.

a. A sliding guide bracket shall be an integral part of the pumping unit. The pump casing shall have machined connection with a yoke to connect with the cast iron discharge connection, which shall be bolted to the floor of the sump and so designed as to receive the pump connection without the need of any bolts or nuts.

b. Sealing of the pumping unit to the discharge connection shall be accomplished by a simple linear downward motion of the pump with the entire weight of the pumping unit guided to and wedging tightly against the discharge connection.

c. Guide rails and all accessories shall be non-sparking. Guide rails shall be 2-inch outside diameter (minimum) stainless steel pipe.

5. Motors

a. Pump motor shall be housed in an oil or air-filled watertight casing and shall have Class F insulated windings that shall be moisture resistant. All three phase motors shall be dual voltage. Pump motors shall have cooling characteristics suitable to permit continuous operation in a totally, partially, or nonsubmerged condition.

b. Motors shall not be overloaded under any condition of operation. Motor service factor shall not be used to prevent overloading. See the Engineers Special Provisions for electrical characteristics for detailed motor specifications.

c. Motors shall be furnished with extra hard usage flexible power cables, length as required. The cable entry into the motor housing shall be equipped with integral strain relief or an external strain relief device installed to prevent a cable pullout.

d. Each submersible pump shall be equipped with a power cable of sufficient length to reach to the control panel without splicing.

e. The pump/motor assembly shall be suitable for use in hazardous locations. The assembly shall be rated or certified for use in NEC Class 1, Group D, Division 1 hazardous locations.

6. Pump Warranty

a. The pump manufacturer shall warrant the pumps being supplied to the OWNER against defects in workmanship and materials for five (5) years under normal use, operation and service. In addition, the manufacturer shall replace certain parts that become defective through normal use and wear on a progressive schedule of cost for five (5) years. Parts included are the mechanical seal, impeller, pump housing, wear ring, and ball bearings. The warranty shall be in published form and apply to all similar units.

2.02 PUMP AND MOTOR CHARACTERISTICS

A. The service conditions, size and characteristics of the pump**s** and motors shall be provided by the Engineer and listed as shown below:

Table 1, Pump Station # - Name of Pump Station (Specify Non-Clog or Grinder)

Item	Unit	Quantity
Number of Units Required	____	_____
Minimum Static Head	Feet	_____
Maximum Static Head	Feet	_____
Capacity Requirement	gpm	_____
Total Head @ Capacity Required And Maximum Static Head	Feet	_____
Maximum Motor Size	HP	_____
Motor Phase	____	_____
Motor Voltage	V,__	_____

All submersible sewage pumps shall be Flygt or the City of Madisonville approved equal.

2.03 ACCESS FRAME AND GUIDES

A. A complete access frame and guides for each pump shall be furnished complete with hinged wand hasp-equipped cover(s), stainless steel upper guide holder and level sensor cable holder. The frame shall be securely mounted above the pumps. Each door shall have safety-locking handle in open position. Doors shall be of checkered aluminum plate, capable of loadings of 300 PSF, aluminum frame and all stainless steel hardware.

B. Lower guide holders shall be an integral part of the discharge connection. Guide rails shall be of stainless steel pipe a minimum of two (2) inch in diameter.

2.04 CONTROLS

A. The pumps shall be furnished with a control panel as specified in Section 12.72. The pumps shall operate by liquid level sensors that shall be furnished with the pumps. Four (4) sensors are required; three (3) normally open for stop, start lead, and start backup, and one (1) normally closed for the alarm level. See the control circuit and the sequence of operation on the Construction Plans for complete control requirements. The controls for the pumps shall be provided by the pump manufacturer.

B. Each submersible pump shall be furnished with seal leak detection. Extra hard usage power cable shall also be furnished with each pump, and a power cable support/mounting bracket. All cables shall be of adequate length to remove pumps

and set wet well pump control elevations as necessary.

PART 3 - EXECUTION

3.01 DELIVERY, STORAGE, AND HANDLING

A. Store indoors.

B. Pumps and motors shall not be stored on vibrating bases or floors. Any motor so stored should be disassembled and inspected for bearing damage, prior to service. If bearing damage in evident, replace bearing.

C. Check the rust preventive coating on external machined surfaces (including shaft extension) for damage. If necessary, recoat the surfaces with Rust Veto No. 342 (Manufactured by E.F. Houghton Co.) or equivalent. The condition of the rust preventive coating shall be checked periodically and surfaces should be recoated as recommended by the coating manufacturer.

D. Oil lubricated bearings - drain oil from bearing housing and refill, to maximum level, with a circulating type oil. Oil should be changed every 12-months while motor is in storage.

E. Grease lubricated bearings - once a month, inject a small quantity of grease into the grease fill such that grease is purged from the drain. Inspect purged greases for water condensation or oxidation. If water condensation or oxidation is evident, the motor shall be disassembled and contaminated grease removed, and replaced with new grease.

F. Take precautions as necessary to prevent rodents, snakes, or other small animals from nesting inside pumps.

G. Prevent moisture or condensation from accumulating by energizing motor space heaters if provided, or apply reduced voltage to one phase of motor windings (tickle-voltage-heating). Request percent of rated voltage and transformer capacity to be used from the manufacturer. The winding should be maintained. 5°C minimum above ambient temperature (some locations require a higher temperature above ambient) to prevent condensation.

H. If pump and motor are covered by plastic or similar material, additional precautions such as heated or circulating air and silica gel may be necessary, to protect against moisture or condensation.

I. Rotate pump and motor shaft several revolutions by hand once every two (2) weeks while in storage to insure a protective oil film on bearing surfaces.

J. Start-up preparation after storage:
   1. Thoroughly clean and inspect motor.

2. Change oil or grease in bearing housing.
3. Secure all plugs, fittings, etc., to prevent leakage.
4. Check insulation resistance.

3.02 INSTALLATION

A. Submersible pumps shall be shipped to the job completely assembled with the power cable attached. The unit must be properly stored and special care given to the protection of the power cable to protect it from mechanical damage and protect the cut end of the cable from the intrusion of moisture. The cable will act like a wick if the cut is allowed to lay in a pool of water. Should this condition be allowed to occur, the unit shall be shipped back to the manufacturer for complete drying out and testing.

B. It is important that the discharge connection is attached to the bottom slab level and at the exact location required relative to the access cover. Suggested procedure.

1. Install access cover.
2. Attached an upper guide bracket(s).
3. Put discharge connection(s) on bottom slab.
4. Cut to length and install guide bars between upper guide bracket(s) and discharge connections(s).
5. Put check with lever (shim, if necessary) and anchor discharge connection(s) exactly where position will result in guide bars being parallel and vertical.

C. Use proper gaskets, tighten bolts gradually and evenly. In deep stations install discharge pipe brackets to relieve discharge connections from overload and intermediate guide bar brackets to prevent guide bars from bending when pumps are pulled.

D. Lower pump units into place along guide bars. Check visually metal-to-metal contact between volute flange and discharge connection. If necessary, re-check and realign discharge connection(s) and guide bars with pumps in place.

E. After proper alignment of all components, including metal-to-metal connection of pump flange is established, grout access cover, discharge connections(s) and pipe thrulets. Build up and shape slopes at pump bottom according to the Construction Plans.

F. As a part of the final inspection each pump shall be pulled to verify trueness of alignment of guide rails, in the presence of the City of Madisonville and Engineer.

G. All motors and controls shall be connected and the motor operated while disconnected from the pump to determine proper rotation and to observe for vibration or motor defects. Disconnecting of the pump and motor on certain factory-assembled units may be waived by the Engineer.

3.03 TESTING OF PUMPS

A. All pumps shall be tested to verify performance data submitted. Pumps shall be tested by pumping down a basin or by filling a basin. All pumps shall be tested for capacity at a minimum of three (3) points on the pump curve. The motor full load amperage and voltage shall be checked and must fall within the rated values of the motor tested. Failure to perform can result in having the unit removed and replaced.

B. All tests shall be performed by the Contractor and Pump Manufacturers Representative in the presence of the City of Madisonville and the Engineer. All equipment needed for the pump tests, rulers, stopwatch, gauges, voltmeter, and ammeter shall be provided by the Contractor.

C. All motors shall be megged with the winding resistance recorded. Motor voltage and amperage shall also be measured and recorded.

D. All test data shall be reported to the Engineer and the City of Madisonville in writing.

3.04 SPARE PARTS

A. Spare parts shall be furnished for all pumping equipment. All spare parts shall be boxed and tagged with positive identification, including part number, description, and the particular pump to which it applies.

B. The required spare parts shall include the following items as a minimum for each different size or model-pumping unit:

1. One (1) complete set of mechanical seals.
2. One (1) set of impeller adjustment washers.
3. One (1) set of O-rings.
4. Wear ring.
5. Impeller screw.

12.60 WATER VALVES

PART 2 - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment, and incidentals required and install complete and ready for operation all valves and appurtenances as shown on the Construction Plans and specified herein.

B. The equipment shall include but not be limited to, the following:

1. Butterfly valves.
2. Gate valves.
3. Fire hydrants.

1.02 RELATED WORK

A. Piping is included in Section 12.16, Potable Water Pipe and Fittings.

1.03 DESCRIPTIONS OF SYSTEMS

A. All of the equipment and materials specified herein is intended to be standard for use in controlling the flow of water.

1.04 QUALIFICATIONS

A. All of the types of valves and appurtenances shall be products of well-established firms who are fully experienced, reputable, and qualified in the manufacture of the particular equipment to be furnished. The equipment shall be designed, constructed, and installed according to the best practices and methods and shall comply with these specifications as applicable.

B. Acceptable Manufacturers.

1. Butterfly Valves - Mueller or the City of Madisonville approved equal.
2. Gates Valves - Mueller or the City of Madisonville approved equal.
3. Fire Hydrants - Mueller Super Centurion 250, Kennedy, or the City of Madisonville approved equal.

1.05 SUBMITTALS

A. Complete Shop Drawings of all valves and appurtenances shall be submitted to the Engineer according to the requirements of Section 12.1, Shop Drawings, Product Data, and Sample Submittals. The City of Madisonville shall retain two (2) copies of all Shop Drawings. Additionally, the City of Madisonville shall pre-approve all "or the City of Madisonville approved equal" submittals before the Engineers' approval.

B. The Engineer shall be furnished two (2) certified copies of reports covering the required leakages, hydrostatic, and proof-of-design tests on the valves to the City of Madisonville.

C. Gate Valves

1. The manufacturer shall furnish the Engineer two (2) copies of an affidavit stating that the valve and all materials used in its construction conform to the applicable requirements of ANSI/AWWA C509-94, and that all tests specified therein have been performed and that all test requirements have been met.

2. The City of Madisonville shall be furnished two (2) copies of an affidavit that the "Valve Protection Testing" has been done and that all test requirements have been met.

