Erwin Utilities Authority
Request for Proposal

Closed Circuit Television (CCTV) Video Inspection and Cleaning Wastewater Collection System

Memorandum To:	*Interested*
Bidders From:	*Lee H. Brown* *President and CEO*
Subject:	***Request for Proposals*** ***CCTV & Clean*** ***Sanitary Sewer Mains*** ***and Manholes***
Date:	*October 16, 2024*

Overview:

Erwin Utilities Authority requests proposals for CCTV inspection and assessment and cleaning services for sanitary sewer mains and lines within Erwin Utilities Wastewater Collection System in response to damage from Hurricane Helene. All bids must be quoted in price per linear foot of each size sewer line to be CCTV and cleaned. Listed below are the diameters for each sewer main to be priced. Locations may vary based on damage incurred by Hurricane Helene and final locations and quantities will be as directed by the Wastewater Collection System Supervisor. No quantity of work provided in the bid documents is guaranteed. The primary location of the work will be within the vicinity of 199 North Industrial Drive, 2nd Street, Carolina Ave, Ohio Ave, Love Street and Elm Ave. It is anticipated that all lines and manholes to be inspected and cleaned are accessible from the right of way except portions of 24" CIPP and 24" VCP located within the Industrial Park on South Industrial Drive.

Proposals are due: October 18, 2024 at 10:00 a.m.
Via email to Noe'l Bailey, Executive Assistant, at nbailey@e-u.cc

Location of Work: Erwin Utilities Wastewater Collection System, Erwin, TN

Scope of Work:

The work will involve inspection and condition assessment rating using current NASSCO PACP and MACP standards and cleaning, as necessary, for the Utilities existing wastewater collection system, including sewer mains and manholes. Locations may vary based on damage incurred by Hurricane Helene and final locations and quantities will be as directed by the Wastewater Collection System Supervisor. No quantity of work provided in the bid documents is guaranteed.

Erwin Utilities reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids, or for any reason determined by the Utility to be in the best interest of the Utility, other than to evade the bid laws. Owner also reserves the right to waive all minor Bid informalities not involving price, time, or changes in the Work, or any other informality that would render a bid as nonresponsive. The owner will reject the Bid of any Bidder that Owner finds, after reasonable inquiry and evaluation, to not be responsible.

Bidder acknowledges that: each Bid Unit Price includes an amount considered by Bidder to be adequate to cover Contractor's overhead and profit for each separately identified item, and estimated quantities are not guaranteed, and are solely for the purpose of comparison of Bids, and final payment for all Unit Price Work will be based on actual quantities.

The Owner may make adjustments to the quantities of an item of Unit Price Work at any time without a change in unit prices.

Required Proposal Information:

1. Contractor's License with the State of Tennessee
2. Certificate of Insurance

Proposals shall be submitted via email to Noe'l Bailey, Executive Assistant, at nbailey@e-u.cc.

Erwin Utilities reserves the right to reject any and / or all proposals. Qualified contractors interested in submitting a proposal for the project should contact Jason Foster, Director of Water and Wastewater, at jfoster@e-u.cc with any questions.

All proposals are due no later than 10:00 AM on Friday, October 18, 2024.

Bid Schedule:

Bid Item No.	Description	Unit	Quantity	Unit Price	Bid Amount	
1	CCTV Inspection – Pipes (diameter or equivalent) 24	LF	4600			As Directed by the Collections Supervisor
2	20	LF	1500			As Directed by the Collections Supervisor
3	18	LF	3600			As Directed by the Collections Supervisor
4	15	LF	2500			As Directed by the Collections Supervisor
5	12	LF	800			As Directed by the Collections Supervisor
6	10	LF	5800			As Directed by the Collections Supervisor
7	8	LF	5200			As Directed by the Collections Supervisor
8	Total	LF	24,000			As Directed by the Collections Supervisor
7	CCTV Mobilization	LS	1			As Directed by the Collections Supervisor
8	Sewer Main Cleaning (sizes ranging from 8"-24")	LF	24,000			As Directed by the Collections Supervisor
9	Cleaning Mobilization	LS	1			As Directed by the Collections Supervisor
10	Traffic Control Per Day	Day	7			
11	Emergency Cleaning Per Day	Day	7			As Directed by the Collections Supervisor
12	**Total**					

ERWIN UTILITIES
WASTEWATER COLLECTION SYSTEM IMPROVEMENTS

SANITARY SEWER REHABILITATION

THE BOARD OF DIRECTORS
OF THE
ERWIN UTILITIES AUTHORITY

Thomas D. Harris, Chairman
D. Scott Charles
Gary Chandler
B. Kevin Horton
Russell D. Brackins

Lee H. Brown, President & CEO

SEPTEMBER 2024

ERWIN UTILITIES
244 LOVE STREET
P.O. BOX 817
ERWIN, TENNESSEE 37650-0817
Telephone 423-743-1820; Fax 423-743-1833

VICINITY MAP
NTS

SHEET INDEX

THESE PLANS AND SPECIFICATIONS SUBMITTED FOR APPROVAL BY THE STATE OF TENNESSEE DIVISION OF WATER RESOURCES HAVE BEEN APPROVED BY ERWIN UTILITIES.

BY: Richard Jason Foster, PE

TITLE: Director of Water and Wastewater

DATE: X/XX/XX

NOT RELEASED FOR CONSTRUCTION

Erwin Utilities	ERWIN UTILITIES 244 LOVE STREET P.O. BOX 817 ERWIN, TENNESSEE 37650-0817	DRAWN BY: RJF DATE: 8/15/2024	WORK ORDER NUMBER W.O. #	REVISIONS	ERWIN UTILITIES WASTEWATER COLLECTION SYSTEM IMPROVEMENTS	PROJECT SANITARY SEWER REHABILITATION	SHEET NAME COVER SHEET	SCALE NTS	SHT. NO. C-0	DWG. NO. S-1097

Erwin Utilities

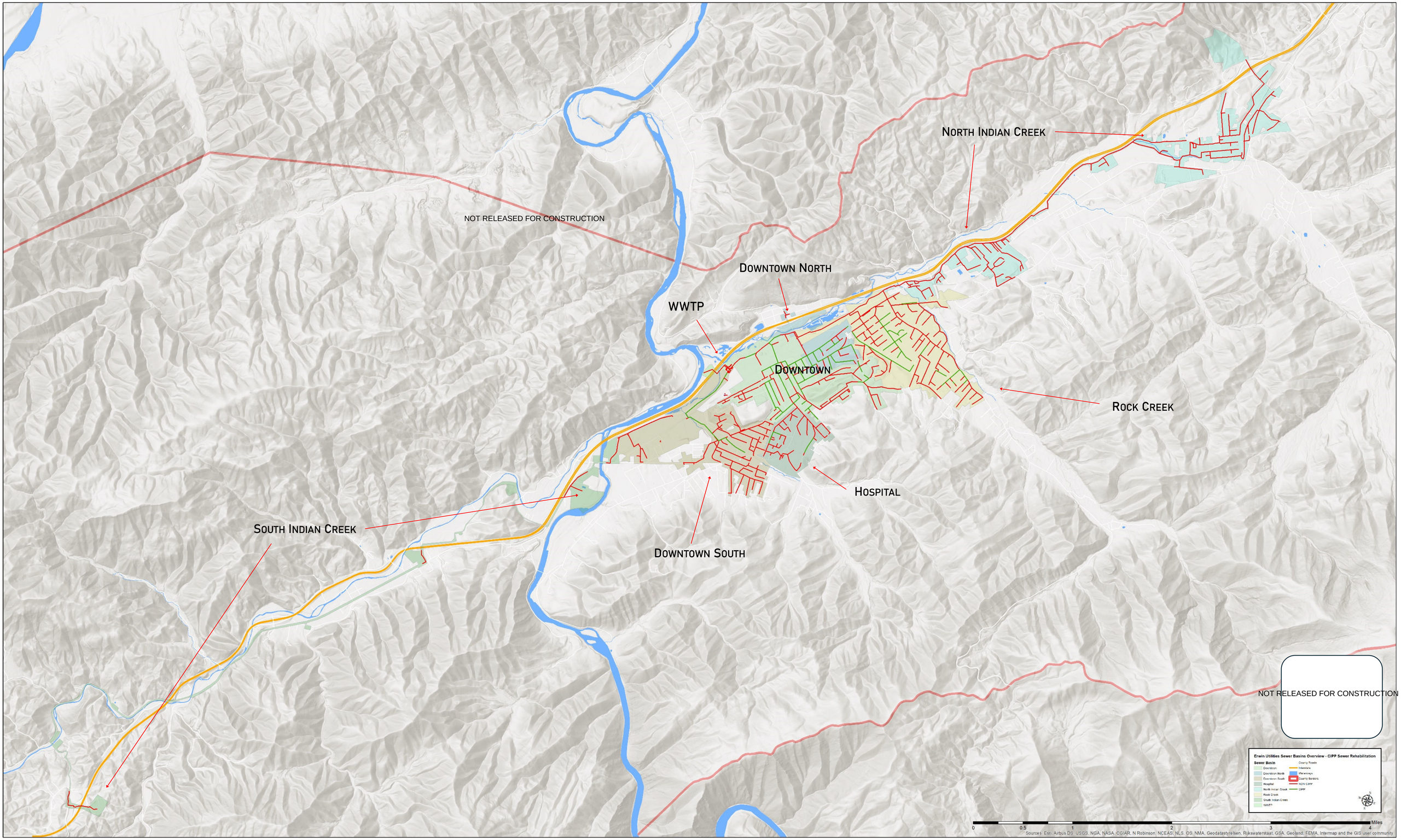
Erwin Utilities Project # : S - 1097

TOWN OF ERWIN

SANITARY SEWER REHAB PROJECT

WW-PDC-1

SEWER BASIN OVERVIEW



Erwin Utilities

Erwin Utilities Project # : S - 1097

TOWN OF ERWIN
SANITARY SEWER REHAB PROJECT
WW-PDC-1

ROCK CREEK SEWER BASIN

ROCK CREEK MAINS (REHAB)		
Size	Segments	Linear Feet
6"	1	169
8"	220	47309
10"	34	7113
12"	5	1081
15"	11	2549
18"	0	0