3. The City of Madisonville shall be furnished with two (2) copies of an affidavit that all inspections and testing have been performed according to AWWA C509-94 Section 6.1 through Section 6.2.

106 OPERATING INSTRUCTIONS

A. The manufacturer's operating and maintenance instructions shall be furnished to the City of Madisonville as set forth in Section 12.2

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. General

1. All valves and appurtenances shall be of the size shown on the Construction Plans and as far as possible all equipment of the same type shall be from one manufacturer.

2. All valves and appurtenances shall have the name of the maker, flow-directional arrows, and the working pressure for which they are designed cast in raised letters on some appropriate part of the body.

3. All buried valves shall open left (counter clockwise).

4. All valves must be provided with suitable operating devices and adapted for operation in the position in which they are shown on the Construction Plans

5. Valves shall have types of operators as shown on the Construction Plans.

6. All bolts and studs shall be according to ASTM A-307 Grade B and nuts shall

be according to ASTM A-563. Bolts, studs, and nuts shall be electro galvanized according to ASTM B-633.

2.02 BUTTERFLY VALVES

A. Rubber Seated Butterfly Valves

1. General

a. Unless otherwise noted in these Specifications or on the Construction Plans, all butterfly valves shall meet the requirements of ANSI/AWWA Specification C504-94. All future reference to section and paragraph numbers will be those of ANSI/AWWA C504-94.

b. Unless otherwise noted, all flanged valves shall be short body type.

c. Unless otherwise shown on the Construction Plans, the maximum nonshock shutoff pressure will not exceed those specified for the various valve classes.

d. Unless otherwise noted on the Construction Plans, or called for in these Specifications, flow though the valves will be:

Normal:	Not more than six (6) feet/second (max)
When Opening:	10-feet/second
When Closing:	16-feet/second

2. General Design

a. Valve Bodies

(1) Valve bodies shall be of cast iron or ductile iron. They shall be short body flanged ends, mechanical joint ends, or nonstandard ends. Wafer type valves are not acceptable.

b. Valve Shafts

(1) Valve shafts shall be according to the requirements of Section 3, paragraph 3.3, and subparagraphs 3.3.1 through 3.3.4, except that carbon steel shafts are not acceptable.

c. Valve Discs

(1) Valve discs shall be according to Section 3, paragraph 3.4, and subparagraphs 3.4.1 through 3.4.4, except that cast steel and fabricated steel discs are not acceptable.

(2) The manufacturer shall furnish the City of Madisonville dimensions of the clearance required for the valve disc.

d. Valve Seals

(1) Valve shaft seals shall be standard split V type packing, standard O-ring seals, or for a pull down packing.

e. Valve Actuators

(1) General

(a) Valve actuators shall be of type called for as shown on the Construction Plans. They shall be equipped with adjustable mechanical stop-limiting devices to prevent over-travel of the valve disc in the open and closed positions. Actuator housing, supports, and connections to the valve shall be designed with a minimum safety factor of five (5), based on the ultimate strength, or three (3) based on the yield strength of the materials used.

(b) Valve actuators shall be according to Section 3, paragraph 3.8, subparagraphs 3.8.1 through 3.8.4, and subparagraphs 3.8.7.9 through 3.8.7.11.

(c) Certification for the proof of design tests of the valve actuator shall be submitted according to Section 12.0.

(2) Buried Actuators

(a) Buried valve actuators shall be lubricated for life of the valve and be designed for satisfactory operation in groundwater conditions. (They shall be designed for operation for Class 150 B butterfly valves.) They shall also be nut and key type of 30-inch bury over top of pipe. All valves with nuts over 30-inches below top of valve box shall have extension stems to within 12-inches of top of boxes.

f. Workmanship and Painting

(1) Workmanship and painting shall be according to Section 4, paragraphs 4.1 and 4.2, and subparagraphs 4.2.1 through 4.2.3.

g. Marking and Shipping

(1) In addition to valve marking as specified under Section 6, paragraph 6.1 marking, each valve shall be given a tag number that will

correspond to the valve locations shown on the Drawings. Tags shall be of durable material and markings and shall be secured to the valve by pliable steel wire.

2.03 GATE VALVES

A. Resilient-Wedge Gate Valve (AWWA type)

1. General

a. Resilient-seated gate valves shall conform in all respects to ANSI/AWWA C509-94 with non-rising or rising stems, in sizes 3, 4, 6, 8, 10, and 12-inch NPS except as otherwise noted below. They shall be designed for a working water pressure of 250 p.s.i.

b. Valves shall have a clear unobstructed waterway, without pockets or ridges in the seating area of the valve body. When fully open, the water way shall be at least as large as the pipe diameter to which it is connected.

c. All future references to section and paragraph numbers shall be those of ANSI/AWWA C509-94.

2. Materials

a. Physical and Chemical Properties

(1) Physical and chemical characteristics of the valve components shall be according to Section 2.2, except that carbon steel castings for valves are not acceptable. Paint shall be as hereinafter specified under "Valve Protection."

3. Detail Design

a. Valve Ends

(1) General

(a) Valve ends shall be mechanical joint type.

b. Stem Seal

(1) Stem seals shall be O-rings according to Section 4.8, paragraph 4.8.2 and subparagraph 4.8.2.1, and materials shall be according to paragraph 4.8.3.

c. Wrench Nuts and Hand wheels

(1) Wrench nuts shall be according to Section 4.10 and subparagraphs 4.10.1 through 4.10.5, except that all valves shall open by turning counterclockwise.

d. Gaskets

(1) Gaskets where used shall be according to Section 4.11. O-rings of Buna-N or equal material.

e. Valve Seats

(1) Valve seats shall be according to Section 4.12, except that seats applied to the valve body are not acceptable.

f. Seat Reinforcement

(1) Seat reinforcement where used shall be according to Section 4.13, except that exposed mechanical devices and hardware used shall be bronze and/or stainless steel.

4. Valve Boxes

a. Valve boxes as specified in Section 12.31 shall be provided for each buried valve.

5. Fabrication

a. Valve Protection (Painting and Coating).

(1) Exterior

(a) Exterior painting of the valve may be according to section 2.2.7.1, or it may be the same as that specified for interior painting of the valves.

(2) Interior

(a) The interior of the valve shall be prepared for and painted according to AWWA C550-90. The coating may be a fusion bonded epoxy, in 8 to 10-mil thickness or it may be a two-part thermosetting epoxy having the same mil thickness. After application the interior coating shall be visually examined and holiday tested according to AWWA C550-90.

2.04 DRY-BARREL FIRE HYDRANTS

A. General

1. This standard covers post-type dry barrel fire hydrants with compression type valves, operating against pressure. They shall meet all requirements of ANSI/AWWA Specification C502-85.

2. They shall have two (2) two and one half (2-1/2) inch hose connection nozzles and one (1) five and one fourth (5-1/4) inch streamer connection nozzle, all with caps and drains and have national standard threads.

3. Main valve opening size shall be five and one fourth (5-1/4) inch that must remain closed when the above ground breakable safety section of the hydrant barrel is broken off.

4. All hydrants shall have six (6) inch mechanical joint bell connection designed for 250 p.s.i. working water pressure, according to ANSI/AWWA C110/A21.10. Joint accessories are to be furnished with the hydrant.

5. Finish paint color of the hydrant barrel above ground line shall be fire hydrant yellow (two (2) coats).

6. All hydrants shall have an automatic drain feature providing positive barrel drainage after hydrant use.

7. The lowest outlet level of the hydrant shall be located sufficiently above the indicated ground level to permit a 360d swing of a 15-inch hydrant wrench. Hydrants shall open by turning counterclockwise.

8. Where the City of Madisonville has standardized on one particular make and model fire hydrant and desires that the hydrants furnished under this project be such standard, that make and model hydrant, namely Mueller Company "Super Centurion 250-inch Fire Hydrant, will govern.

9. All further reference to section and paragraph numbers shall be those of ANSI/AWWA C502-85.

B. Affidavit of Compliance

1. The manufacturer shall furnish the City of Madisonville, through the Engineer, three copies of an affidavit according to Section 1, paragraph 1.7.

C. Materials

1. All materials used in the production of dry-barrel fire hydrants shall conform to the referenced standards for each material as set forth in Section 2 -

Materials, paragraphs 2.1.1 through 2.1.5.

D. General Design and Detailed Design

1. General Design

a. General design of hydrants shall be according to Section 3, paragraph 3.1 and subparagraphs 3.1.1 and 3.1.2.

2. Detailed Design

a. Valves

(1) Valves shall be according to Section 3, paragraph 3.2.1 and subparagraphs 3.2.1.1 and 3.2.1.2.

b. Valve Facings

(1) Valve facings shall be according to Section 3, paragraph 3.2.2.

c. Valve Seats

(1) Valve seats shall be according to Section 3, paragraph 3.2.3.

d. Size

(1) Hydrant size shall be according to Section 3, paragraph 3.2.4, except that main valve opening diameter may not be less than five and one fourth (5-1/4) inches.

e. Bury-length and Trench Depth

(1) Unless otherwise noted, depth of the hydrant will be 3'-6". In the event that a hydrant is installed at a location requiring greater than the "standard bury" depth, the Contractor will be required to provide the riser sections required at no additional cost to the City of Madisonville.

f. Barrel Sections

(1) Hydrant barrel sections shall be according to Section 3, paragraph 3.2.6 and subparagraphs 3.2.6.1 and 3.2.6.2 except that the flange or other joint at 2 inches above the ground line shall be a breakable joint.

g. Hydrant Top

(1) Hydrant tops shall be according to Section 3, paragraph 3.2.7.

h. Outlet Nozzles

(1) Hydrant outlet nozzles shall be according to Section 3, paragraph 3.2.8 and subparagraph 3.2.8.1 and 3.2.8.2 except that lead shall not be used in fastening nozzles to the hydrant barrel.

I. Operating Stem and Mechanism

(1) An automatic drain outlet shall be provided. The outlet shall be located in the base or barrel or between the base and barrel. Tapping of the outlet is not required. Other features of the drain outlet shall be according to Section 3, paragraph 3.2.10.1 and 3.2.10.2.

j. Drain Outlet

(1) An automatic drain outlet shall be provided. The outlet shall be located in the base or barrel or between the base and barrel. Tapping of the outlet is not required. Other features of the drain outlet shall be according to Section 3, paragraph 3.2.10.1 and 3.2.10.2.

k. Drain Valve mechanism

(1) The hydrant drain valve shall be according to Section 3, paragraph 3.2.11.

l. O-ring Seals

(1) A seal that use O-rings shall be used. O-rings and their ring groves shall be according to Section 3, paragraph 3.2.12.1 and 3.2.12.2

m. Gaskets

(1) Gaskets shall be according to Section 3, paragraph 3.2.14.

n. Bolts and Nuts

(1) With the exception of flange bolts at breakable hydrant barrel section, all bolts and nuts shall be of corrosion resistant material, according to Section 3, paragraph 3.2.17. Breakable

section bolts may be of steel.

o. Hydrant Inlet

(1) The base of the hydrant shall have a bottom inlet provided with a hub end for mechanical joint connection provided with strapping lugs for strapping the hydrant to water main to prevent separation of the hydrant and hydrant branch from the main line, or the hub end may be plain mechanical joint, provided locked type pipe joints are used between the hydrant and water main. Refer to Section 12.16 of these Specifications for optional methods of restraint for fire hydrants.

E. Workmanship and Painting

1. Workmanship shall be according to Section 4, paragraph 4.1 and subparagraph 4.1.1 through 4.1.3.

2. Painting shall be according to Section 4, paragraph 4.2 and subparagraphs 4.2.1 through 4.2.3.

F. Inspection, Testing and Rejection

1. Testing shall be according to Section 5, paragraph 5.1 and subparagraphs 5.1.1 through 5.1.3. The Engineer shall be furnished the City of Madisonville 2 copies of all tests.

2. Inspection and rejection shall be according to Section 5, paragraph 5.2, with 2 copies of affidavit being supplied the Engineer.

G. Marking and Shipping

1. Marking and shipping shall be according to Section 6, paragraphs 6.1 and 6.2, except that hydrants having a depth of bury greater than the standard 3'-6", shall be given a tag number that corresponds to the hydrant's plant location number. Tags, if required, shall be of durable materials and markings.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Exterior

1. Valves in ground shall be installed with operating stems vertical, unless otherwise shown on the Construction Plans or called for in these Specifications. Tops of operating nuts shall be not more than 30-inches below

ground surface. Where valve-operating nuts are more than 30-inches below tops of valve boxes, stems shall be provided to bring the operating nut to within 12 to 24-inches of box tops.

2. Valve boxes shall be accurately centered over valve operating nuts and the backfill shall be mechanically tamped about them, to prevent subsequent movement. Tops of boxes shall be flush with ground surface, paving, walk, or road surface.

3. Valve boxes shall be provided with a concrete collar, required about valve boxes, as shown on the City of Madisonville Standard Details.

B. For butterfly valves, installation shall be according to ANSI/AWWA C504-94.

C. For gate valves, installation shall be according to ANSI/AWWA C504-94.

D. Fire hydrants shall be installed at locations as shown on the Construction Plans.

3.02 SHOP PAINTING

A. Interior surfaces of all valves, the exterior surfaces of buried valves and miscellaneous piping appurtenances shall be given a shop finish of an asphalt varnish conforming to Federal Specification TT-V51e for Varnish Asphalt.

B. The exterior surface of various parts of valves and miscellaneous piping shall be thoroughly cleaned of all scale, dirt, grease, or other foreign matter and thereafter one shop coat of an approved rust-inhibitive primer such as Rust-Oleum 9578 Coal Tar Epoxy shall be applied according to the instructions of the paint manufacturer.

3.03 INSPECTION AND TESTING

A. The various pipelines in which the valves and appurtenances are to be installed are specified to be field-tested. During these tests any defective valve or appurtenance shall be adjusted, removed and replace, or otherwise made acceptable to the Engineer and the City of Madisonville.

B. Testing shall be done according to Section 12.16 "**TESTING**" with no visible leaks allowed on valves.

3.04 TOOLS AND SPARE PARTS

A. "All special tools required for normal operation and maintenance shall be furnished by the valve manufacturer."

12.61 CORPORATION AND CURB STOPS AND MISCELLANEOUS APPURTENANCES FOR WATER MAINS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish all labor, materials, and accessories to install equipment required by the Project, shown on the Construction Plans or specified herein, including the following:

1. Miscellaneous cocks and stops for water service.

1.02 RELATED WORK

A. Pressure pipe is included in Section 12.16.

B. Water valves, fire hydrants, and appurtenances are included in Section 12.60.

1.03 QUALITY ASSURANCE

A. All equipment and appurtenances shall be products of well-established firms who are fully experienced, reputable, and qualified in the manufacture of the particular equipment to be furnished. All materials of construction shall be of an acceptable type and shall be designated for the pressure and temperatures at which they are to be operated, for the materials they are to handle, and for the use for which they are intended. The materials shall meet established technical standards of quality and strength necessary to assure safe installations and conform to applicable standards. The equipment shall be designed, constructed, and installed according to the best practices and methods and shall comply with these Specifications as applicable.

1.04 SUBMITTALS

A. Copies of all materials required to establish compliance with these Specifications shall be submitted according to the provisions of Section 12.1.

PART 2 - PRODUCTS

2.01 GENERAL

A. All stops and appurtenances shall be of the size shown on the Construction Plans and as far as possible all equipment of the same type shall be from one manufacturer.

2.02 MISCELLANEOUS STOPS

A. Corporation Stops and Accessories

1. Corporation stops to be used shall be compression type for straight copper

tubing where connected into ductile iron pipe, shall be brass ground joint type with AWWA taper (Mueller CC) thread inlet and compression copper outlet and shall be Mueller H-15000, or approved Ford equal.

2. Corporation stops shall be factory tested to 250 p.s.i. to be compatible with the pipes in which they are installed.

B. Curb Stops

1. Curb stops to be used at the meter shall be inverted key curb stop with copper compression nut inlet and female iron pipe thread outlet. Curb stops shall be Mueller H-15175, or approved Ford equal.

2.01 FREEZELESS FLUSH HYDRANTS

A. Above ground flush hydrants shall be of the anti-freezing, non-pollutable type, one (1) inch size for 30-inch cover over water service line. The flush hydrant assembly shall include a ball wheel handle, vacuum breaker, one (1) inch hose connection, and double ball check valve on the drain. The operating valve shall be located at the bottom of the hydrant assembly. When the operating valve is turned off it shall allow the water remaining in the supply line in the hydrant above the valve to drain from the hydrant by means of a by-pass in the valve stem. The hydrant handle, casing, and base shall be cast iron and the operating valve red brass.

B. The flush hydrant shall be Murdock BFHM-100-1-inch or the City of Madisonville approved equal.

C. All hydrants shall be furnished with anti-siphon vacuum breaker.

PART 3 - EXECUTION

3.01 INSTALLATION

A. All miscellaneous water service valves, stops, and appurtenances shall be installed in locations shown, true to alignment and rigidly supported. Any damage to the above items shall be repaired to the satisfaction of the Engineer before they are installed.

B. After installation, all valves and appurtenances shall be tested at least one hour at the working pressure corresponding to the class of pipe, unless a different test pressure is specified. If any joint proves to be defective, it shall be repaired to the satisfaction of the Engineer.

C. All materials shall be carefully inspected for defects in workmanship and materials, all debris and foreign material cleaned out of openings, etc., all operating mechanisms operated to check their proper functioning, and all nuts and bolts checked for tightness. Equipment that does not operate easily, or is otherwise defective, shall be repaired or replaced.

3.02 INSPECTION AND TESTING

A The various pipeline in which the specified equipment is to be installed is specified to be field-tested. During these tests any defective equipment shall be adjusted, removed and replaced, or otherwise made acceptable to the Engineer and the City of Madisonville.

12.70 BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 CONTRACTOR'S UNDERSTANDING

A The Contractor shall read all applicable sections to the Specifications. If any discrepancies are discovered between the Basic Electrical Requirements and Electrical Codes referenced in this Section, the above-mentioned documents shall overrule this Section. The Basic Electrical Requirements are intended as a supplement to the above-mentioned documents.

1.02 SCOPE

A. Work included in this section of the Specifications includes the furnishing of all labor, material, tools, state approvals, utility connection fees, excavation, backfill, and other equipment necessary to install the electrical system as shown on the Construction Plans and as specified herein.

B. It also includes installation and connection of all electrical utilization equipment included on the project but furnished by other Contractors or suppliers.

C. The Contractor shall furnish and install all conduits, wire, and miscellaneous material to make all electrical connections to all items of utilization equipment or wiring devices except as otherwise specified.

D. All devices and items of electrical equipment, including those shown on the Construction Plans but not specifically mentioned in the Specification or those mentioned in the Specifications but not shown on the Construction Plans, are to be furnished under this section of the Specifications. Any such device or items of equipment, if not defined in quality, shall be equal to similar equipment and/or devices specified herein.

E. All devices and items of equipment mentioned in this section of the Specifications whether electrical or not or whether furnished under this or other divisions of the Specifications shall be installed under this division of the specifications, unless specifically indicated otherwise.

F. Where wiring diagrams are not shown on the Construction Plans, they are to be provided by the supplier of the equipment served and such diagrams shall be adhered to except as herein modified.

G. The following is a list of items that may not be defined clearly on the Construction Plans or in other parts of these Specifications. The list is meant to be an aid to the Contractor and is not necessarily a complete list of all work to be performed.

1. Furnish, install, and connect all electrical conduits, duct, and cables.

2. Furnish, install, and connect all utility poles.
3. Furnish, install, and connect all power distribution equipment.

1.03 SHOP DRAWINGS, DESCRIPTIVE LITERATURE, INSTALLATION, OPERATION AND MAINTENANCE (O&M) INFORMATION

A. Shop Drawings including descriptive literature and/or installation, operation and maintenance instructions shall be submitted in the amount of eight (8) copies for this division. All Shop Drawings shall be submitted in loose-leaf three-ring cardboard reinforced vinyl binders.

B. Shop Drawings will be required on the following materials specified in this division.

1. Conduit - all types and sizes, including liquid tight flexible.
2. Boxes - all types and sizes.
3. Wiring devices.
4. Device plates.
5. Metal framing system (Strut type channel).
6. Conduit fittings, expansion joints, support hardware.
7. Power distribution equipment - including individually mounted items.
8. Wire - all types and sizes.
9. Light fixtures - all types.
10. Wire markers, signs, and labels.

C. The Engineer and the City of Madisonville reserve the right to make modifications to motor control and power distribution equipment ratings after Shop Drawing review. If the Shop Drawings are submitted (prematurely meaning submitted before all utilization equipment has been reviewed and accepted), cost of modifications shall be the Contractor's responsibility.

1.04 SYMBOLS AND ABBREVIATIONS

A. The symbols and abbreviations generally follow standard electrical and architectural practice, however, exceptions to this shall be as shown on the Construction Drawings.

1.05 COORDINATION OF WORK WITH OTHER TRADES

A. The Contractor shall coordinate the electrical work with that of other trades to ensure proper final location of all electrical equipment and/or connections.