MANHOLES	
# On Rehab Mains	VerticalFeet
271	2222

SERVICE LATERALS
Linear Feet
21530

NOT RELEASED FOR CONSTRUCTION

Rock Creek Sewer Basin - CIPP Sewer Rehabilitation

Erwin Utilities

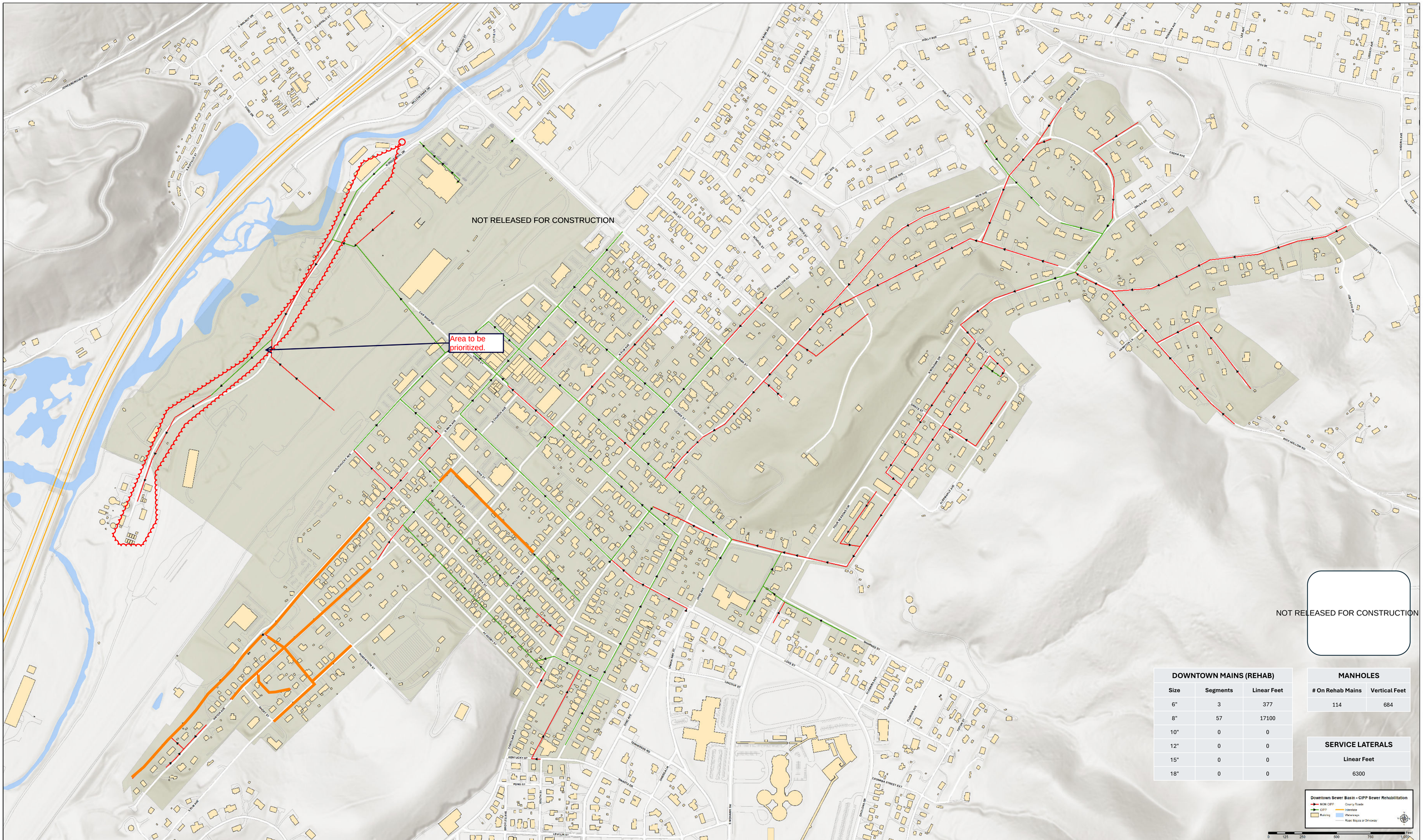
Erwin Utilities Project # : S - 1097

TOWN OF ERWIN

SANITARY SEWER REHAB PROJECT

WW-PDC-1

DOWNTOWN SEWER BASIN



DOWNTOWN MAINS (REHAB)		
Size	Segments	Linear Feet
6"	3	377
8"	57	17100
10"	0	0
12"	0	0
15"	0	0
18"	0	0

MANHOLES	
# On Rehab Mains	Vertical Feet
114	684

SERVICE LATERALS
Linear Feet
6300

Erwin Utilities

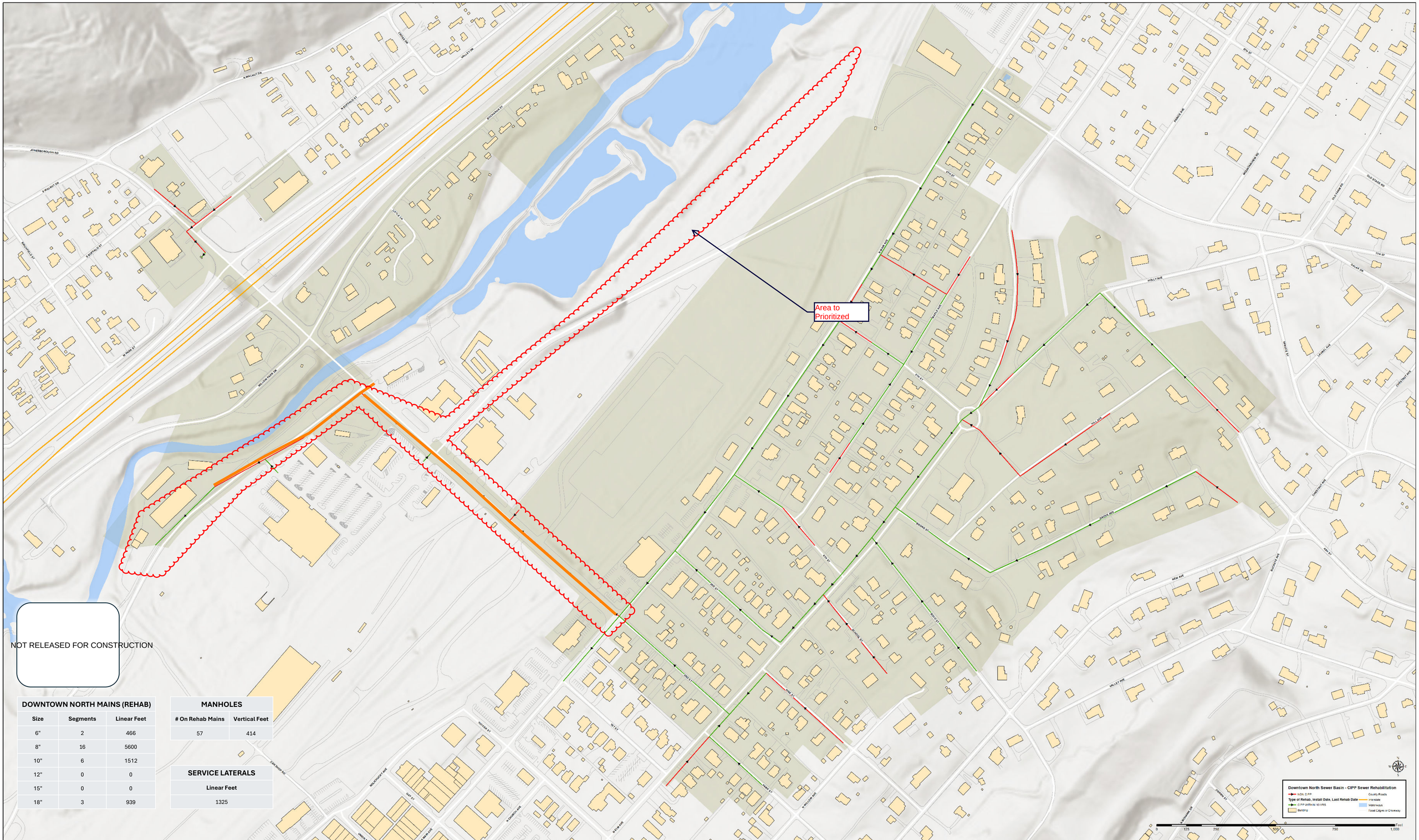
Erwin Utilities Project # : S - 1097

TOWN OF ERWIN

SANITARY SEWER REHAB PROJECT

WW-PDC-1

DOWNTOWN NORTH SEWER BASIN



DOWNTOWN NORTH MAINS (REHAB)		
Size	Segments	Linear Feet
6"	2	466
8"	16	5600
10"	6	1512
12"	0	0
15"	0	0
18"	3	939

MANHOLES	
# On Rehab Mains	Vertical Feet
57	414

SERVICE LATERALS
Linear Feet
1325

Erwin Utilities

Erwin Utilities Project # : S - 1097

TOWN OF ERWIN

SANITARY SEWER REHAB PROJECT

WW-PDC-1

DOWNTOWN SOUTH SEWER BASIN

DOWNTOWN SOUTH MAINS (REHAB)		
Size	Segments	Linear Feet
6"	5	1125
8"	78	25075
10"	5	1235
12"	0	0
15"	0	0
18"	0	0

MANHOLES	
# On Rehab Mains	Vertical Feet
166	1328

SERVICE LATERALS
Linear Feet
6205

NOT RELEASED FOR CONSTRUCTION

Area to be prioritized

Downtown South Sewer Basin - CIPP Sewer Rehabilitation

Non CIPP
CIPP
Building
County Roads
Interstate
Waterways
Road Edges or Driveway

0 125 250 500 750 1,000 Feet

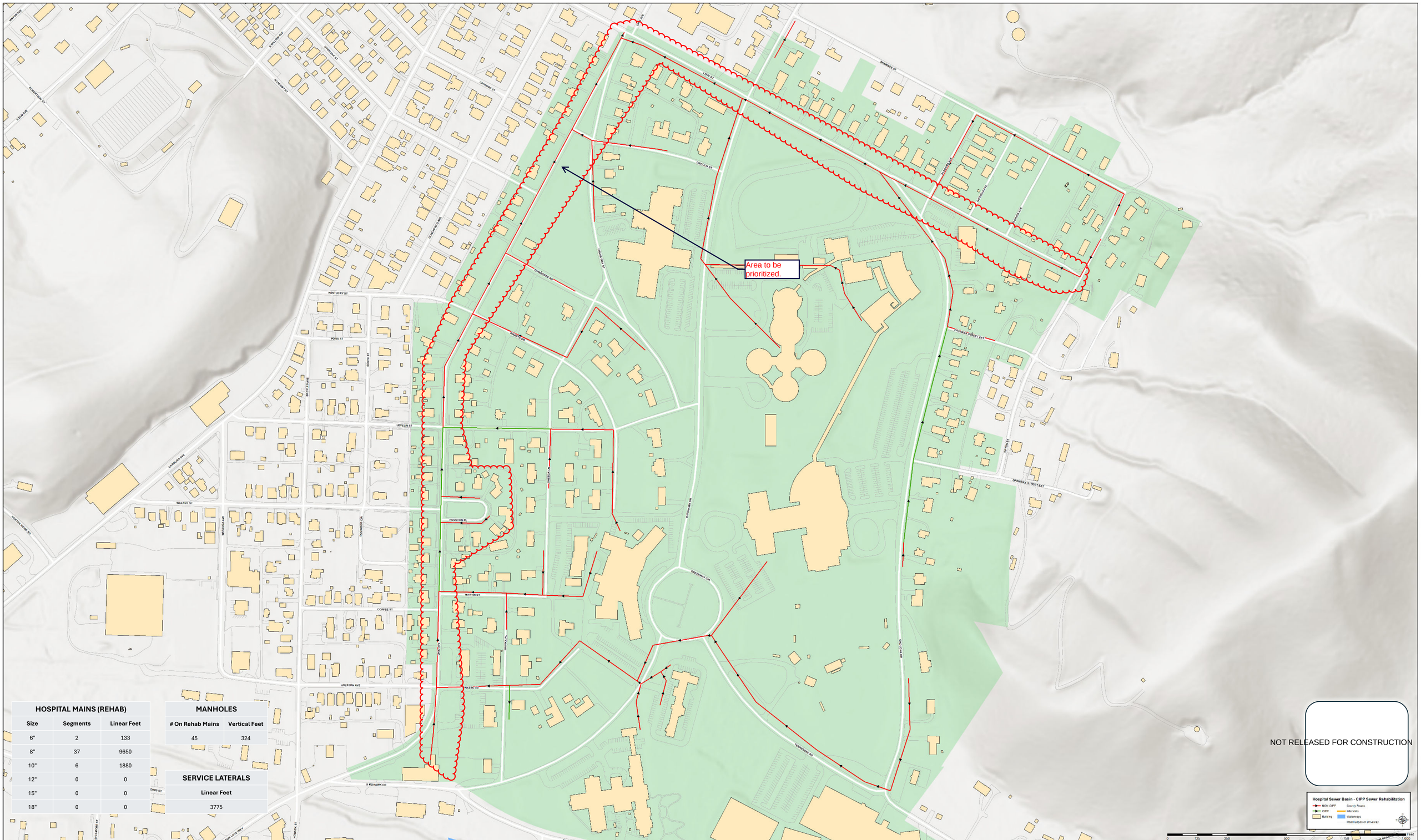
Sources: Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community

Erwin Utilities

Erwin Utilities Project # : S - 1097

TOWN OF ERWIN
SANITARY SEWER REHAB PROJECT
WW-PDC-1

HOSPITAL (OLD) SEWER BASIN



HOSPITAL MAINS (REHAB)		
Size	Segments	Linear Feet
6"	2	133
8"	37	9650
10"	6	1880
12"	0	0
15"	0	0
18"	0	0