1.06 CODES

A. The minimum standard for all work shall be the latest revision of the Kentucky Building Code (KBC), and the National Electrical Code (NEC). Whenever and wherever state and/or local laws or ordinances and/or regulations and/or the Engineer's design requires a higher standard than the current NEC or IKBC, then these laws and/or regulations and/or the design shall be followed.

B. Following is a list of other applicable Standards or Codes.

	Organization/Code/Standard	Abbreviated Title
1.	Kentucky Building Code	KBC
2.	National Electrical Code	NEC
3.	National Electrical Safety Code	NESC
4	Underwriters Laboratories, Inc.	UL
5.	Factory Mutual System	FM
6.	National Fire Protection Assoc.	NFPA
7.	National Electrical Manufacture Assoc.	NEMA
8.	Occupational Safety and Health Admin.	OSHA
9.	Insulated Cable Engineers Assoc., Inc.	ICEA
10.	Illumination Engineering Society of N. Am	IES
11.	Instrument Society of America	ISA
12.	Institute of Electrical and Electronic Engineers, Inc.	IEEE
13.	Certified Ballast Manufacturers Assoc.	CBM
14.	American National Standards Institute, Inc.	ANSI
15.	Anti-Friction Bearing Manufacturers Assoc., Inc.	AFBMA
16.	Joint Industry Council	JIC
17.	American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.	ASHRAE
18.	Federal Communications Commission	FCC

1.07 INSPECTION AND PERMITS

A. Inspection of the electrical system on all construction projects is required. If the Local Government has appointed a State Licensed Inspector, the Contractor shall be required to use that person to perform the inspections. If a locally mandated Inspector does not exist, the Contractor shall select and hire a State Licensed Inspector, who has jurisdiction before any work is concealed.

B. At the time of completion of the project, there shall be furnished to the City of Madisonville a certificate of compliance, from the agency having jurisdiction pursuant to all electrical work performed. The Engineer shall also receive a photostatic copy.

C. All costs incurred by the Contractor to execute the above-mentioned requirements shall be paid by the Developer at no extra cost to the City of Madisonville.

D. All permits necessary for the complete electrical system shall be obtained by the Contractor from the authorities governing such work.

1.08 STORAGE

A. All work, equipment, and materials shall be protected against dirt, water, or other injury during construction.

B. Sensitive electrical equipment delivered to the job site, shall be protected against injury or corrosion due to atmospheric conditions or physical damage by other means. Protection is interpreted to mean that equipment shall be stored under a roof, in a structure properly heated in cold weather and ventilated in hot weather. Provision shall be made to control the humidity in the storage area to 50 percent relative. The stored equipment shall be inspected periodically, and if it is found that the protection is inadequate, further protective measures shall be employed.

1.09 MATERIALS

A. All materials used shall be new and at least meet the minimum standards as established by the NEC and/or National Electrical Manufacture Association (NEMA). All materials shall be UL listed for the application, where a listing exists. All equipment shall meet applicable FCC requirements and restrictions.

B. The material and equipment described herein has been specified according to a particular trade name or make to set quality standards. However, each Contractor has the right to substitute other material and equipment in lieu of that specified, other than those specifically mentioned as matching or for standardization, providing such material and equipment meets all of the requirements of those specified and is accepted, in writing by the Engineer and the City of Madisonville.

C. The reuse of salvaged electrical equipment and/or wiring will not be permitted.

1.10 ERRORS, CORRECTIONS AND/OR OMISSIONS

A. Should a piece of utilization equipment be supplied of a different size than shown on the Construction Plans, the Contractor shall be responsible for installing the proper size wiring, conduit, starters, circuit breakers, etc., for proper operation of that unit and the complete electrical system at no extra cost to the City of Madisonville

B. It is the intent of these Specifications to provide for an electrical system installation complete in every respect, to operate in the manner and under conditions as shown in these Specifications and on the Construction Plans. The Contractor shall notify the Engineer, in writing, of any omission or error in the electrical design.

C. Necessary changes or revisions in electrical work to meet any code or power company requirements shall be made by the Contractor.

1.11 GUARANTEE AND WARRANTIES

A. The Contractor shall guarantee all work including equipment, materials, and

workmanship. This guarantee shall be against all defects of any of the above and shall run for a period of one (1) year from the date of acceptance of the work, concurrent with the one (1) year guarantee period designated for the construction under which electrical work is performed. The date of acceptance shall be considered the date on which all "punch list" items are completed (punch lists is defined to be the written listing of work that is incomplete or deficient that must be finished or replaced/repaired before the City of Madisonville accepts the work).

B. Repair and maintenance for the guarantee period is the responsibility of the Contractor and shall include all repairs and maintenance other than that which is considered as routine. (That is replacement of lamps, oiling, greasing, etc.) The City of Madisonville shall be the judge of what shall be considered as routine maintenance.

1.12 CLEANUP

A. Cleanup shall be completed as soon as possible after the electrical installation is complete. All electrical equipment shall be free of shipping tags, stickers, etc. All painted equipment shall be left free of scratches or other blemishes, such as splattered or blistered paint, etc. All light fixture diffusers shall be clean. Surplus material, rubbish, and equipment resulting from the work shall be removed from the job site by the Contractor upon completion of the work.

1.13 EXCAVATION AND BACKFILL

A. Excavation

1. Excavation for conduits shall be of sufficient width to allow for proper jointing and alignment of the type conduit used. Conduit shall be bedded on original ground. Where conduit is in solid rock, a six (6) inch earth cushion must be provided. Conduit shall be laid in straight lines between pull boxes and/or structures unless otherwise noted on the Construction Plans.

A. Backfill

1. Backfill shall be hand placed, loose granular earth for a height of six (6) inches above the top of the largest conduit. This material shall be free of rocks over one half (1/2) inches in diameter.

1.14 POWER COMPANY COORDINATION

A. The Contractor is responsible for coordinating all activities onsite by the Power Company.

B. Any special provisions required by the serving electrical utility shall be as outlined on the Construction Plans or as advised by the utility at the time of construction, and work required by these special provisions shall be executed with no extra cost to the City of Madisonville.

1.15 TEMPORARY ELECTRICAL POWER

A. The Contractor shall be responsible for providing temporary electrical power as required during the course of construction and shall remove temporary service equipment when no longer required. The City of Madisonville will not place the electric account in the name of the City of Madisonville until project certification by the Engineer.

1.16 OVERCURRENT PROTECTION

A. Circuit breakers or fused switches shall be the size and type as written herein and shown on the Construction Plans. Any additional over current protection required to maintain an equipment listing by an authority having jurisdiction shall be installed by the Contractor at no extra cost to the City of Madisonville**.**

1.17 RECORD DRAWINGS

A. The Contractor shall maintain one (1) set of the Construction Plans on the job in good condition for examination at all times. The Contractor's qualified representative shall enter upon these drawings, from day to day, the actual "as-built" record of construction and/or alteration progress. Entries and notes shall be made in a neat and legible manner and these drawings delivered to the Engineer after completion of the construction, for use in preparation of Final Record Drawings.

1.18 GROUNDING AND BONDING

A. All metallic conduit, cabinets, equipment and service shall be grounded according to the latest issue of the National Electrical Code. All supporting framework and other metal or metal clad equipment or materials that are in contact with electrical conduit, cable and/or enclosures, shall be properly grounded to meet the code requirements.

1.19 SERVICE ENTRANCE

A. Conductors and terminations for service entrances shall be furnished and installed by the Contractor. Voltage, phase, and number of wires shall be as shown on the Construction Plans. Clearances for overhead entrance wires shall be per Power Company, NEC, and NESC requirements.

B. Any details not shown on the Construction Plans or written in the Specifications pertaining to the service entrance shall be per power company requirements. It is the Contractor's responsibility to contact the utility prior to bidding and obtain any special requirements or costs they will be imposing.

1.20 CONTRACTOR LICENSING

A. The Contractor performing electrical work on this project shall be locally licensed, if required by local law or ordinance. If the Contractor has passed the State Test, it may not be necessary to meet Local Testing requirements. It shall be the Contractor responsibility to investigate these requirements.

1.21 ANCHORING/MOUNTING

A. Electrical conduits and/or equipment shall be rigidly supported. Anchors used shall be metallic expansion type, or if appropriate to prevent spalling concrete, epoxy set type. Plastic or explosive type anchors are prohibited.

B. Since this project is in Seismic Zone 1, the Contractor shall be sure that all supports are consistent with the KBC requirements in this regard.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

12.71 RACEWAYS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. This section of the Specifications includes all raceways for accommodation of electrical conductors, communications conductors, sleeves for underground electrical installations, conduit stubs for future installation, fittings therefore, and accessories.

B. All raceways shall be marked with the manufacturer's name or trademark as well as type of raceway and size. This marking shall appear at least once every 10-feet and shall be of sufficient durability to withstand the environment involved. All raceways shall be furnished and installed as outlined under the following sections.

C. All raceways and fittings shall be painted to match existing surfaces except in mechanical spaces.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Tubular Raceways

1. Steel, Galvanized, Rigid, Heavy-Well, Threaded – "Wheatland Tube Co.," "Triangle," "Allied Tube & Conduit Corp.," or equal.

2. Aluminum, Rigid, Heavy-Wall, Threaded - "VAW," " Alcoa," ""Reynolds," or equal.

3. Steel, Intermediate Metal Conduit (IMC), Electro-Galvanized, Rigid, Threaded – "Allied Tube and Conduit Corp.," "Triangle," "Wheatland Tube Co.", or equal.

4. Plastic (PVC), Type A (Thin Wall); Type 40 (or Schedule 40); Type 80 (or Schedule 80) (Heavy-Wall) – "Robin-Tech," @Carlon," or equal.

B. Raceway Fittings

1. Conduit fittings - "Crouse-Hinds," "Appleton, " "OZ Gedney, " or equal.

2. Non-metallic conduit fittings - "Robin-Tech, " "Carlon, " "Scepter, " or equal.

2.02 MATERIALS

A. Aluminum Conduit

1. Aluminum conduit shall be extruded from alloy 6063 and shall be the rigid type, non-toxic, corrosion resistant, and non-staining. It shall be manufactured per UL Standards as well as listed/labeled by same.

2. Fittings, boxes, and accessories used in conjunction with aluminum conduit shall be die cast, copper free type. They shall be resistant to both chemical and galvanic corrosion. All covers shall have neoprene gaskets.

B. Rigid Steel Conduit

1. Rigid steel conduits and fittings shall be of mild steel piping, galvanized inside and out, and shall conform to UL standards. The conduit and fittings shall be listed and labeled by UL as well. The galvanized coating of zinc shall be of uniform thickness applied by the hot-dipped process, and shall be applied also to the threads. It shall be further dipped in a chromic acid bath to chemically form a corrosion resistant protective coating of zinc chromate that has a characteristic yellow-green color. Each piece of conduit shall be straight, free from blisters and other defects, cut square, and taper reamed. It shall be delivered with plastic protectors on the threads.

C. Polyvinyl chloride (PVC) Conduit

1. PVC conduit and fittings shall be Schedule-40, 80, heavy wall, or thin wall, as indicated in these Specifications manufactured to conform to UL Standards. It shall be listed and labeled by UL. It shall have at least the same temperature rating as the conductors' insulation. Expansion joints shall be used as recommended by the manufacturer in published literature. PVC systems shall be 90° C minimum UL rated, have a tensile strength of 7,000 p.s.i. @ 73.4° F, flexural strength of 11,000 p.s.i. and compressive strength of 8,000 p.s.i.

D. Intermediate Metal Conduit

1. Intermediate metal conduit (IMC) shall be made of high performance steel and given extra strength by a special electro-weld forming process, and shall have a larger internal diameter than rigid steel conduit. IMC conduit shall be listed and labeled by UL. Exterior surfaces shall be hot-dip galvanized in the smaller sizes and electro-galvanized in the larger sizes and then chromated. All threads shall be galvanized after cutting. The interior wall shall be coated with a silicone epoxy-ester lubricant. Each piece of conduit shall be straight, free from blisters and other defects, cut square, and taper reamed.

E. Conduit Fittings

1. Rigid Steel and IMC Conduit Fittings

a. Standard threaded couplings, locknuts, bushings, and elbows made only of steel or malleable iron are acceptable. Integral retractable type IMC couplings are acceptable also.

b. Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure.

c. Bushings Metallic insulating type, consisting of an insulating insert molded or locked into the metallic body of the fitting. Bushings made entirely of metal or nonmetallic material are not permitted.

d. Erickson (union-type) and set screw type couplings. Approved for use in concrete are permitted for use to complete a conduit run where conduit is installed in concrete. Use set screws of case hardened steel with hex head and cup point to firmly seat in conduit wall for positive ground. Tightening of set screws with pliers is prohibited.

e. Sealing fittings: Threaded cast iron type. Use continuous drain type sealing fittings to prevent passage of water vapor. In concealed work, install fittings in flush steel boxes with blank cover plates having the same finishes as that of other electrical plates in the room.

2. Rigid Aluminum Conduit Fittings

a. Standard threaded couplings, locknuts, bushings, and elbows: Malleable iron, steel or aluminum alloy materials. Zinc or cadmium plate iron or steel fittings. Aluminum fittings containing more than 0.4 percent copper are prohibited.

b. Locknuts and bushings: As specified for rigid steel and IMC conduit.

c. Set screw fittings: Not permitted for use with aluminum conduit.

3. Expansion and Deflection Couplings

a. Accommodate 1.9 cm (0.75-inch) deflection, expansion, or contraction in any direction, and allow 30-degree angular deflections.

b. Include internal flexible metal braid sized to guarantee conduit ground continuity and fault currents according to UL and NEC code tables for ground conductors.

c. Watertight seismically qualified, corrosion-resistant, threaded for and

compatible with rigid or intermediate metal conduits.

d. Jacket: Flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber material, and stainless steel jacket clamps.

PART 3 - EXECUTION

3.01 PREPARATION

A. Exterior underground metallic conduits shall be degreased and pretreated with Koppers 40 Passivator or an equal substitute product evaluated and accepted according to Section 12.41 of the Specifications, or Koppers 30 Metal Conditioner or an equal substitute product evaluated and accepted according to Section 12.41 of the Specifications, and painted with two (2) coats of Koppers Bitumastic 300-M or an equal substitute product evaluated and accepted according to Section 12.41 of the Specifications. Other finishes may be acceptable upon the Engineer's review. No open wiring will be allowed.

3.02 INSTALLATION

A. Conduit

1. All conduit shall be installed in a first class workmanship manner. It shall be installed in horizontal and vertical runs in a way that ensures against trouble from the collection of trapped condensation and shall be arranged to be without traps wherever possible. No open wiring is allowed.

2. Fittings or symmetrical bends shall be required wherever right angle turns are made in exposed work. Bends and offsets shall be avoided wherever possible, but where necessary, they shall be made with an approved conduit-bending machine. All conduit joints shall be cut square, reamed smooth and drawn up tight, using couplings intended for the purpose.

3. Conduits shall be securely fastened to all sheet metal outlets, junction and pull boxes with double galvanized locknuts and insulating-grounding bushings as required by the NEC. Runs of exposed conduits shall be supported according to the NEC using cast aluminum or malleable iron one-hole pipe straps with spacers to provide an air space behind the conduit. Stainless steel minerallac, one (1) piece conduit clamps shall be acceptable where located such that building occupants are not in danger of inadvertent contact, since this type fittings have several sharp edges

4. During construction, all conduit work shall be protected to prevent lodgment of dirt, plaster or trash in conduits, fittings, or boxes. Conduits that have been plugged shall be entirely freed of accumulations or be replaced. All conduits below grade shall be swabbed free of debris and moisture before wires are pulled. Crushed or deformed conduits shall not be permitted.

5. All open conduit work through new slabs shall be run through sleeves that shall be made watertight. These sleeves shall be PVC of suitable diameter to permit the passage of the conduit used.

6. In certain situations, conduit expansion joints shall be required to ensure against conduit and/or cable damage due to settling or thermal expansion and contraction. These expansion joints shall be required where required by the manufacturer or the Construction Plans and shall be installed per manufacturers instructions.

7. PVC conduit installed underground for low voltage application shall be schedule 80 without encasement, except service entrance conduits shall be schedule 40 PVC, thin wall PVC, or Fibre Duct, and shall be concrete encased, and where rigid metal conduit is required to comply with requirements for hazardous locations. Where PVC conduit is installed, transition shall be made to GRS conduit at bends where wire pulling could cut conduit.

8. All metal raceway systems shall be grounding conductive, solidly bonded throughout and grounded according to N.E.C. requirements and/or as noted on the Construction Plans. In addition, all raceway systems shall be provided with separate grounding conductors.

9. Minimum conduit size shall be three fourths (3/4) inch. The following table shows the minimum burial depth required for all exterior conduit or cable:

Rigid Steel Conduit	18”
Schedule 80 PVC	30”
Schedule 40 PVC, thin wall, or fiberduct, Concrete Encased (for low voltage service entrance)	18”

10. Wire pulling shall be facilitated by a UL approved pulling compound in pulls more than 30-feet in length or where there are two or more 90-degree bends. Only polypropylene, nylon, or manila pulling ropes with be permitted. Standard industry recognized wire-pulling equipment shall be used.

11. Areas of use for each type of conduit:

	Schedule 40 PVC	Schedule 80 PVC	GRS	IMC	Aluminum Exterior Underground*
Low Voltage	X	X	X	X	
Low Voltage Service Entrance (Concrete Encased)	X	X	X	X	X

Exterior Exposed

Low Voltage	X	X

* Rigid metal conduits shall be used underground when compliance with code for hazardous locations is required.

12. Underground raceways (conduit) shall be provided with steel sleeves where they pass over or under obstructions, such as: sidewalks, roadways, piping; etc.

13. All conduit shall have an insulated ground wire pulled to all equipment and receptacles.

14. All raceway runs are shown diagrammatically to outline the general routing of the raceway. The installation shall be made to avoid interference with pipes, ducts, structural members or other equipment. Should structural or other interference prevent the installation of the raceways, or setting of boxes, cabinets, or the electrical equipment, as indicated in the Construction Plans, deviations must be approved by the City of Madisonville, and after approval, shall be made without additional charges and shown on the Final Record Drawings.

12.72 CONTROLS

PART 1 - GENERAL

1.01 REQUIREMENTS

A. Equipment controls shall be as specified herein and shown on the Construction Plans. Legends for starter nameplates shall be taken from the one line diagram in the Construction Plans.

B. Certain equipment starters contain nonresettable elapsed time meters as shown in the Construction Plans. Also, certain motor starters have remote control devices and require connections to operate these control devices as shown on starter schematics (control circuits).

C. All starters contain red "on" lights, control transformers, and auxiliary contacts to operate as defined on the control circuits of the Construction Plans. Reset pushbuttons shall also be provided for overloads built into the starters.

1.02 CUSTOM CONTROL PANELS (INDOOR USE ONLY)

A. All control panels furnished shall be manufactured according to Industry Standards and as herein specified. Some control panels are specified to be furnished with the equipment controlled and others are to be furnished by the Contractor, as written elsewhere.

B. Control panels shall be as manufactured by Hennessy Products Inc. Panel construction shall comply with OSHA and other code requirements as applicable, and may be attested to by UL listing the panels as an assembly. Otherwise, panel modifications as required by the Electrical Inspector shall be performed by the supplier.

C. Control panels to be furnished on this project shall be wired to function according to schematics shown on the Construction Plans. In addition to the requirements shown on the Construction Plans, the panels shall adhere to additional requirements as written herein, and in the utilization equipment specifications.

D. Enclosures shall be dead front with all operators' devices accessible without opening the enclosure door. All relays, timers, terminal strips, etc., shall be mounted to a subpanel inside the enclosure. All wiring must be stranded and sized to be protected by a 20 A / IP circuit breaker. Supplemental overcurrent protection may be used in lieu of oversized wiring. All panels mounted outside shall have operators devices mounted on an inner door with an outdoor door that is blank.

E. All terminal strips and lugs shall be of a type UL listed to terminate the size and quantity of wires encountered.

F. Enclosures shall be provided with a locking hasp and any exterior hardware shall be stainless steel or other corrosion resistant material. Enclosures for interior use in dry areas shall be NEMA 12 enclosed, unless otherwise indicated. Wet location or outdoor mounted enclosures shall comply with Article 1.03 below.

G. Elementary control schematics and connection diagrams showing the spatial relationship of components and wiring shall be submitted for review. Also, a bill of materials, drawing of device arrangement on front, and enclosure fabrication drawings shall be submitted. Further, descriptive literature is required on all components. A copy of the Shop Drawing shall be furnished and stored in a pocket inside the enclosure.

H. Sleeve type wiremarkers or other "permanent" type marker shall be installed on all wires, keynoted back to the elementary schematic or the connection diagram, and all terminals identified.

1.03 CONTROL PANEL ENCLOSURES FOR OUTDOOR/WET LOCATIONS

A. General

1. The purpose of this Specification is to provide details of an enclosure that protects internal equipment from rain, dust, vandalism, and other conditions found in an outdoor environment or otherwise harsh environment.

2. The manufacturer shall provide part numbers on all components for repair purposes. Enclosure shall be single or double door as required.