MANHOLES	
# On Rehab Mains	Vertical Feet
45	324

SERVICE LATERALS
Linear Feet
3775

Erwin Utilities

Erwin Utilities Project # : S - 1097

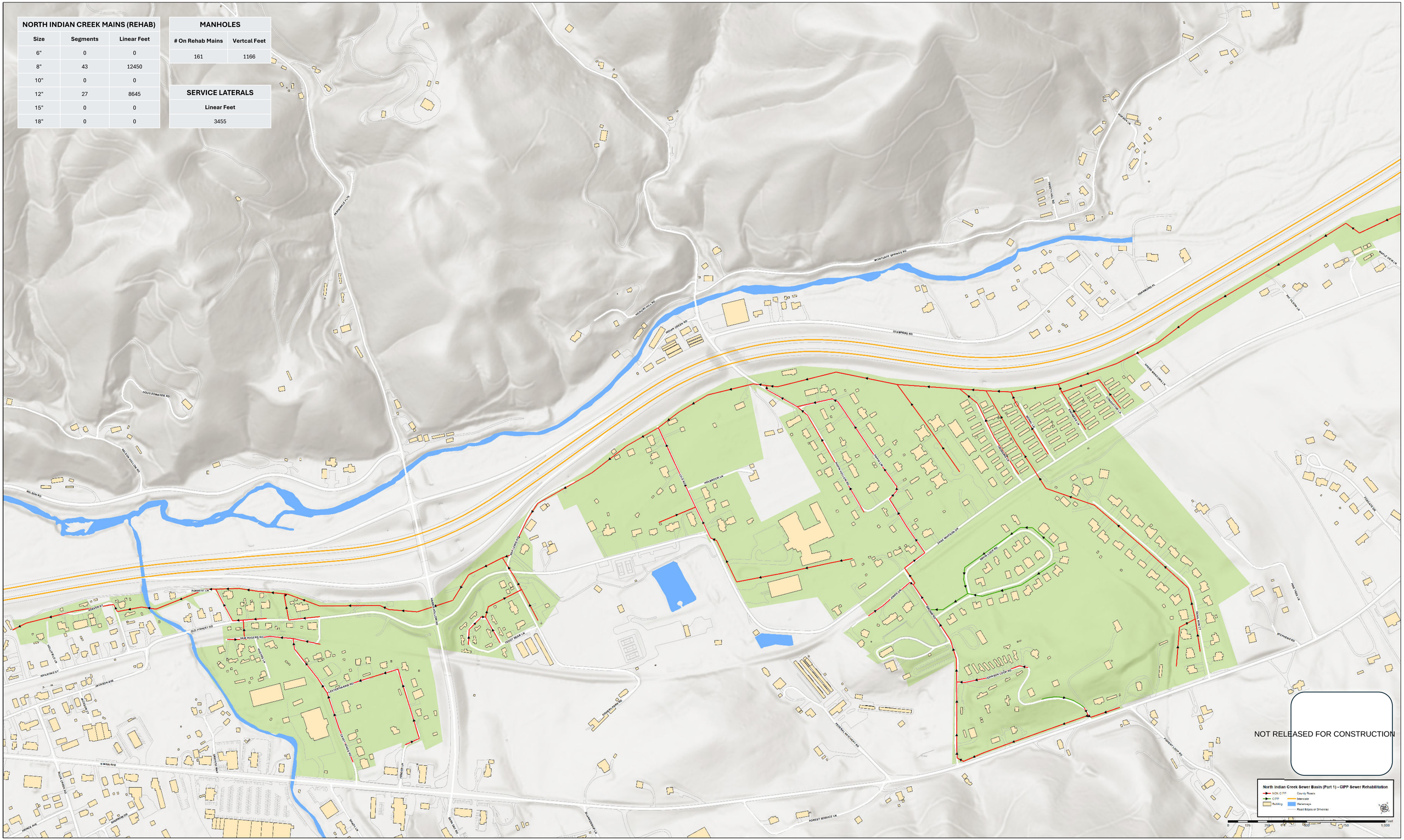
TOWN OF ERWIN
SANITARY SEWER REHAB PROJECT
WW-PDC-1

NORTH INDIAN CREEK SEWER BASIN
(PART 1)

NORTH INDIAN CREEK MAINS (REHAB)		
Size	Segments	Linear Feet
6"	0	0
8"	43	12450
10"	0	0
12"	27	8645
15"	0	0
18"	0	0

MANHOLES	
# On Rehab Mains	Vertcal Feet
161	1166

SERVICE LATERALS
Linear Feet
3455

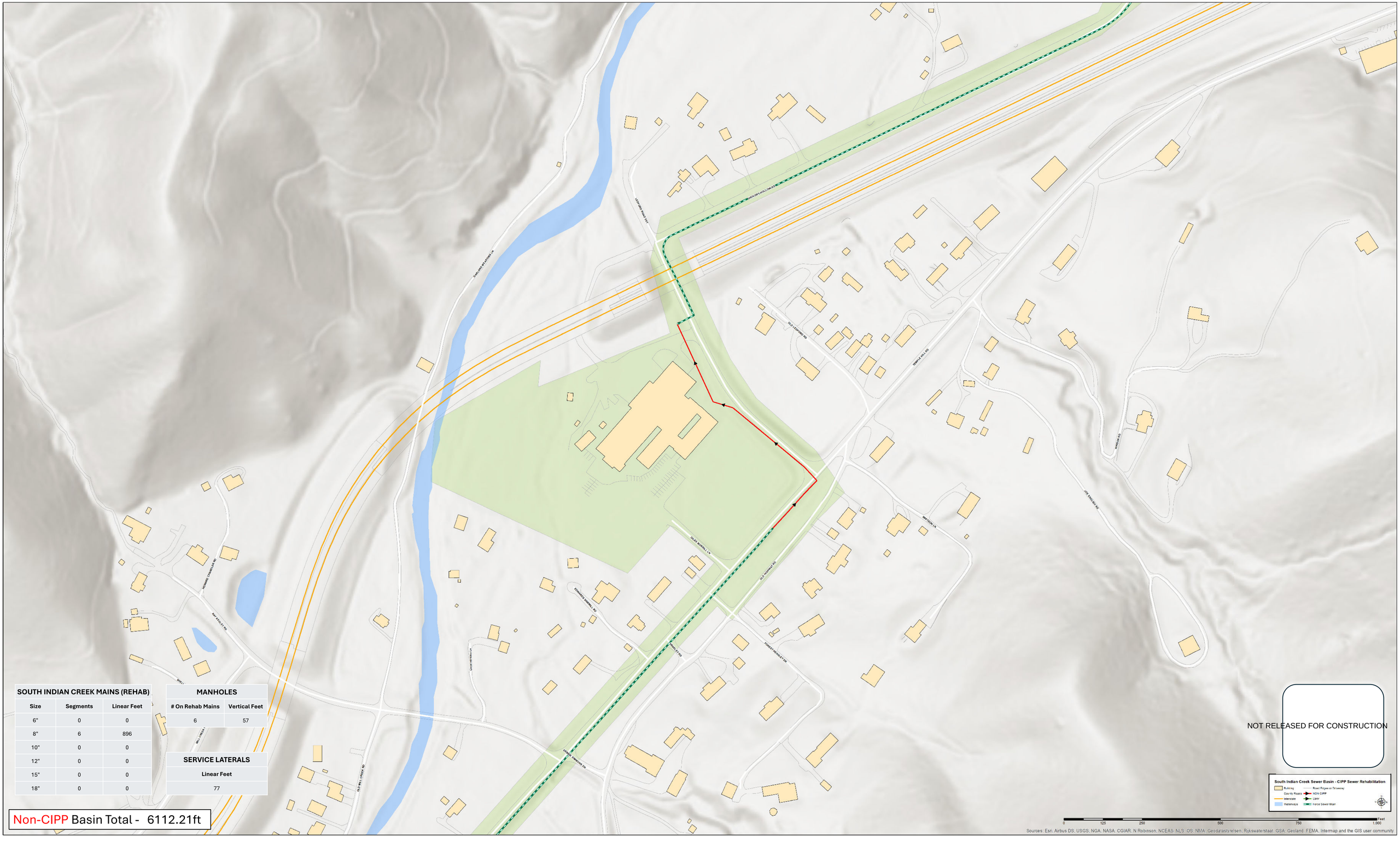


Erwin Utilities

Erwin Utilities Project # : S - 1097

TOWN OF ERWIN
SANITARY SEWER REHAB PROJECT
WW-PDC-1

SOUTH INDIAN CREEK SEWER BASIN
(PART 2)



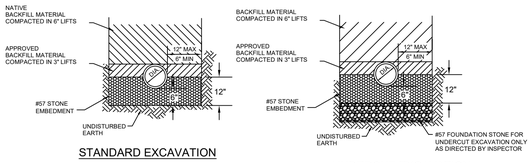
SOUTH INDIAN CREEK MAINS (REHAB)		
Size	Segments	Linear Feet
6"	0	0
8"	6	896
10"	0	0
12"	0	0
15"	0	0
18"	0	0

MANHOLES	
# On Rehab Mains	Vertical Feet
6	57

SERVICE LATERALS
Linear Feet
77

Non-CIPP Basin Total - 6112.21ft

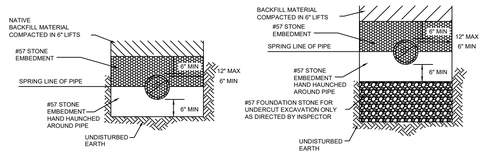
DUCTILE IRON GRAVITY SEWER



STANDARD EXCAVATION

UNDERCUT EXCAVATION IN UNSTABLE SOILS TYPES

POLYVINYL CHLORIDE (PVC) SEWER PIPE



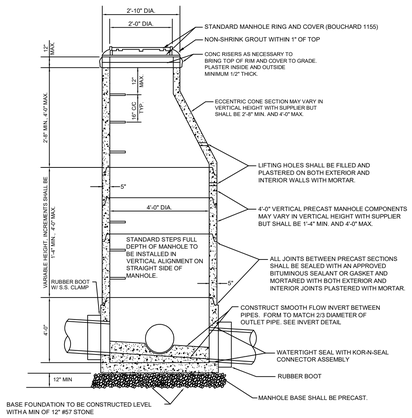
STANDARD EXCAVATION

UNDERCUT EXCAVATION IN UNSTABLE SOILS TYPES

NOTES:
1. CONSTRUCTION OF TRENCHES SHALL COMPLY WITH ALL FEDERAL, STATE AND LOCAL SAFETY AND HEALTH REGULATIONS WHICH HAVE JURISDICTION AT THE PROJECT SITE. IT IS THE CONTRACTOR'S RESPONSIBILITY TO BE FAMILIAR WITH THE APPLICABLE REGULATIONS AND FOLLOW THEM ACCORDINGLY.
2. THE BACKFILL MATERIAL SHALL CONSIST OF 100% #57 STONE IN AREAS UNDER PAVEMENT AND IN ROADWAYS.

TYPICAL GRAVITY SEWER TRENCHING DETAILS

NOT TO SCALE

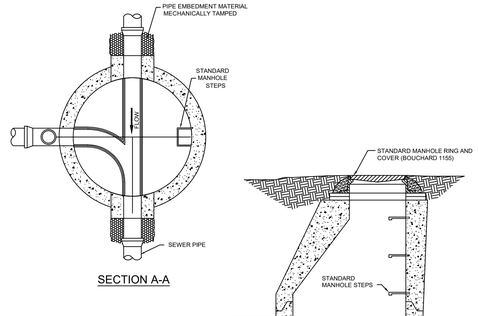


ELEVATION VIEW

PRECAST MANHOLE NOTES:
1. ALL PRECAST MANHOLE COMPONENTS SHALL MEET REQUIREMENTS OF ASTM C-478, LATEST REVISION.
2. ALL MANHOLES SHALL BE CONSTRUCTED PLUMB.
3. ALL MANHOLE GRADES SHOWN ON THE PLANS ARE FOR THE INVERT OF THE MANHOLE CENTER.
4. IF MANHOLE IS SET IN LOCATION OF HIGH WATER TABLE OR UNDERGROUND WATER IS ENCOUNTERED, THE CONTRACTOR SHALL INSTALL UNDERDRAINS AND STONE AS DIRECTED IN THE FIELD BY THE INSPECTOR.
5. STEPS SHALL BE INSTALLED ON STRAIGHT SIDE OF MANHOLE.

PRECAST CONCRETE MANHOLE

NOT TO SCALE

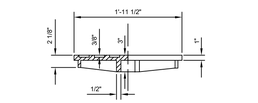


NOTE:
1. PROVIDE DROP MANHOLE WHEN THE INLET PIPE IS 24" OR GREATER ABOVE THE MANHOLE INVERT.

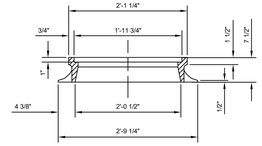
OUTSIDE DROP MANHOLE

NOT TO SCALE

HALF PLAN OF MANHOLE RING AND COVER



SECTION A-A MANHOLE COVER

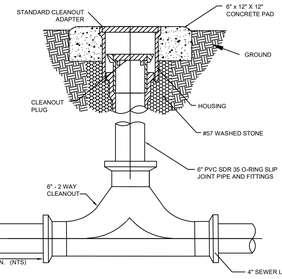


SECTION A-A MANHOLE RING

NOTE: TRAFFIC BEARING RING AND COVER. MINIMUM WEIGHT 315 POUNDS

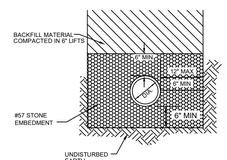
MANHOLE RING AND COVER

NOT TO SCALE



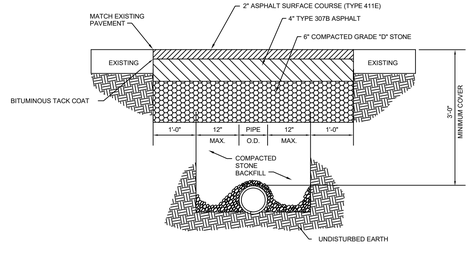
2 WAY CLEANOUT DETAIL FOR EXISTING CONSTRUCTION

NOT TO SCALE



TYPICAL SEWER SERVICE LINE TRENCHING DETAIL

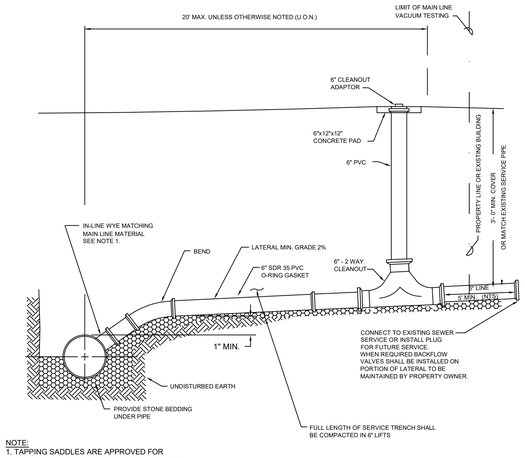
NOT TO SCALE



NOTES:
1. EDGE TO BE SAWED WITH A CONCRETE SAW TO A NEAT SQUARED EDGE. BROOMED CLEAN OF DUST BEFORE TACK COAT IS APPLIED.
2. EDGES TO BE TACKED WITH CRS-I OR CRS-II.
3. CONTRACTOR RESPONSIBLE FOR REPLACEMENT OF ANY PAVEMENT MARKINGS DISTURBED OR COVERED BY OVERLAY.

TYPICAL PAVEMENT REPAIRS

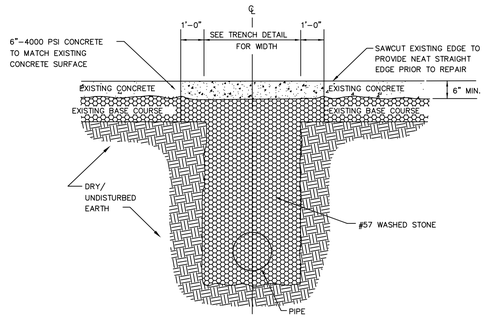
NOT TO SCALE



NOTE:
1. TAPPING SADDLES ARE APPROVED FOR CONNECTIONS TO EXISTING SEWER LINES ONLY
2. INTERMEDIATE CLEANOUTS SHALL BE INSTALLED EVERY 125 LINEAR FEET OF CUSTOMER'S SEWER SERVICE LATERTAL AND AT ALL CHANGES IN DIRECTION.
3. BACKFILL WITH COMPACTED #57 STONE

SANITARY SEWER SERVICE (EXISTING CONNECTION)

NOT TO SCALE



CONCRETE DRIVE REPAIR DETAIL

NOT RELEASED FOR CONSTRUCTION

Erwin Utilities	ERWIN UTILITIES 244 LOVE STREET P.O. BOX 817 ERWIN, TENNESSEE 37650-0817	DRAWN BY: RJF DATE: 8/15/24	APPROVED BY: W.O. #	REVISIONS	ERWIN UTILITIES WASTEWATER COLLECTION SYSTEM IMPROVEMENTS	PROJECT SANITARY SEWER REHABILITATION	SHEET NAME SYSTEM DETAILS	SCALE NTS	SHT. NO. DT-1	DWG. NO. S-1097

STANDARD SEWER SPECIFICATIONS AND DETAILS FOR SANITARY SEWER SYSTEM CONSTRUCTION

ERWIN UTILITIES AUTHORITY
ERWIN, TENNESSEE

Erwin Utilities

STANDARD SPECIFICATIONS
AND DETAILS
FOR
SANITARY SEWER SYSTEM
CONSTRUCTION

ERWIN UTILITIES
ERWIN, TENNESSEE

ERWIN UTILITIES
244 LOVE STREET
P.O. BOX 817
ERWIN, TENNESSEE 37650-0817
Telephone 423-743-1820; Fax 423-743-1833

Revised June 2016

ERWIN UTILITIES
WASTEWATER SYSTEM STANDARD SPECIFICATIONS

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DIVISION 2 – SITE WORK AND UTILITY PIPING

DIVISION 11 – EQUIPMENT

STANDARD DETAILS – GRAVITY SEWER & FORCE MAIN

STANDARD DETAILS – LOW PRESSURE SEWER

SECTION 01200 SPECIAL CONDITIONS

PART 1: GENERAL

1.01 SCOPE OF THESE SPECIFICATIONS

A. INTENT

It is the intent of these Specifications to provide the minimum acceptable standards for materials, equipment, and design parameters for furnishing and installation of various components for Erwin Utilities Sewer System. These components include, but are not limited to, gravity sewer lines, manholes, service connections and lines, pumping stations, grinder pumps, force mains, odor control facilities, meters and telemetry, sampling equipment, corrosion control, and other special structures, equipment, materials, and appurtenances required for a complete and operable system.

In addition to the Special Conditions of this Section, the Specifications include a section of Detailed Specifications for Sanitary Sewer System Construction with various subsections and component detail sheets.

B. REGULATORY REQUIREMENTS

It is the intent that all sanitary sewerage works to be included in and serviced by Erwin Utilities' Sanitary Sewer System be done in compliance with applicable and current Erwin Utilities, State, County, and Federal acts, regulations, and/or guidelines. These acts, regulations, and guidelines include, but are not limited to:

1. Erwin Utilities Special Conditions and Standard Specifications and Details for Sanitary Sewer System Construction (this document);

2. Erwin Utilities Sewer Use Ordinance;

3. Erwin Utilities Sewer Rate Ordinance;

4. Erwin Utilities Developer's Agreement;

5. Occupational Safety and Health Act – P.L. 91-596;

6. Contract Work Hours and Safety Standards Act – P.L. 91-54;

7. Tennessee Department of Environment and Conservation, Division of Water Resources, "Tennessee Design Criteria," current edition;

8. Tennessee Department of Environment and Conservation "Guidelines for Erosion and Sediment Control" as promulgated by the Tennessee Erosion and Sediment Control Handbook, issued March 2002, and any updates; and

9. Erwin Utilities "Permit-Required Confined Spaces Entry Policy."

It is not the intention of these Specifications to conflict with these acts, regulations, or guidelines in any way, and where conflicts may arise, the acts, regulations, or guidelines shall govern. Requirements by the Specifications that are more stringent than those of the acts, regulations, or guidelines shall not be considered conflicts.

Erwin Utilities does not assume responsibility for enforcing County, State, or Federal acts, regulations, or guidelines and will not be considered in charge of or responsible for acts of the Contractor, methods of construction, construction, construction progress, construction forces or equipment, or safety procedures.

1.02 SYSTEM DESIGN AND REVIEW REQUIREMENTS

A. PRELIMINARY ENGINEERING STUDY

1. Erwin Utilities' Sewer System incorporates standard gravity sewers and grinder pumps with low pressure force mains. A Preliminary Engineering Study is required for any significant additions to the System. Any Customer or Developer proposing to connect to the system shall contact Erwin Utilities and perform a study for their proposed project.

2. The Developer shall include the basic information in the study, including, but not limited to:

   a. project location,

   b. general layout,

   c. number of customers,

   d. required capacity, and

   e. possible future expansions.

3. The Developer shall submit two (2) copies of the Preliminary Engineering Study and any preliminary drawings to the Director of Water & Wastewater for review. The study will assist Erwin Utilities in determining if service is feasible, the

type of system that will be required, and the size and location of the connection to Erwin Utilities' system.

4. The requirement for the Preliminary Engineering Study may be waived at Erwin Utilities' discretion for short line extensions or service connections to existing lines.

B. DESIGN AND PERMITTING REQUIREMENTS

Following the Engineering Study, the Developer, at his own expense, shall have the system designed by a Tennessee-licensed Professional Engineer qualified to design the type of system required.

1. The Plans and Specifications shall be submitted to Erwin Utilities for review and approval.

2. After receiving Erwin Utilities' approval, the Developer shall submit Plans and Specifications to the Tennessee Division of Water Resources for review. Review fees required by the Division of Water Resources will be paid by the customer or Developer. Two (2) copies of the Plans and Specifications stamped "Approved" by the Division of Water Resources shall be provided to Erwin Utilities before construction on the project is begun.

3. In general, proposed sewer collection systems shall be designed in accordance with TDEC Division of Water Resources Guidelines, with specific attention paid to the following:

   a. Gravity sewer manholes shall be designed and installed no more than three hundred feet (300') apart.

   b. Force mains shall be designed and installed with a minimum of thirty inches (30") of cover after the area has been brought to final grade.

1.03 CONSTRUCTION PHASE

A. PRE-CONSTRUCTION CONFERENCE

1. The Developer shall notify Erwin Utilities at least forty-eight (48) hours in advance to schedule the pre-construction conference.

2. The conference shall include representatives of the Developer, the Contractor, Erwin Utilities, and all other utilities having an interest in the project. The conference will be held at Erwin Utilities Office Building.

3. The roles, responsibilities, and authority of the various parties shall be defined and discussed. Other subjects regarding the project may be covered at the pre-construction conference.

4. At the conclusion of the conference, a "Notice to Proceed" may be issued with the concurrence of Erwin Utilities. No work on the sewer system shall be performed prior to the pre-construction conference.

   Note: Submittals shall be submitted a minimum of five (5) days before the pre-construction conference.

B. CONSTRUCTION INSPECTION

Erwin Utilities will provide an inspector to determine if the installation of the sewer system complies with the requirements of the approved Plans and Specifications. Other duties of the inspector may include, but not be limited to, witnessing tests, inspecting material and equipment incorporated into the work, and reporting project progress and status to the Developer and Erwin Utilities. It is the Contractor's responsibility to maintain project records and prepare field record drawings. The inspector will not supervise or direct the work of the Contractor.

C. CONTRACTOR

All sewer system components to be performed for Erwin Utilities Sewer System shall be installed by a fully bonded and insured General Contractor (with Utilities License), properly licensed in the State of Tennessee to perform the type of work required by the project.

D. RECORD DRAWINGS

Upon completion of the project, a set of Record Drawings showing any deviations from the Approved Plans and Specifications, location and depth of all service connections, and other pertinent construction or field data shall be provided to Erwin Utilities in CADD format.

E. START-UP OF FACILITIES

1. No sewage shall be discharged into Erwin Utilities Sewer System without prior written authorization by Erwin Utilities. At Erwin Utilities' discretion, individual line segments or parts of a total project may be allowed to connect to the system, provided the segments or partial sections have been successfully tested, inspected, and approved by Erwin Utilities.

2. Pumping, metering, and other facilities utilizing mechanical equipment shall not be started up until:

    a. Three (3) bound copies of shop drawings and operation and maintenance manuals have been turned over to Erwin Utilities;

    b. Electrical and any other required codes inspections have been completed and approved;

    c. The installation of the facility has been inspected and start-up authorized by Erwin Utilities; and

    d. Start-up services of a factory-authorized technician have been scheduled.