3. Control panel enclosure sizing shall be by supplier according to appropriate standards codes.

B. Performance

1. The enclosure(s) will meet or exceed the requirements of a NEMA 4X rating and shall be UL listed.

C. Cabinet Construction

1. General

a. The cabinet and door or doors shall be constructed from 5052-H32 sheet aluminum alloy that has a thickness of 0.125-inch. External welds shall be made by using the Heliarc Welding Method, whereas internal welds will be made by the Wire Welding Method. All welds shall be neatly formed and free of cracks, blowholes, and other irregularities.

b. All inside and outside edges of the cabinet shall be free of burrs.

c. The cabinet shall be designed with a sloped top to prevent the accumulation of water on its top surface.

d. The door openings shall be double flanged on all four (4) sides that increase strength around openings and keeps dirt and liquids from entering the enclosure when the door is opened.

e. Door restraints shall be provided to prevent door movement in windy conditions.

2. Door Hardware

a. The cabinet door or doors will be a minimum of 80 percent of the front surface area and shall be hinged on the right side when facing the cabinet (right and left outside edges for double door enclosures).

b. Each door shall be furnished with a gasket that satisfies the physical properties as found in UL508 table 21.1 and shall form a weather right seal between the cabinet and door.

c. The hinges shall be continuous and bolted to the cabinet and door utilizing 1/4-20 stainless steel carriage bolts and Ny-Lock ® nuts.

d. The hinges will be made of 0.093-inch thick aluminum and shall have a three (3) inch open width with a 0.250-inch diameter stainless steel hinge pin.

e. The hinge pin shall be capped top and bottom by weld to render it tamper proof.

f. All bolt holes shall be gasketed.

g. The latching mechanism shall be a three (3) point draw roller type.

h. The center catch and pushrods shall be cadmium plated, Type II, Class I, or equal.

i. Pushrods will be turned edgewise at the outward supports and shall be 0.250-inch by 0.750-inch steel, minimum.

j. Rollers shall have a minimum diameter 0.875-inch and will be made of nylon. The center catch shall be fabricated from 0.140-inch steel, minimum.

k. An operating handle shall be furnished.

l. The handle shall be stainless steel with a three fourths (3/4) inch diameter shank.

m. The latching handle shall have a provision for padlocking in the closed position.

n. A light/alarm bracket shall be provided.

3. Switch Compartment

a. A switch compartment, with removable back panel, is to be supplied on the enclosure main door. It shall be large enough to include all operating devices.

b. The switch compartment door opening shall be double flanged on all four (4) sides for strength and to prevent liquids or dirt from dropping into the compartment when the door is open.

c. The door shall be furnished with a gasket that satisfies the physical properties as found in UL508 Table 21.1 and will form a weather tight seal between cabinet and door.

d. The switch compartment door shall have a tight key lock. Two keys shall be furnished with each lock.

e. The switch compartment door hinge shall be 0.063-inch stainless steel with a 0.120 diameter stainless steel hinge pin.

D. Equipment Mounting

1. Adjustable Channels

a. The enclosure shall be equipped with two adjustable "C" mounting channels on both sidewalls and back wall of the enclosure, allowing versatile positioning of shelves or panels.

b. The mounting channels shall provide infinite vertical and horizontal adjustment and not limit the positioning of shelves or panels. All mounting hardware will be furnished.

2. Shelves

a. If equipment is to be shelf mounted, the enclosure shall be provided with shelves fabricated from 5052-H32 aluminum having a thickness of 0.125-inch.

b. The shelf depth shall be a minimum of 10.5-inches. The enclosure

will have provision for positioning shelves or panels to within four (4) inches of the bottom and to within eight (8) inches of the top of the enclosure.

3. Aluminum Back Panel

a. If the equipment is to be panel mounted, the enclosure shall be provided with a 5052-H32 aluminum back panel have a thickness of 0.125-inch.

b. The panel shall be natural finish. All mounting hardware will be furnished.

4. Print Storage Pocket

a. A control panel shop drawing storage pocket shall be provided inside the enclosure at a convenient location.

E. Cabinet Finish

1. Unless otherwise specified, the outside surface of the cabinet shall have a smooth, uniform, natural aluminum finish.

2. If painted, the following steps shall be taken as a minimum requirements:

a. The cabinet, doors, and any other parts to be painted will be submerged in each tank of a three (3) step iron phosphate conversion technique.

b. After phosphatizing, the parts shall be baked to eliminate any moisture in seams.

c. The finish coat of alkyd bake enamel will be baked to 10 minutes at 300-325°F.

d. The finish shall be commercially smooth, substantially free of flow lines, paint washout, streaks, blisters, and other defects that would impair serviceability or detract from general appearance.

F. Cabinet Mounting

1. Pole or Wall Mounted Enclosure

a. Enclosures intended for pole or wall mounting shall be provided with stiffener plates with a thickness of 0.125-inch aluminum welded to top and bottom of rear wall for added strength and rigidity.

b. All mounting holes must be gasketed.

2. Pedestal Mounted Enclosure

a. Enclosures intended for pedestal mounting shall be provided with a reinforced base plate. If the enclosure is fabricated from 0.125-inch thick aluminum, the base plate will be a thickness of 0.250-inch aluminum.

b. All mounting holes must be gasketed.

3. Pad Mounted Enclosure

a. A solid plate shall be bolted and gasketed in place on the bottom of the enclosure to provide a weather tight seal.

G. Acceptable Manufacturers

1. Cabinet is to be manufactured by Hennessy Products, Inc., or the City of Madisonville approved equal.

1.04 SYSTEM DESCRIPTION

A. Sewage Pump Stations

1. Power to the sewage pumps shall be provided from a fused double throw safety switch pole mounted beside the station. The sewage pumps shall be controlled by full or reduced voltage, non-reversing, molded case breaker, combination starters. The starters shall be mounted with all control circuitry as described herein, in a NEMA 4X enclosure of dead front construction with a NEMA 4X exterior and three (3) point lockable latch. The lead pump selector switch, hand-off-automatic switches, and alarm silence switch shall be oil-tight and mounted on the NEMA 4X dead front. The pilot lights and elapsed time meters shall be either oil-tight and mounted on the dead front or visible through a waterproof window in the dead front. This shall constitute the pump control panel furnished by the pump supplier and shall be mounted beside the station, or on the wet well slab.

2. Each pump starter shall have an H-O-A (hand-off-automatic) selector switch. In H position the unit shall run continuously and on A position, the unit shall be controlled by wet well level. Each starter shall be equipped with a phase failure relay such that if one phase fails to reach proper voltage level, the relay shall disconnect power to all phases.

3. The pump control panel shall also have an alarm light that signifies wet well level and a manual alternator switch for selection of lead and lag pumps. All external connections to the panel shall be made through terminal strips. For

further details, see the Construction Plans.

12.80 FENCING

PART 1 - GENERAL

1.01 REQUIREMENTS

A. The Developer shall furnish all labor, materials, equipment, and services required to install fencing as specified herein.

1.02 QUALIFICATIONS

A.. The fencing shall be furnished and installed by a manufacturer and supplier who are reputable and qualified in the design, fabrication, and installation of fencing in accordance with best practices and methods.

1.03 SUBMITTALS

A. Shop Drawings and other items needed to establish compliance with these specifications shall be submitted to the Engineer.

PART 2 - PRODUCTS

1.04 SECURITY FENCING

A. General

1. Fencing shall be woven wire, chain link type, and shall be eight (8) feet high overall. Fabric shall be seven (7) feet with one (1) foot of height of three-strand barbed wire overhanging outside at a 45-degree angle.

A. Fittings

1. All fittings necessary to make a complete installation shall be malleable iron, pressed steel, aluminum or forgings. All ferrous materials shall be thoroughly galvanized by the hot dip method as specified in ASTM A 525-81.

Table 1
Chain Link Framework Table
(Schedule 40)

Size Pipe	Weights (Lbs. Per Ft)	Depth	Concrete Diameter
1 5/8" OD	2.27 lbs		
2" OD	2.72 lbs		
2 1/2" OD	3.65 lbs	30"	10”
3" OD	5.79 lbs	3'	12"
4" OD	9.11 lbs	3'	12"
6 5/8" OD	8.97 lbs	4'	14"
8 5/8" OD	5.00 lbs	4'	16"

C. Corner, Terminal and Pull Post

1. Corner, terminal and pull post shall be hot dipped galvanized inside and outside at a rate of 2.0 oz. per square foot of actual surface area. The three (3) inch outside diameter seamless steel pipe shall weigh 5.79 pounds per foot and extend three (3) foot below ground level. The post shall extend high enough to allow attachment of barbed wire by three (3) tension bands equally spaced to give a uniform appearance. All post shall be capped with a heavy malleable iron top of bullet type construction to exclude moisture.

D. Line Post

1. Line post shall be tow and one half (2-1/2) inch diameter high carbon seamless steel pipe, hot galvanized inside and outside at a rate of 2.0 oz per square foot of actual surface area. The two and one half (2-1/2) inch outside diameter seamless steel pipe shall weight 3.65 pounds per foot and extend 30-inches below ground level. All line posts shall be capped with a barbed wire extension arm as specified herein.

E. Gate Post

1. The posts shall be in conformance with the "Gate Post Schedule" and shall be capped with a heavy malleable iron top, of bullet type construction to exclude moisture. Gatepost shall be coated inside and outside with hot galvanized at a rate of 2.0 oz. per square foot of actual surface area. Posts shall extend high enough to allow attachment of barbed wire by three (3) tension bands equally spaced to give a uniform appearance.

2 Gate Post Schedule

Single Gates	Double Gates	Schedule 40
Up thru 5"	Up thru 10”	3" OD
Over 5' thru 8'	Over 10' thru 16'	4" OD

F. Rails

1. Top rails and brace rails shall have a one and five eights (1-5/8) inch outside diameter seamless steel tubing, weighting 2.27 lbs per foot, hot dip galvanized at a rate of 2.0 oz. per square foot of actual surface area. Rails shall be not less than 20-feet in length joined with extra long pressed steel sleeved as specified herein.

G. Fabric

1. The fabric shall be aluminum coated steel to meet ASTM A-491-80 composed of individual wire pickets, helically wound, and interwoven from No. 9 gauge steel wire to form a continuous chain link fabric having a two (2) inch mesh.

Both the top and bottom edges shall have twist construction. Basic steel wire shall conform to the following:

Carbon	.18 - .31
Manganese	.60 - .90
Phosphorous	0.040 Max
Sulphur	.050 Max

2. The aluminum coating weight shall be a minimum of 0.40 oz. per square foot of wire surface. The breaking strength of the aluminum-coated wire shall be a minimum of 1,290 ft. - lbs.

H. Gates

1. Swing frames shall be two (2) inch OD galvanized seamless steel pipe weighting 2.72 lbs. per foot, corners fitted with rigid watertight heavy malleable iron castings or electrically welded joints. Internal bracing shall be one and 1-5/8-inch OD galvanized seamless steel pipe weighting 2.27 lbs. per foot.