3. The initial start-up of the facility shall be performed by the factory-authorized technician in the presence of representatives of the Contractor and Erwin Utilities.

    a. As part of the start-up service, the technician shall train and instruct Erwin Utilities' operating and maintenance personnel in the proper operation and maintenance of the facility.

    b. The Developer or Contractor shall provide sufficient service time to start-up and adjust the facility and to instruct and train Erwin Utilities' personnel.

c. The factory-authorized technician shall submit a written start-up report certifying that the equipment has been properly installed, is operating satisfactorily, and that Erwin Utilities personnel have been trained and instructed in the operation and maintenance of the facility.

4. For pump stations, metering facilities, and other mechanical facilities, a thirty (30)-day "trial run" period shall be in effect following the initial start-up, during which the Developer or his Contractor shall make necessary adjustments, verify that the equipment meets performance requirements, and provide additional operation and maintenance instructions to Erwin Utilities' personnel. Erwin Utilities will transfer the necessary utilities for these facilities at the end of the thirty (30)-day trial run.

F. WARRANTY

1. The Developer will provide Erwin Utilities a maintenance bond guaranteeing the work. As a minimum, all sewerage facilities will be guaranteed by the Developer for a period of twelve (12) months against defects in material and workmanship from the written date of acceptance by Erwin Utilities.

2. If certain segments or facilities are accepted and put into service before a total project is completed, the warranty for those segments or facilities will begin upon written acceptance by Erwin Utilities. Providing the equipment meets required performance requirements and the facility is operating properly at the end of the thirty (30)-day "trial run," Erwin Utilities will accept the facility and the twelve (12)-month warranty period will start. This beginning date for the twelve (12)-month warranty period shall supersede any limitations on the warranty period by the manufacturer or supplier. If the equipment does not meet the performance requirements at the end of the thirty (30)-day "trial run," the beginning of the warranty period will be delayed until the performance requirements are met.

3. In certain instances, extended or graduated warranties may be required for specific pieces of equipment or material. Any such extended or graduated warranties specified or provided

by the manufacturer shall accrue to Erwin Utilities upon acceptance of the equipment or material.

G. PROGRESS MEETINGS

1. The Contractor and any subcontractors, material suppliers, or vendors whose presence is necessary or requested shall attend meetings, referred to as Progress Meetings, when requested by Erwin Utilities or his representative for the purpose of discussing the execution of work.

2. Each meeting will be held at the time and place designated by Erwin Utilities or his representative. These meetings shall be binding and conclusive on the Contractor and such decisions, instructions, and interpretations shall be confirmed in writing by Erwin Utilities or his representative.

3. The proceedings of these meetings will be recorded, and the Contractor will be furnished with a reasonable number of copies for his use and for his distribution to the subcontractors, material suppliers, and vendors involved.

1.04 SUBMITTALS

A. GENERAL

All transmittals from the Contractor shall be accompanied by a transmittal cover form that includes pertinent information related to the project and the particular transmittal. The Contractor shall use the "Transmittal Form" provided at the end of this section or a similar form that includes the required information.

B. CONSTRUCTION SCHEDULE

The Contractor shall prepare and submit to Erwin Utilities a practicable construction schedule showing the order in which the Contractor proposes to carry on the work, the date on which they will start the several salient features, and the contemplated dates for completing such salient features. The schedule may be in any form, at the option of the Contractor, and contain at least the following information:

1. The various classes and areas of work, broken down into times projected for submittals, approvals, and procurement; times for installation and erection; and times for testing and inspection;

2. The work completed and the work remaining to complete the project; and

3. Any items of work that will delay the start or completion of other major items of work so as to delay completion of the whole project.

C. MATERIAL SUPPLIERS AND SUBCONTRACTOR LISTINGS

The Contractor shall supply the names and addresses of all major material suppliers and subcontractors to Erwin Utilities.

D. SHOP DRAWINGS AND SAMPLES

The Contractual requirements for shop drawings and samples are specified below and in the individual Specification Sections for each item. The Contractor shall submit shop drawings and samples accompanied by the "Submittal and Routing Form" included at the end of this section a minimum of five (5) days prior to the pre-construction conference. Resubmissions, where required, shall be in accordance with the procedures established for the initial submittal.

Submittals required by Erwin Utilities are identified in the individual Specification Sections for each item.

1. Shop Drawings

The data shown on the shop drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Erwin Utilities the services, materials, and equipment Contractor proposes to provide and to enable Erwin Utilities to review the information for the purposes stated below.

2. Samples

Each sample required will be identified clearly as to material, Supplier, pertinent data such as catalog numbers, and the use for which intended and otherwise as Erwin Utilities may require to enable Erwin Utilities to review the submittal for the purposes stated below.

3. Where a shop drawing or sample is required by the Specifications, any related work performed prior to Erwin

Utilities' review and approval of the pertinent submittal will be at the sole expense and responsibility of the Contractor.

4. Submittal Procedures

a. Before submitting each shop drawing or sample, Contractor shall have determined and verified:

i. All field measurements, quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;

ii. All materials with respect to intended use, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and

iii. All information relative to means, methods, techniques, sequences, and procedures of construction and safety precautions and programs incident thereto.

b. Contractor shall also have reviewed and coordinated each shop drawing or sample with other shop drawings and samples and with the requirements of the Work and the Specifications.

c. Each submittal shall bear a stamp or specific written indication that Contractor has satisfied his obligations under the Specifications with respect to Contractor's review and approval of that submittal.

d. At the time of each submittal, Contractor shall give Erwin Utilities specific written notice of such variations, if any, that the shop drawing or sample submitted may have from the requirements of the Specifications, such notice to be in a written communication separate from the submittal; and, in addition, shall cause a specific notation to be made on each shop drawing and sample submitted to Erwin Utilities for review and approval of each such variation.

5. Erwin Utilities' Review

a. Erwin Utilities will perform review in a timely fashion.

b. Erwin Utilities' review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the work, conform to the information found in the Specifications and Drawings and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Specifications and Drawings.

c. Erwin Utilities' review and approval will not extend to means, methods, techniques, procedure of construction, or safety precautions or programs incident thereto except where expressly called for in the Specifications. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

d. Erwin Utilities' review and approval of shop drawings or samples shall not relieve Contractor from responsibility for any variation from the requirements of the Specifications and Drawings unless Contractor has in writing called Erwin Utilities' attention to each such variation at the time of each submittal, and Erwin Utilities has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the shop drawing or sample approval; nor will any approval by Erwin Utilities relieve Contractor from responsibility required within these Specifications.

6. Re-submittal Procedures

Contractor shall make corrections required by Erwin Utilities and shall return the required number of corrected copies of shop drawings and submit as required new samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Erwin Utilities on previous submittals.

1.05 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall be responsible for delivery, storage, and handling of all materials and equipment, unless otherwise noted.

All material and equipment shall be shipped to arrive at the job site on the dates indicated on the purchase order. The following information shall be supplied:

1. The contents, bill of lading, and number of shipments;
2. The method of shipments;
3. The date of shipment; and
4. The name of the construction project.

B. Prior to shipment, all items shall be properly prepared to protect all critical areas from the effects of weather, normal expected transport, and on-site handling.

C. Items shall be tagged and marked with equipment and/or motor numbers as per the manner stipulated in the purchase order.

D. All spare parts and expendable supplies shall be properly crated, marked, and shipped to the job site on the date specified.

PART 2: PRODUCTS

2.01 EQUIPMENT AND MATERIAL STANDARDS

All equipment and materials of construction described in this Specification shall meet the more stringent requirements of the applicable codes listed below:

A. OSHA - Occupational Safety and Health Administration;

B. TOSHA – Tennessee Occupational Safety and Health Administration;

C. ASTM - American Society for Testing Materials;

D. ANSI - American National Standards Institute;

E. AGMA - American Gear Manufacturers Association;

F. AISC - American Institute of Steel Construction;

G. AWS - American Welding Society;

H. NEC - National Electric Code;

I. NEMA - National Electrical Manufacturers Association; and

J. API - American Petroleum Institute.

2.02 QUALITY ASSURANCE

A. All equipment shall, after installation by the Contractor, be inspected, tested, and started up by a qualified representative of the equipment manufacturer. The Contractor and the manufacturer's representative shall complete the "Equipment Start-up Form" provided at the end of this section and submit the completed form to Erwin Utilities.

B. The listing of a manufacturer in the Specifications does not necessarily imply that the manufacturer's standard equipment meets the requirements of the specifications, but that the manufacturer listed has the capability to meet the requirements of the Specifications.

PART 3: EXECUTION

3.01 SPECIAL REQUIREMENTS

A. LIMITS OF CONSTRUCTION

The Contractor shall confine all operations and personnel to the limits of construction as shown on the plans. There shall be no disturbance whatsoever of any areas outside the limits of construction nor shall the workmen be allowed to travel at will through the surrounding private property.

B. CONSTRUCTION SUPERINTENDENT

The Contractor shall place in charge of the work a competent and reliable superintendent, who shall have the authority to act for the Contractor and who shall be accountable to Erwin Utilities. The Contractor shall, at all times, employ labor and equipment sufficient to accomplish the several classes of work to full completion in the manner and time specified.

C. SITE CONDITIONS

1. The Contractor shall maintain the work and project grounds free from rubbish, debris, and waste materials during all phases of the work.

2. Immediately upon completion of the work and prior to final acceptance, the Contractor shall remove all rubbish, debris, temporary structures, equipment, and excess or waste materials and shall leave the work and project grounds in a

neat and orderly condition that is satisfactory to Erwin Utilities.

D. RIGHT OF ENTRY

Erwin Utilities and their representative will at all times have access to the work. In addition, authorized representatives and agents of any participating Federal or State agency shall be permitted to inspect all work, materials, payrolls, records of personnel, invoices of materials, and other relevant data and records.

E. TEMPORARY CONSTRUCTION SERVICES AND FACILITIES

The Contractor shall obtain all necessary permits, licenses, etc., and shall pay all costs incident to the furnishing, installing, and maintenance of temporary utility services and facilities required for the duration of the work.

F. CONTROL OF EROSION, SILTATION, AND POLLUTION

1. The Contractor shall fully conform to the TDEC Division of Water Resources, Rule 0400-40-10-.05, “General NPDES Permit for Storm Water Discharge Associated with Construction Activity” and Rule 0400-40-7-.08, “General Permit for Utility Line Crossing of Streams.”

2. Surface drainage from cuts and fills within the construction limits, whether or not completed, and from borrow and waste disposal areas, shall, if turbidity producing materials are present, be graded to control erosion within acceptable limits. Temporary erosion and sediment control measures such as berms, dikes, or drains, if required to meet the above standards, shall be provided and maintained until permanent drainage and erosion control facilities are completed and operative. The area of bare soil exposed at any one time by construction operations should be held to a minimum. Fills and waste areas shall be constructed by selective placement to eliminate silts or clays on the surface that will erode and contaminate adjacent streams.

3. The Contractor shall take whatever measures are necessary to minimize soil erosion and siltation, water pollution, and air pollution caused by his operations. The Contractor shall also comply with the applicable regulations of all legally constituted authorities relating to pollution prevention and control. The Contractor shall keep himself fully informed of all such regulations that in any way affect the conduct of the

work, and shall at all times observe and comply with all such regulations. In the event of conflict between such regulations and the requirements of the specifications, the more restrictive requirements shall apply.

4. Erwin Utilities shall have the authority to limit the area over which clearing and grubbing, excavation, borrow, and embankment operations are performed whenever the Contractor's operations do not make effective use of construction practices and temporary measures that will minimize erosion, or whenever construction operations have not been coordinated to effectively minimize erosion, or whenever permanent erosion control features are not being completed as soon as permitted by construction operations.

5. The Contractor shall control dust throughout the life of the project within the project area and at all other areas affected by the construction of the project, including, but not specifically limited to, unpaved secondary roads, haul roads, access roads, disposal sites, borrow and material pits, and production sites. Dust control shall not be considered effective where the amount of dust creates a potential or actual unsafe condition, public nuisance, or condition.

G. DISPOSAL OF MATERIALS

Debris and waste materials, including all combustibles, shall be removed by the Contractor from the construction area unless otherwise approved in writing by Erwin Utilities or their Representative. Debris may not be buried on the construction site.

H. UTILITY COORDINATION

The Contractor shall make all necessary arrangements with private and public utility companies to avoid any possible damage to or interruption of utility equipment or service. The Contractor shall be responsible for all inquiries concerning locations of utility lines. Repair of any damage to public or private utilities resulting from this work shall be the responsibility of the Contractor.

I. CONSTRUCTION SURVEYING

1. All work shall be constructed in accordance with the lines, grades, and elevations shown on the Plans. The Contractor shall be fully responsible for maintaining alignment and grade.

2. The Contractor shall protect and safeguard all points, stakes, grade marks, monuments, and benchmarks at the site of the work and shall re-establish, at his own expense, any marks that are removed or destroyed due to his construction operations.

J. USE OF CHEMICALS

1. All chemicals used during project construction, whether herbicide, pesticide, disinfectant, polymer, reactant, or of other classification, must show approval of either EPA or USDA.

2. Use of all such chemicals and disposal of residues shall be in conformance with instructions provided by the manufacturers of said chemicals.

K. SAFETY AND HEALTH REGULATIONS

1. The Contractor shall comply with all Federal, State, and Local Safety and Health Regulations, including the Department of Labor Safety and Health Regulations for construction promulgated under the Occupational Safety and Health Act of 1970 (P.L. 91 - 596) and under Section 107 of the Contract Work Hours and Safety Standards Act (P.L. 91-54).

2. The Contractor shall provide continuous, safe access to all properties, both public and private, along the project in all cases where such access will be provided by the completed facility and shall conduct his operations in such a manner that inconvenience to the property owners will be held to a minimum.

3. The Contractor shall comply with Tennessee's drug-free workplace law (Tennessee Code Annotated, Section 50-9-101 through 50-9-112).

L. EQUIPMENT AND MATERIAL STORAGE

The Contractor shall plan his activities so that all materials and equipment can be stored within the project limits. There shall be no disturbance whatsoever of any areas outside the project limits without the prior approval of Erwin Utilities.

M. DISTURBED AREAS

All areas disturbed as a result of the work of the Contractor shall be restored to the original or better condition. Reasonable care shall be taken during construction to avoid damage to the owner's property or that of any adjacent property owner(s). Any damage to adjacent properties shall be restored to original condition or better at the contractor's expense.

N. TEMPORARY SANITARY FACILITIES

1. The Contractor shall be solely responsible for furnishing and maintaining temporary sanitary facilities during the construction period. Such facilities shall include, but not be limited to, potable water supply and toilet facilities.

2. Such facilities shall be in compliance with all applicable State and Local laws, codes, and ordinances and shall be placed convenient to work stations and secluded from public observation.

3. Once the project is completed, all temporary sanitary facilities shall be removed by the Contractor.

O. TRAFFIC MAINTENANCE

1. The Contractor shall provide, erect, and maintain all necessary barricades, suitable and sufficient warning lights, danger signals, and signs; shall provide a sufficient number of flagmen to direct traffic; and shall take all necessary precautions for the protection of the work and the safety of the public.

2. All traffic control equipment and methods shall comply with the most recent edition of the U.S. Department of Transportation, Federal Highway Administration's Manual on Uniform Traffic Control Devices (MUTCD).

3. All barricades and obstructions or hazardous conditions shall be illuminated as necessary to provide for safe traffic conditions.

4. Warning and caution signs shall be posted throughout the length of any portion of the project where traffic flow is restricted.

END OF SECTION

(Recommended Standard Forms Follow)

TRANSMITTAL FORM

( ) Shop Drawings
( ) Printed Materials
( ) Other

Transmittal Date: _____
Return Date: _____

REFERENCE: _____
Project
_____
Owner
_____
Address
_____
Location

FOR: ( ) Transmittal Only
( ) Approval
( ) Approved as noted
( ) Revise & Resubmit

FROM: _____
Name
_____
Company
_____
Address
_____
telephone/fax

TO _____
Name
_____
Company
_____
Address
_____
telephone/fax

Log #	Description	Copies	Sheet/Drawing #	Status

Project Ref. No. _____

By: _____
Signature

ATTENTION: CONSTRUCTION ADMINISTRATION

SUBMITTAL AND ROUTING FORM

(TO BE USED WITH EACH INDIVIDUAL PLAN SUBMITTAL OR SHOP DRAWING)

SUBMITTAL AND APPROVAL (Contractor to complete)	
Project Name: _____	Project #: _____
Contractor: _____	Submittal #: _____
Contract for: _____	Specification Section: _____
Submittal Title: _____	
Sheet/item numbers: _____	
_____	
_____	
Subcontractor: _____	Supplier: _____
Date Transmitted: _____	Date Needed: _____
Change from Contract Documents? Yes ____ No ____	Attached documentation: _____
Complete Submittal? Yes ____ No ____	_____
The Contractor must review and approve this submittal for all requirements and conformance to Contract documents prior to submittal to Erwin Utilities. Submittals forwarded without the Contractor's approval will be returned without review or comment.	
Reviewed by: _____	Date: _____

SUBMITTAL ROUTING (Erwin Utilities to complete)

Date Received: _____ Logged _____ To: _____ Return by: _____

REVIEW CODES: 1 = **Approved**: 2 = **Approved as Noted**: 3 = **Revise & Resubmit**: 4 = **Not Approved**

Reviewed by (in order)	Review Code	COMMENTS	Date	Initials

Erwin Utilities' approval: _____ Date _____

Erwin Utilities

EQUIPMENT START-UP FORM NO.

Proj. # _____

Date: _____

PROJECT DATA

NAME: _____ NUMBER: _____

LOCATION: _____ DATE: _____

OWNER: _____ DRAWING NO.: _____

OTHER: _____ SPEC. SECTION: _____

NAME OF EQUIPMENT CHECKED: _____

NAME OF MANUFACTURER OF EQUIPMENT _____

1. The equipment furnished by us has been checked on the job by us. We have reviewed (where applicable) the performance verification information submitted to us by the Contractor.
2. The equipment is properly installed, except for the items noted below.*
3. The equipment is operating satisfactorily, except for the items noted below.*
4. The written operating and maintenance information (where applicable) has been presented to the Owner, and gone over with him in detail. Three (3) copies of all applicable operating and maintenance information and parts lists have been furnished to him.

CHECKED BY:

_____
Name of Manufacturer's Representative

_____
Address & Phone No. of Representative

_____
Signature and Title of Person Making Check

_____
Date Checked

_____
Name of General Contractor

_____
Authorized Signature/Title/Date

_____
Name of Subcontractor

_____
Authorized Signature/Title/Date

MANUFACTURER'S REPRESENTATIVE Notations: Exceptions noted at the time of check were:

_____

_____

_____

_____

Manufacturer's Representative to note adequacy of related equipment that directly affects operation, performance or function of equipment checked. (No comment presented herein will indicate adequacy of related systems or equipment.)

_____

_____

_____

COPIES TO:

☐ OWNER: _____ ☐ CONTRACTOR: _____

☐ ENGINEER: _____ ☐ FIELD: _____

☐ ARCHITECT: _____ ☐ OTHER: _____

SECTION 02220 EXCAVATION AND BACKFILL

PART 1: GENERAL

1.01 SCOPE OF WORK

A. GENERAL

1. The work covered by this Section shall consist of furnishing all materials, labor, equipment, and services for the excavation and backfill at all areas within the limits of the project. Work is limited to the areas of construction, and includes, but is not limited to, stockpiling of topsoil, site grading, excavation of footings and trenches, filling, backfilling, compaction, finish grading, spreading of topsoil, disposal of waste material, and proof rolling.

2. Perform all excavation, dewatering, sheeting, bracing, and backfilling in such a manner as to eliminate all possibility of undermining or disturbing the foundations of existing structures.

3. Provide all labor, materials, equipment, and services indicated on the Drawings, or specified herein, or reasonably necessary for or incidental to a complete job.

4. Excavations shall provide adequate working space and clearances for the work to be performed therein and for installation and removal of concrete forms. In no case shall excavation faces be undercut for extended footings.

5. Subgrade surfaces shall be clean and free of loose material of any kind when concrete is placed thereon.

6. Backfilling during freezing weather shall not be done except by permission of Owner. No backfill, fill, or embankment materials shall be installed on frozen surfaces, nor shall frozen materials, snow, or ice be placed in any backfill, fill, or embankment.

1.02 SYSTEM DESCRIPTION

Excavation consists of the removal and disposal of all materials encountered for footings, foundations, pipework, and other construction as shown on the Drawings. Perform all excavation work in compliance with applicable requirements of governing authorities having jurisdiction.

1.03 QUALITY ASSURANCE

A. REFERENCED STANDARDS

Unless otherwise indicated, all referenced standards shall be the latest edition available at the time of bidding. Any requirements of these Specifications shall in no way invalidate the minimum requirements of the latest versions of the referenced standards. Comply with the provisions of the following codes and standards, except as otherwise shown or specified.

1. ASTM C33: "Standard Specifications for Concrete Aggregate";

2. ASTM D698: "Standard Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5 lb. Rammer and 12" Drop";

3. ASTM D3282: "Standard Recommended Practice for Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes";

4. Standard Specifications for Road and Bridge Construction, Tennessee Department of Transportation, March 1, 1995 edition; and

5. Erosion and Sediment Control Planning and Design Manual.

B. UNAUTHORIZED EXCAVATION

Except where otherwise authorized, indicated, or specified, all materials excavated below the bottom of concrete walls, footings, slabs on grade, and foundations shall be replaced, by and at the expense of the Contractor, with concrete placed at the same time and monolithic with the concrete above.

C. EXISTING UTILITIES

1. Locate existing underground utilities in the area of work. If utilities are to remain in place, provide adequate means of protection during earthwork operations.

2. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult Erwin Utilities immediately for directions as to procedure. Cooperate with Erwin Utilities and property owner in keeping respective services and facilities in operation. Repair damaged utilities to the satisfaction of utility companies.

1.04 SITE CONDITIONS

Test borings and other exploratory operations may be undertaken by the Contractor at his own expense provided such operations are acceptable to the property owner.

PART 2: PRODUCTS

2.01 MATERIALS

A. CLASSIFICATION OF EXCAVATED MATERIALS

All materials excavated for this project, regardless of its nature or composition shall be classified as Unclassified Excavation.

B. CLASSIFICATION OF OTHER MATERIALS

1. Satisfactory Subgrade Soil Materials

Soils shall comply with ASTM D 3282, soil classification Groups A-l, A-2-4, A-2-5, and A-3.

2. Unsatisfactory Subgrade Soil Materials

Soils described in ASTM D 3282, soil classification groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7; also peat and other highly organic soils shall not be used, unless otherwise acceptable to the owner.

3. Cohesionless Soil Materials:

Gravels, sand-gravel mixtures, sands, and gravelly-sands are classified as cohesionless soil materials.

4. Cohesive Soil Materials

Clayey and silty gravels, sand-clay mixtures, gravel-silt mixtures, clayey and silty sands, sand-silt mixtures, clays, silts, and very fine sands are classified as cohesive soil materials.

5. Backfill and Fill Materials

Provide satisfactory soil materials for backfill and fill, free of masonry, rock, or gravel larger than four inches (4") in any dimension, and free of metal, gypsum, lime, debris, waste, frozen materials, vegetable, and other deleterious matter. Use only excavated material that has been sampled, tested, and certified as satisfactory soil material.

6. Select Backfill

Select backfill is defined as backfill and fill material that is transported to the site from outside the project limits, and which meets the soil requirements specified above under "Backfill and Fill Materials." Material excavated in conjunction with the construction of this project cannot be considered as "select backfill" for payment purposes.

7. Pipe Bedding

Crushed stone or crushed gravel used in pipe bedding shall meet the requirements of ASTM C 33, Gradation #57.

8. Inundated Sand:

Sand for inundated sand backfill shall be clean with not more than twenty-five percent (25%) retained on a No. 4 sieve and not more than seven percent (7%) passing a No. 200 sieve and shall have an effective size between 0.10 mm and 0.30 mm. Sand shall be deposited in, or placed simultaneously with application of, water so that the sand shall be compacted by a mechanical probe type vibrator. Inundated sand shall be compacted to seventy-percent (70%) relative density as determined by ASTM D4253 and D4254.