2. Gate hinges shall be double clamping offset type allowing gates to swing back parallel with line of fence. They shall be of malleable iron and forged steel heavily galvanized.

3. Gate latches shall be of the eccentric couple locking type which engage the strikes securely bolted to either gate frame or gate frame at both the top and bottom. In the case of double gates, latches shall also engage a heavy malleable iron non-freezing gate stop anchored in concrete footing latches shall be equipped for locking with padlock.

4. Gatekeepers shall be furnished with each gate frame to automatically engage gate frame when swung to open position.

5. Barbed wire shall be three (3) strands each of two (2) 12-1/2 gauge twisted copper hearing steel line wires, hot dipped aluminum per ASTM A 585-81 for Class II coating. The weight of the coating shall be 0.30 oz. per square foot of surface area. The barbs shall be No. 14 gauge aluminum four-point barbs, spaced not more than four (4) inches apart.

I. Chain Link Special Appurtenances (Per ASTM F 626-79)

1. Each line post shall be equipped with a hot dipped galvanized barbed wire extension arm capable of passing top rail. The arm shall be pressed steel riveted to a malleable iron base at a 45-degree angle carrying three strands of barbed wire.

2. Brace and tension bands shall be beveled edge type fabricated from pressed

steel or aluminum. Steel bands shall be hot dipped galvanized with a minimum of 1.2 oz. of zinc coating per square foot of surface area. Brace bands shall be a minimum of 12 gauge of thickness and a minimum width of 3/4-inch or 19.05 mm. Tension bands shall be a minimum of 14 gauge with a minimum of 3/4-inch or 19.05 mm in width.

3. All post caps and end rails shall be designed to fit snugly over posts and prevent moisture from entering the inside of the tube. Post cap shall be fabricated from malleable iron, pressed steel of aluminum. Line post caps shall be designed to allow top rail top rail to pass through. All ferrous materials shall be thoroughly galvanized by the hot dip method with a minimum of 1.2 oz. of zinc per square foot of surface area.

4. Top rail shall be fabricated from pressed steel or round steel tubing. Sleeve shall be hot dipped galvanized with a minimum of 1.2 oz. of zinc coating per square foot of surface area. The design of the sleeve shall be such that no movement along the rail shall take place upon installation.

5. Tension bars for attached fabric to terminal post shall be a minimum of 3/16-inch thickness by 3/4-inch in width. The length shall be a minimum of two (2) inches less than the full height of the chain link fabric.

6. Truss rods shall be a minimum of 5/16-inch in diameter fabricated from merchant quality steel rod and hot dip galvanized with a minimum of 1.2 oz. of zinc coating per square foot of surface area. All rods shall be designed and equipped with a truss tightener.

7. Aluminum ties shall be used for attaching fabric to top rail, brace rails and line post. The aluminum ties shall be nine (9) gauge round wire of Alloy 1100-H14 or equal.

8. Carriage bolts shall be hot dip galvanized or aluminum, 5/16" x 1-1/4", with nut and shall be used in conjunction with brace and tension bands. Galvanized bolts and nuts shall be coated in accordance with ASTM A 153-80. Larger bolts required at gates and latches shall be galvanized coated in accordance with ASTM A 153-80.

PART 3 EXECUTION

3.01 SITE PREPARATION

A. The location of fence lines, gates, and terminal post shall be as shown on the Construction Plans. Prior to construction the Contractor shall locate and flag all underground utilities in or about the fence construction.

3.02 SECURITY FENCE INSTALLATION

A. Posts

1. All posts shall be set 10-feet or less on centers equally spaced between pull posts in a hole filled with concrete as required in Table 1. All concrete shall be left two (2) inches below grade to allow for cover with sod, blacktop or other covered material. Posts shall be accurately lined and plumbed. Intermediate pull post bracing shall be equally spaced when a straight run becomes greater than 300-feet in length.

B. Terminal, Gate, Pull, and Corner Post Bracing

1. A center rail is required with horizontal braces and truss rods to adjacent line post, securely fastened with adequate adjustment.

C. Top Rail

1. The top rail shall run through the openings in the line posts tops on a continuous grade uniformly parallel with the ground surface. Connection to the corner, gate, terminal, and pull posts shall be with brace bands and rail ends. Offset at corners will not be permitted.

D. Fabric Stretching

1. Two (2) stretcher bars shall be threaded through the fabric from top to bottom at a location in the center of the fence section to be stretched. The bars shall be adequately spaced such that when stretched the installer has room to thread a loose picket link down through the meshing links of the two ends to make a perfect jointing. The stretching shall be done with two (2) blocks and when released the fabric shall be taut along any point of the fence line. The top selvage shall be dressed about the top rail and the fabric secured with tie wire spaced not more than 24-inch apart and uniformity tied. The fabric shall be fastened to the line post with specified tie wires spacing not more than 14-inches on center uniformity tied.

E. Barb Wire Stretching

1. Block and tackles and come along shall be used to string barbed wire. Wire shall be placed in the openings provided in the barb arms, and locked in place by sliding the locking wire down inside the V-channel and over the barbed wire.

F. Repair of Galvanized Surfaces

1. Galvanized surfaces damaged by welding or other reasons shall be repaired

according to Federal Specification MIL-P-21035 (Galvanized Repair Spec.) As follows:

(a) Remove foreign matter from both damaged and contiguous undamaged area by wire brushing and clearing with metal conditioner recommended by cold galvanizing coating manufacturer.

(b) Apply two (2) coats of cold galvanized coating to damaged area, ensuring a overlap of the surrounding undamaged galvanizing for continuity of galvanic protection. Cold galvanized coating shall by Z.R.C. Chemical Products Co., "Z.R.C. Cold Galvanizing" or Galvicon Corp., "Cold Galvanizing, " or equal.

3.03 CLEAN-UP

A. The Contractor is responsible for removal of all excess material, earth, etc. due to fence construction.

B. Earth shall be slightly mounted around each post to enhance drainage.

APPENDIX A

SELECTED DEFINITIONS

AASHTO - An abbreviation for American Association of State Highway Transportation Officials.

ACI - An abbreviation for American Concrete Institute.

ASTM - An abbreviation for American Society for Testing and Materials.

ANSI - An abbreviation for American National Standards Institute.

AWWA - An abbreviation for American Water Works Association.

Abandoned - To remove from service for all functional use.

Average Daily Flow - That flow occurring in the sewers as a 24-hour dry weather average, including a nominal amount of infiltration, otherwise described as the total quantity of flow tributary to a point divided by the number of days of flow measurement.

Backfill - (a) The refilling of an excavation after a structure has been placed therein.
(b) The material placed in an excavation in process of backfilling.

Bacteria - Single-celled microorganisms that lack chlorophyll. Some bacteria can cause human, animal, or plant diseases: others are essential in pollution control because they break down organic matter in the air and in the water.

Barrel, Manhole - The vertical portion of a manhole used to gain access to a sewer or sewer structure.

Base, Manhole - The bottom or supporting structure on which the manhole barrel rests.

Bedding - The earth or other materials, on which a sewer of other structure is supported.

Bell - The recessed, over enlarged, female end of a pipe into which the male or spigot end fits.

Blow Off - A waste gate or device for discharging accumulated solids or for emptying a depressed sewer. A device for flushing a water main.

Blueline Stream - Natural surface drainage structure shown on USGS topographic maps as a solid blueline. Also, classified by Kentucky Division of Water as a natural drainage structure having continuous flow during normal weather conditions.

Borings - Surface investigation performed to classify the types of soils.

Branch, Y (Wye) - A pipe joined to another pipe (usually at 60 degrees with alignment of the other) molded together and manufactured as a whole unit.

Capacity - The amount of flow in terms of cubic feet per second that a conduit can or will discharge. Capacity depends on factors such as velocity, coefficient of roughness, size, shape, and slope of the conduit.

Castings - Metallic objects (normally cast iron) formed of molten in a mold. Examples are: manhole lids, manhole rims, valve and meter boxes, etc.

cfs - Cubic feet per second, a measure of the amount of flow in a pipe or in a stream.

Chamfer - A flat surface created by slicing off a square edge or corner.

Chlorination - The application of chlorine to drinking water or sewer for disinfection or the oxidation of undesirable compounds or microorganisms.

Chlorine - An element ordinarily existing as a greenish-yellow gas about 2.5 times as heavy as air. At atmospheric pressure and a temperature of -30.1 degrees Fahrenheit, the gas becomes an amber liquid about 1.5 times as heavy as water. The chemical symbol of chlorine is Cl. Its atomic weight is 35.457, and its molecular weight is 70.914.

Coefficient - A numerical quantity interposed in a formula, which expresses the relationship between two or more variables, which may be derived by theoretical or experimental methods.

Coefficient, Roughness - A factor, "n", in the Kutter, Manning, Hazen-Williams, and other formula that represent the effect of roughness of the confining channel or conduit material upon the energy losses in the flowing water.

Collar - (a) A cylindrical ring of either brick or precast concrete, secured upon the cone or barrel of a manhole upon which the frame will rest.

(b) A cylindrical monolithic concrete encasement for securing a joint and preventing shear by movement.

Collector System - A network of lateral and branch sewers in a defined area, which collects and transports sewage to a larger sewer.

Conduit - A continuous piping or passage system for transporting water or sewerage underground. Also, used for containing wires and cables of other utilities.

Connection, House - See Property Service Connection.

Construction Documents - The Standards Manual, Construction Plans, and Special Provisions, with all amendments, modifications and supplement.

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

Contractor - The individual, firm, corporation or any acceptable combination thereof, or joint venture, contracting with a Developer or the City of Madisonville for performance of prescribed work.

Cradle - Type of bedding, usually of gravel or concrete, being laid upwards from the trench bottom to the spring line of the pipe.

Crown - The highest inside part of a conduit; the inner top of a conduit.

Cubic Feet per Second - (Abbreviated cfs) A unit of measure of the volume of liquid flow past a given point in one second.

Cul-de-sac - An alley or street having no outlet at one end, usually having an area at its dead end for turning around.

Culvert - A closed conduit typically of precast or monolithic structure of sufficient length for the passage of water.

Dechlorination - Removal of residual chlorine in water by a chemical or physical process.

Discharge - (a)As applied to a sewer or stream, the rate of flow, or volume of water flowing therein at a given place and within a given time.

(b)The act, in water or other liquid, of passing through an opening or passes along a conduit or channel.

(c)The water or other liquid that emerges from an opening or passes along a conduit or channel.

DOW - Refers to the Division of Water, a branch of the Commonwealth of Kentucky's Natural Resource and Environmental Protection Cabinet, Department for Environmental Protection.

Drainage Area - A tributary area that is generally limited by a topographic area, but may be also limited by political boundary or economic factors.