9. Graded Gravel

Gravel for compacted backfill shall conform to the following gradation:

Sieve Size	Percent Passing by Weight
1”	l00
3/4”	85 - 100
3/8”	50 - 80
No. 4	35 - 60
No. 40	15 - 30
No. 200	05 - 10

The gravel mixture shall contain no clay lumps or organic matter. The fraction passing the No. 4 sieve shall have a liquid limit not greater than 25 and a plasticity index not greater than 5. Gravel backfill shall be deposited in uniform layers not exceeding twelve inches (12”) in uncompacted thickness. The backfill shall be compacted by a suitable vibratory roller or platform vibrator to not less than seventy percent (70%) relative density as determined by ASTM D4253 and D4254.

2.02 EQUIPMENT

A. MECHANICAL EXCAVATION

1. The use of mechanical equipment will not be permitted in locations where its operation would cause damage to trees, buildings, culverts, or other existing property, utilities, or structures above or below ground. In all such locations, hand excavating methods shall be used.

2. Mechanical equipment used for trench excavation shall be of a type, design, and construction and shall be controlled, that uniform trench widths and vertical sidewalls are obtained at least from an elevation one foot (1’) above the top of the installed pipe to the bottom of the trench, and that trench alignment is such that pipe when accurately laid to specified alignment will be centered in the trench with adequate clearance between the pipe and sidewalls of the trench. Undercutting the trench sidewall to obtain clearance will not be permitted.

PART 3: EXECUTION

3.01 PREPARATION

A. DEWATERING

1. The Contractor shall provide and maintain adequate dewatering equipment to remove and dispose of all surface water and groundwater entering excavations, trenches, or other parts of the work. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the structure to be built, or the pipe to be installed therein, is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.

2. All excavations for concrete structures or trenches that extend down to or below groundwater shall be dewatered by lowering and keeping the groundwater level beneath such excavations twelve inches (12") or more below the bottom of the excavation.

3. Surface water shall be diverted or otherwise prevented from entering excavated areas or trenches to the greatest extent practicable without causing damage to adjacent property.

4. The Contractor shall be responsible for the condition of any pipe or conduit that he may use for drainage purposes, and all such pipes or conduit that he may use for drainage purposes, and all such pipes or conduits shall be left clean and free of sediment.

5. Where trench sheeting is left in place, such sheeting shall not be braced against the pipe, but shall be supported in a manner that will preclude concentrated loads or horizontal thrusts on the pipe. Cross braces installed above the pipe to support sheeting may be removed after pipe embedment has been completed.

B. STABILIZATION

1. Subgrades for concrete structures and trench bottoms shall be firm, dense, and thoroughly compacted and consolidated; free from mud and muck; and sufficiently stable to remain firm and intact under the feet of the workmen.

2. Subgrades for concrete structures or trench bottoms, which are otherwise solid but that become mucky on top due to construction operations, shall be reinforced with one (1) or more layers of crushed rock or gravel. The stabilizing material shall be spread and

compacted to a depth of not more than four inches (4”); if the required depth exceeds four inches (4”), the material shall be furnished and installed as specified for granular fills. Not more than one-half inch (1/2”) depth of mud or muck shall be allowed to remain on stabilized trench bottoms when the pipe bedding material is placed thereon. The finished elevation of stabilized subgrades for concrete structures shall not be above subgrade elevations indicated on the drawings.

C. CUTTING CONCRETE OR ASPHALT SURFACE CONSTRUCTION

1. All pavement cutting and repair shall be done in accordance with Local ordinances. Cuts in concrete and asphaltic concrete shall be no larger than necessary to provide adequate working space for proper installation of pipe and appurtenances. Cutting shall be performed with a concrete saw in a manner that will provide a clean groove the complete thickness of the surface material along each side of the trench and along the perimeter of cuts for structures.

2. Concrete and asphaltic concrete over trenches excavated for pipelines shall be removed so that a shoulder not less than twelve inches (12”) in width at any point is left between the cut edge of the surface and the top edge of the trench. Trench width at the bottom shall not be greater than at the top, and no undercutting will be permitted. Cuts shall be made to and between straight or accurately marked curved lines that, unless otherwise required, shall be parallel to the center line of the trench.

3. Pavement or other surfaces removed for connections to existing lines or structures shall not be of greater extent than necessary for the installation.

4. Where the trench parallels the length of concrete walks and the trench location is all or partially under the walk, the entire walk shall be removed and replaced. Where the trench crosses drives, walks, curbs, or other surface construction, the surface construction shall be removed and replaced between existing joints or between saw cuts as specified for payment.

D. SITE GRADE

1. General

Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finish the surface within specified tolerances; compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.

2. Ground Surface Preparation

Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow, strip, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface. Shape the subgrade as indicated on the Drawings by forking, furrowing, or plowing so that the first layer of new material placed thereon will be well bonded to it.

3.02 FIELD MEASUREMENTS

A. ALIGNMENT, GRADE, AND MINIMUM COVER

1. Vertical and horizontal alignment of pipes, and the maximum joint deflection used in connection therewith, shall be in conformity with requirements of the Section covering installation of pipe.

2. Where pipe grades or elevations are not definitely fixed by the Contract Drawings, trenches shall be excavated to a depth sufficient to provide a minimum depth of backfill cover over the top of the pipe. Additional cover depths may be necessary on vertical curves or to provide necessary clearance beneath existing pipes, conduits, drains, drainage structures, or other obstructions encountered at normal pipe grades. Measurement of pipe cover depth shall be made vertically from the outside top of pipe to finished ground or pavement surface elevation except where future surface elevations are indicated on the Drawings.

B LIMITING TRENCH WIDTHS

Trenches shall be excavated to a width that will provide adequate working space and sidewall clearances for proper pipe installation, jointing, and embedment. Maximum trench widths shall be no greater than the pipe outside diameter plus twenty-four inches (24”) (twelve inches (12”) on either side of pipe).

3.03 PROTECTION

A. TEMPORARY PROTECTION

Protect structures, utilities, sidewalks, pavements, and other facilities from damages caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. SHEETING AND BRACING

Make all excavations in accordance with the rules and regulations promulgated by the Department of Labor, Occupational Safety and Health Regulations for Construction. Furnish, put in place, and maintain such sheeting, bracing, etc., as may be necessary to support the sides of the excavation and to prevent any movement of earth that could in any way diminish the width of the excavation to less than that necessary for proper construction, or could otherwise injure or delay the work, or endanger adjacent structures, roads, utilities, or other improvements.

C. BLASTING

1. The Contractor shall be responsible for all damage caused by blasting operations. Suitable methods shall be employed to confine all materials lifted by blasting within the limits of the excavation or trench.

2. All rock that cannot be handled and compacted as earth shall be kept separate from other excavated materials and shall not be mixed with backfill or embankment materials, except as specified or directed.

D. CARE AND RESTORATION OF PROPERTY

1. Enclose the trunks of trees that are to remain adjacent to the work with substantial wooden boxes of such height as may be necessary to protect them from piled material, equipment, or equipment operation. Use excavating machinery and cranes of suitable type,

and operate the equipment with care to prevent injury to remaining tree trunks, roots, branches, and limbs.

2. Do not cut branches, limbs, and roots except with permission of the property owner. Cut smoothly and neatly without splitting or crushing. In case of cutting or unavoidable injury to branches, limbs, and trunks of trees, neatly trim the cut or injured portions and cover with an application of grafting wax and tree healing paint as directed. If significant roots are cut then the tree can be removed with the property owner's permission.

3. Protect by suitable means all cultivated hedges, shrubs, and plants that might be injured by the Contractor's operations. Promptly heel in any such trees or shrubbery necessary to be removed and replanted. Perform heeling in and replanting under the direction of a licensed and experienced nurseryman. Replant in their original position all removed shrubbery and trees after construction operations have been substantially completed and care for until growth is reestablished.

4. Replace cultivated hedges, shrubs, and plants injured to such a degree as to affect their growth or diminish their beauty or usefulness, by items of kind and quality at least equal to the kind and quality existing at the start of the work.

5. Do not operate tractors, bulldozers, or other power-operated equipment on paved surfaces if the treads or wheels of the equipment are so shaped as to cut or otherwise injure the surfaces.

6. Restore all surfaces, including lawns, grassed, and planted areas that have been injured by the Contractor's operations, to a condition at least equal to that in which they were found immediately before the work was begun. Use suitable materials and methods for such restoration. Maintain all restored plantings by cutting, trimming, fertilizing, etc., until acceptance. Restore existing property or structures as promptly as practicable and do not leave until the end of construction period.

E. PROTECTION OF STREAMS

Exercise reasonable precaution to prevent the silting of streams. Provide at Contractor's expense temporary erosion and sediment control measures to prevent the silting of streams and existing drainage facilities.

F. AIR POLLUTION

1. Comply with all pollution control rules, regulations, ordinances, and statutes that apply to any work performed under the Contract, including any air pollution control rules, regulations, ordinances and statutes, or any municipal regulations pertaining to air pollution.

2. During the progress of the work, maintain the area of activity, including sweeping and sprinkling of streets as necessary so as to minimize the creation and dispersion of dust. If Erwin Utilities decides that it is necessary to use calcium chloride or more effective dust control, furnish and spread the material as directed and without additional compensation.

3.04 TRENCH EXCAVATION

A. LENGTH OF TRENCH

1. No more trench shall be opened in advance of pipe laying than is necessary to expedite the work. One (1) block or four hundred (400) feet (whichever is the shorter) shall be the maximum length of open trench on any line under construction.

2. Except where tunneling is indicated on the Drawings, in the Specifications, or is permitted by Erwin Utilities, all trench excavation shall be open cut from the surface.

B. TRENCH EXCAVATION

1. The work covered by this Section consists of the excavation and satisfactory disposal of all materials excavated in the construction of trenches.

2. Trenches will be defined as all excavation for the installation of storm sewers, sanitary sewers, water pipe, manholes, catch basins, hydrants, watergates, sewer services, water taps, drainage structures, drainage ditches, and other unclassified excavation as may be deemed necessary by Erwin Utilities.

3. The excavation shall be done to the lines, grades, typical sections, and details shown on the Plans or established by Erwin Utilities.

4. All work covered by this Section shall be coordinated with the grading, construction of drainage structures, and other work along the project, and shall be maintained in a satisfactory condition so

that adequate drainage is provided at all times. Any roots that protrude into the trench shall be trimmed flush with the sides of the trench. Trenches for pipe lines shall be completed before the pipe is installed unless otherwise permitted by Erwin Utilities.

5. All trenches shall be excavated in accordance with all applicable OSHA regulations or other regulations having jurisdiction at the project site.

6. All excavation shall be by open cut unless otherwise authorized by Erwin Utilities.

7. Trench Excavation in Earth

Earth excavation includes all excavation of whatever substance encountered. In locations where pipe is to be bedded in earth excavated trenches, fine grade the bottoms of such trenches to allow firm bearing for the bottom of the pipe on undisturbed earth. Where any part of the trench has been excavated below the grade of the pipe, fill the part excavated below such grade with pipe bedding material and compact at the Contractor's expense.

Trench Excavation in Fill

If pipe is to be laid in embankments or other recently filled material, first place the fill material to the finish grade or to a height of at least one foot (1') above the top of the pipe, whichever is the lesser. Take particular care to ensure maximum consolidation of material under the pipe location. Excavate the pipe trench as though in undisturbed material.

Trench Bottom in Poor Soil

Excavate and remove unstable or unsuitable soil to a depth of six inches below the unsuitable material, and refill with a thoroughly compacted gravel bedding.

8. The excavation shall be of sufficient width to allow a clearance of not less than six inches (6") between the side of the trench and the outside of the pipe, or in case of pipe with a bell, the outside of the bell of the pipe. This rule will apply at all times, and consequently, proper allowance must be made for additional space required for sheeting the trench where necessary. Maximum trench width, unless as otherwise authorized by Erwin Utilities, as measured at a depth of two feet (2'-0") above the top of the pipe shall be thirty inches (30") total or twelve-inch (12") clearance from the outside of

the pipe, whichever is greater. Do not widen trenches by scraping or loosening materials from the sides. Provide bell holes at each joint to permit the joint to be made properly and to provide a continuous bearing and support for the pipe.