Dynamic Head - In pumping water, a head usually expressed in pounds per square inch (p.s.i.) representing both the pressure due to the elevation to which the water is pumped and that due to friction of the water in the pipe, the head against which a pump works.

Effluent - The water or wastewater that flows from a basin, treatment process or treatment plant.

Encasement - Usually monolithic concrete used to enclose the periphery of a conduit.

Engineer - A person registered to practice Engineering in the Commonwealth of Kentucky pursuant to KRS Chapter 322. A Professional Engineer.

Equivalent - Being equal in measure.

Flap Gate - A gate that opens and closes by rotation around a hinge or hinges at the top of the gate permitting the fluid to pass only in one direction.

Flood Level - The stage of a stream at the time of a flood.

Flood Plain - The land contained within the perimeter of the probable limiting flood.

Flood Frequency - The frequency with which the maximum flood may be expected to occur at a site and any average interval of years. Frequency analysis defines the "N-year flood" as the flood that will, over a long period of time, be equaled or exceeded once every N year.

Flow, Dry-Weather (Sanitary) - The flow of wastewater in a sewer during dry weather. Such flow consists mainly of sewerage and wastes with no stormwater of groundwater included.

Force Main - A pipe under internal pressure created by being on the discharge side of a pump station.

F.P.S - Feet per second

GPD - Gallons per day.

Grade (a)The inclination or slope of a stream channel, conduit or natural ground surface, usually expressed as the ratio or percentage of vertical rise or fall per 100-feet of horizontal distance. See Slope.

(b)The elevation of the invert of the bottom of a pipeline, culver, sewer, etc.

Grade, Hydraulic - In a closed conduit under pressure, a line joining the elevation to which water would rise in pipes freely vented and under atmospheric pressure. See Gradient, Hydraulic; also, Line, Hydraulic Grade.

Gradient - The rate of change of any characteristic per unit of length or slope. The term is usually applied to such things as elevations, velocity, pressure, etc. See Slope.

Gradient, Hydraulic - The slope of the hydraulic grade line, the rate of change of pressure head, the ratio of the loss in the sum of the pressure head, and positive head of the flow distance.

Groundwater - Subsurface water occupying the zone of saturation. In a strict sense, the term applies only to water below the water table.

Head - The height of the free surface above any point in a hydraulic system; a measure of the pressure or force exerted by the fluid.

Head, Friction - The head lost by water flowing in a conduit as the result of intermolecular friction or disturbances setup by the contact between the moving water and its containing conduit.

Head, Loss of - The vertical distance or height through which a body must fall freely under the force of gravity to acquire the velocity that it possesses. It is equal to the square of the velocity divided by twice the acceleration of gravity.

Hydraulic Grade Line - A hydraulic profile of the piezometric level of water at all points along the line. The term is usually applied to water moving in a conduit, open channel, stream, etc. In an open channel it is the free water surface.

I/I - Refers to infiltration and/or inflow.

Infiltration - Refers to groundwater that enters a sewer system through such sources as defective pipes, pipe joints, connections, or manholes.

Infiltration, Groundwater - That part of sanitary sewerage flow derived from groundwater sources and passing into public sewers through defects or faulty construction.

Inflow - Refers to water other than wastewater that enters a sewer system from means such as roof leaders, yard drains, area drains, drains from springs or swampy areas, openings in manhole covers, cross connections with storm sewers, catch basins, cooling towers, storm waters, source runoff, street wash waters, drainage, or any other source which directs rainwater into the sewer system.

Interceptor Sewer - A sewer that receives flow from a number of traverse sewers or outlets and transports such water to a point for treatment.

Invert - The floor, bottom or lowest point of the internal cross-section of a sewer or other conduit.

Joint, Ball-and-Spigot - A form of joint used on pipes that have an enlarge diameter or bell at one end, and a spigot at the other that fits into and is laid in the bell. The joint is then made tight by cement, lead, a rubber "O" ring, or other jointing compounds.

KAR - Kentucky Administrative Regulations.

Lathes - Wooden 1" x 2" survey stakes.

Manhole - An opening by which a man may enter or leave a sewer, conduit, or other closed structure for inspection, cleaning, and other maintenance operations, closed by a removable cover.

MGD - An abbreviation for millions of gallons per day.

Milligrams per liter (mg/L) - A measure of the concentration by weight of a substance per unit volume. One mg/L is equivalent to one part per million (ppm).

MMU – Madisonville Municipal Utilities

Monolithic - Cast-in-place, rather than precast.

MUTCD - An abbreviation for Manual on Uniform Traffic Control Devices for Streets and Highways.

NEMA - An abbreviation for National Electrical Manufacturers Association.

NREPC - The Commonwealth of Kentucky's Natural Resource and Environmental Protection Cabinet.

Outfall - The conduit leading to the discharge stream, through which the effluent flows.

Peak - A maximum quantity that occurs over a relatively short period of time, such as an hour or day.

Peak Demand - The maximum, monetary load place on a wastewater plant or pumping station.

Peak, Instantaneous - The maximum rate that ever occurs, possibly for only a moment.

Pipe, Vitrified Clay - A pipe made of clay burned in a kiln with surfaces glazed for water tightness.

Population, Equivalent - A hypothetical number of persons representing flow. The equivalent population of an existing industry or a school, for example, is determined from the normal flow of sewerage divided by the average condition of wastewater per person.

Population, Saturation - The actual or equivalent of a given area that exists or would occur when the area is completely developed according to its present use for developed area, and its present zoning for undeveloped areas.

Population, Total Equivalent - The sum of the residential population in a given area, and its equivalent population.

Potable Water - Water suitable for drinking or cooking purposes, free from health and aesthetic considerations. Water that meets standards established by the Kentucky Department of Environmental Protection for human consumption.

PPM - Part per million. A measure of the concentration by weight of a substance per unit volume. One ppm is equal to one mg/L.

Precast - That which is formed in a mold or form and distributed by the manufacturer as a complete unit.

Property Service Connection - That portion of a sewer system located within an easement or right-of-way, which transports sewerage from private property to the main line.

Proposed - That which is to have consideration for construction.

Pump Station - A facility through which sewage water or sewage is pumped to a higher elevation or head.

Sanitary Sewers - Sewers intended to carry wastewater from houses, businesses, and industries. Stormwater runoff is carried in a separate system.

Service Area - A defined geographic area in which the City of Madisonville provides water and

sanitary services.

Sewer Line - Devices used for collecting, transporting, pumping, or disposing of sewage, but not a building sewer, which serves a individual building. Sewer lines include gravity sewer lines, pump stations, and force mains.

Sewer Line Extension - A proposed construction project, which extends sewer systems, it includes gravity sewer lines, pump stations, and force mains.

Sewer System - A network of sewer lines, pump stations, and force mains that discharge to a common WWTP.

Sewerage - Largely, the water supply of a community after it has been fouled by various uses. From the standpoint of a source, it may be a combination of the liquid or water carried wastes from houses, businesses and institutions, with those from industrial establishments, and with such groundwater, surface water, and stormwater as may be present.

Sewerage, Domestic - Sewerage derived principally from dwellings, businesses, institutions, and the like. It may or may not contain groundwater, surface water, or stormwater.

Sewerage, Industrial - Sewerage in which industrial wastes predominate.

Sewerage, Sanitary -(a)Domestic sewerage with storm and surface water excluded.
(b)Sewerage discharging from the sanitary conveniences of dwellings (including apartment complexes and hotels), office buildings, factories, or institutions.
(c)The water supply of a community after it has been used and discharged into a sewer.

Sewer - A pipe or conduit that carries waste, storm, or surface water.

Sewer, Branch - A sewer that receives sewerage from lateral sewers and discharges into a larger sewer.

Sewer, Collector - A sewer that receives flow directly from property service connections. Collector sewers are tributaries to interceptor sewers.

Sewer, Combined - A sewer intended to receive both wastewater and storm water.

Sewer Interceptor - A sewer that receives flow from a number of traverse sewers or outlets and transports such water to a point for treatment.

Sewer, Inverted Siphon - A section of sewer constructed lower than adjacent sections to pass beneath a watercourse or other obstruction. It runs full or at greater than atmospheric pressure because its crown is depressed below the hydraulic line.

Sewer, Lateral - A sewer that receives sewerage from a relatively small area that discharges into a branch or other sewer and has few other sewers tributary to it.

Sewer, Main - The principal sewer to which branch sewers and submains are tributary, also called trunk sewers.

Sewer, Outfall - A sewer that receive wastewater and/or stormwater and carries it to a point of final discharge.

Sanitary Relief - A sewer built to carry the flows greater than the capacity of an existing sewer.

Sewer, Sanitary - A sewer that primarily caries sewerage, and to which storm surface, and ground waters are not intentionally admitted.

Slope - The inclination of the invert of a conduit expressed as a decimal or as feet per stated length measured horizontally in feet.

Special Provisions - Additions and revisions to the Standards Manual covering conditions peculiar to an individual project.

Specifications - A general term applied to all directions, provisions, and requirements pertaining to the performance of the work.

Standard Drawings - Drawings approved for repetitive use, showing details to be used where appropriate. Individual standard drawings attached to, or cited in, the plans become a part of the Construction Documents.

Storm Sewer - A separate sewer that carries runoff from storms, surface drainage and street, and does not include domestic or industrial wastes.

Subgrade - The bottom of a trench or other excavation that is somehow below the predetermined elevation of the bottom of the final excavation or structure, the intervening space being back filled with some special material such as gravel, broken stone, or tamped earth, or impervious lining. The term is also applied to the elevation of such bottom.

Sump - A depression that serves as a receptacle for liquids to be pumped.

Surface Water - Water on the earth's surface open to the atmosphere, such as rivers, streams, and oceans.

"**Ten-States Standards**" - "Recommended Standards for Wastewater Facilities of the Great Lakes-Upper Mississippi River Board of State Public Health and Environmental Managers, " 1990 Edition or the "Recommended Standards for Water Works of the Great Lakes-Upper Mississippi River Board of State Public Health and Environmental Mangers, " 1992 Edition.

Topography - The configuration of a surface area including its relief, or relative elevations, and the location of its natural and constructed features.

Transition - A short section of a conduit used as a conversion section to untie two conduits having

different hydraulic elements.

Tributary - Flowing into another, A river or stream flowing into a larger river or stream.

Trunk Sewer - A sewer that receives many tributary branches, which serves a large area.

UL - An abbreviation for Underwriter's Laboratory.

USGS - Abbreviation for United States Geological Survey.

Velocity, Self-Cleaning - The minimum velocity in sewers necessary to keep solids in suspension and prevent their deposition and the subsequent nuisances from stoppages and odors on decomposition.

Watershed - The area drained by a given stream or segment of a stream.

WTP - Water Treatment Plant.

WWTP - Wastewater Treatment Plan.