9. Sheeting, Bracing Trenches, and Trench Boxes

a. If necessary, the Contractor will be required to keep the sides of the excavation vertical by sheeting and/or bracing or the use of a trench box to prevent movement by slides or settling of the sides of the trench, in such manner as to prevent injury or displacement of the pipe or appurtenances or diminish the working space required at the sides of the pipe. Also, the Contractor may be required for the purpose of preventing injury to persons or property or adjacent structures in place or to be constructed, to leave sheeting and bracing in place. Sheeting and bracing shall be provided in accordance with all applicable Federal, State, and Local safety and health regulations.

b. No sheeting or bracing shall extend closer than two feet (2'-0") off the ground surface or within subgrade, and no timbers shall be left in the trench that may form pockets or cavities that cannot easily be filled during the operation of backfilling and settling or compacting the trench backfill. It is understood that Erwin Utilities will be under no obligation to pay for sheeting or bracing left in place by the Contractor. Failure to sheet and brace trenches or other excavation shall be the Contractor's risk, and he will be held responsible for caving, settlement, and all other damage resulting therefrom

10. Excavated materials to be used for backfill will be approved by Erwin Utilities, and if acceptable shall be neatly deposited at the sides of the trenches where space is available. Where stockpiling of excavated material is required, the Contractor shall so maintain his operations as to provide for natural drainage and not present an unsightly appearance. Materials that are excess to the needs of the project will be disposed of according to the Section on "Waste Material Disposal."

C. TRENCH BACKFILL

Backfill trenches immediately after approval of the pipeline construction.

1. Pipes Outside of Roadways

a. Use backfill carefully placed in uniform layers not exceeding six inches (6”) in thickness to a depth of two feet (2’-0”) over the top of the pipe.

b. Place material, and fill the area under the pipe haunches. Place each layer, moisten, then uniformly compact by use of hand, pneumatic, or mechanical tampers, exercising care to prevent lateral displacement of the pipe.

c. Areas of backfill greater than two feet (2’-0”) over top of pipe to top of trench shall be backfilled with a material containing no rocks larger than six inches (6”) in the greatest dimension and shall be free of material with an exceptionally high void content.

d. The initial backfill up to a depth of two feet (2’-0”) shall meet the same requirements except that no rocks over four inches (4”) in diameter will be allowed.

e. If SDR 35 PVC sewer pipe is used, Contractor shall install six inches (6”) of TDOT No. 57 crushed stone below the pipe, hand haunch No. 57 stone around the pipe, and install six inches (6”) of No. 57 stone above the pipe, in accordance with the Standard Details.

f. Moisten backfill above two feet (2’-0”) over the top of the pipe and place in eight-inch (8”) layers. Compact each layer with hand, pneumatic, or mechanical compactor. Puddling or flooding of trench for consolidation of backfill or use of wheel rolling by construction equipment will not be permitted.

g. Place bedding material to the level shown on the Drawings and work material carefully around the pipe to insure that all voids are filled, particularly in bell holes.

2. <u>Backfill Material</u>

a. If material excavated from the trench is unsuitable to be used as backfill, select backfill shall be transported to the site by the Contractor from outside the project limits to be used as backfill material. Material excavated in conjunction with the construction of the project is not considered select backfill for payment purposes. Erwin Utilities shall approve the borrow source and all select backfill material. Select

backfill shall be high quality clay soil and shall be free of foreign debris such as roots and rock. The nature of the materials will govern both their acceptability for backfill and the methods best suited for their placement and compaction in the backfill. Both are subject to the approval of Erwin Utilities.

b. Do not place stone or rock fragments larger than four inches (4”) in greatest dimension in the backfill.

c. Do not drop large masses of backfill material into the trench in such a manner as to endanger the pipeline. Use a timber grillage to break the fall of material dropped from a height of more than five feet (5’).

d. Exclude pieces of bituminous pavement from the backfill.

3. Roadways and Road Crossings

a. Use #57 stone backfill placed in uniform layers not exceeding six inches (6”) in thickness for full trench depth and width, thoroughly compacted with mechanical tampers to ninety-five percent (95%) compaction; one hundred percent (100%) for the top two feet (2’-0”) of subgrade beneath pavements. Replace removed paving and base course with new material of equal or better quality and of the same texture and color as the adjacent roadway.

b. All backfill shall be compacted so as not to damage the pipe and appurtenances and shall be compacted to ninety-five percent (95%) of the Standard Proctor Test for the various types of backfill material; one hundred percent (100%) as determined by ASTM D0698 for the top two feet (2’-0”) of subgrade beneath pavements. Methods of backfilling shall be in strict accordance with the pipe Manufacturer's recommendations. All backfill material shall have been approved by Erwin Utilities.

c. Care shall be taken during backfill and compaction operations to maintain alignment and prevent damage to the joints.

d. The backfill shall be kept free from stones, frozen lumps, chunks of highly plastic clay, or other objectionable material. All pipe backfill areas shall be graded and maintained in

such a condition that erosion or saturation will not damage the pipe bed or backfill.

e. Heavy equipment shall not be operated over any pipe until it has been properly backfilled and has a minimum cover as required by the Plans and Specifications. Pipe that becomes misaligned, shows excessive settlement, or has been otherwise damaged by the Contractor's operations, shall be removed and replaced by the Contractor at no cost to Erwin Utilities.

f. Where any part of the required cover is above the proposed finish grade, the Contractor shall place, maintain, and finally remove such material at no cost to Erwin Utilities.

g. The Contractor shall maintain all pipes installed in a condition that they could function continuously from the time the pipe is installed until the project is accepted.

4. Cleanup

a. Grade all areas disturbed to a finish ordinarily obtained from a blade grader with no abrupt changes in grade or irregularities that will hold water.

b. Prior to final inspection and acceptance, remove all rubbish and excess material and leave area in a neat, satisfactory condition.

c. Cleanup and seeding is part of the pipeline installation. Cleanup and seeding should be completed as early as possible. No more than three thousand linear feet (3,000 LF) of sewer line may be laid prior to completion of cleanup of the first section of pipeline laid. To facilitate this, Erwin Utilities reserves the right to withhold up to thirty percent (30%) of the unit price bid for sewer line if, in the opinion of Erwin Utilities, completed sections have not been properly cleaned.

3.05 SITE GRADE

A. PLACEMENT AND COMPACTION

1. Place backfill and fill material in layers not more than eight inches (8”) in loose depth. Before compaction, moisten or aerate each layer as necessary to provide the optimum moisture content. Compact each layer to the required percentage of maximum density for each area classification. Do not place backfill or material on surfaces that are muddy, frozen, or contain frost or ice.

2. In areas not accessible to rollers or compactors, compact the fill with mechanical hand tampers. If the mixture is excessively moistened by rain, aerate the material by means of blade graders, harrows, or other approved equipment, until the moisture content of the mixture is satisfactory. Finish the surface of the layer by blading or rolling with a smooth roller, or a combination thereof, and leave the surface smooth and free from waves and inequalities.

3. Place backfill and fill materials evenly adjacent to structures, to the required elevations. Take care to prevent wedging action of backfill against structures. Carry the material uniformly around all parts of the structure to approximately the same elevation in each lift.

4. When existing ground surface has a density less than that specified under the subsection entitled Compaction for the particular area classification, break up the ground surface, pulverize, moisture-condition to the optimum moisture content, and compact to required depth and percentage of maximum density.

B. GRADING OUTSIDE BUILDING LINES

Grade to drain away from structures to prevent ponding of water. Finish surface free from irregular surface changes.

C. PLANTING AREAS

Finish areas to receive topsoil to within not more than one inch (1") above or below the required subgrade elevations, compacted as specified, and free from irregular surface changes.

D. WALKS

Shape the surface of areas under walks to line, grade, and cross-section, with the finish surface not more than zero inches (0") above or one inch (1") below the required subgrade elevation, compacted as specified, and graded to prevent ponding of water after rains.

E. PAVEMENTS

1. Shape the surface of the areas under pavement to line, grade and cross-section, with finish surface not more than one-half inch (1/2") above or below the required subgrade elevation, compacted as specified, and graded to prevent ponding of water after rains. Include such operations as plowing, discing, and any moisture or aerating required to provide the optimum moisture content for compaction.

2. Fill low areas resulting from removal of unsatisfactory soil materials, obstructions, and other deleterious materials, using satisfactory soil material.

3. Shape to line, grade, and cross-section as shown on the Drawings.

F. PROTECTION OF GRADED AREAS

Protect newly graded areas from traffic and erosion, and keep free of trash and debris. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

G. RECONDITIONING COMPACTED AREAS

Where completed compacted areas are disturbed by subsequent construction operations or adverse weather prior to acceptance of work, scarify surface, reshape, and compact to required density prior to further construction.

H. UNAUTHORIZED EXCAVATION

1. Unauthorized excavation consists of the removal of materials beyond indicated elevations without the specific direction of Erwin Utilities. Under footings, foundations, bases, etc., fill unauthorized excavation by extending the indicated bottom elevation of the concrete to the bottom of the excavation, without altering the required top elevation. Lean concrete fill may be used to bring elevations to proper position only when acceptable to Erwin Utilities.

2. Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations of the same classification, unless otherwise directed by Erwin Utilities.

3.06 BACKFILL AROUND STRUCTURES

A. GENERAL

1. Unless otherwise indicated in the Specifications or on the Drawings, use suitable material for backfill.

2. Do not use frozen material for the backfill, and do not place backfill upon frozen material. Remove previously frozen material before new backfill is placed.

B. MATERIAL

1. Approved selected materials available from the excavations may be used for backfilling around structures.

2. Obtain material needed in addition to that of construction excavations from approved off-site borrow pits. Furnish all borrow material needed on the work.

3. Place and compact all material, whether from the excavation or borrow, to make a dense, stable fill.

4. Use fill material which contains no vegetation, masses of roots, individual roots over eighteen inches (18”) long or more than one-half inch (1/2”) in diameter, stones over four inches (4”) in diameter, or porous matter. Organic matter must not exceed minor quantities.

C. PLACING BACKFILL

1. Do not place backfill against or on structures until they have attained sufficient strength to support the loads (including construction loads) to which they will be subjected, without distortion, cracking, or other damage.

2. Make special leakage tests, if required, as soon as practicable after the structures are structurally adequate and other necessary work has been done.

3. Use the best of the excavated materials in backfilling within two feet (2’) of the structure.

4. Avoid unequal soil pressures by depositing the material evenly around the structure.

3.07 COMPACTION

A. GENERAL

Control soil compaction during construction, providing at least the minimum percentage of density specified for each area classification.

B. PERCENTAGE OF MAXIMUM DENSITY REQUIREMENTS

1. After compaction, all fill will be tested in accordance with Method “C” of ASTM D-698, unless specified otherwise.

2. Except as noted otherwise for the zone around pipe, provide not less than the following percentages of maximum density of soil material compacted at optimum moisture content, for the actual density of each layer of soil material-in-place:

UNPAVED AREAS	Compact Full Depth to 92%
DRIVES AND PARKING	Top 9” - 100%
TRENCH BACKFILL (PAVED AREAS)	Compact full depth to 95%
TRENCH BACKFILL (UNPAVED AREAS)	Compact full depth to 95%
ALL OTHER BACKFILL	Compact full depth to 95%

C. MOISTURE CONTROL

1. Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material, to prevent free water appearing on surface during or subsequent to compaction operations.

2. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing, or pulverizing, until moisture content is reduced to a satisfactory value, as determined by moisture-density relation tests.

3.08 FIELD QUALITY CONTROL

Compaction tests of all fill areas will be made by an independent testing laboratory. Such tests will be provided and paid for by the Developer, except that tests that reveal non-conformance with the Specifications and all succeeding tests for the same area shall be at the expense of the Contractor until conformance with the Specifications is established. The Developer will be responsible for paying for only the successful tests.

3.09 FLOWABLE FILL

A. STRENGTH

Select and proportion ingredients to obtain compressive strength between 50 psi and 150 psi at 28 days in accordance with ASTM D4832.

B. MATERIAL

1. Cement: ASTM C150, Type I or Type II.

2. Aggregate: ASTM C33, Size 7.

3. Fly Ash (if used): ASTM C618, Class C.

4. Water: Clean, potable, containing less than 500 ppm of chlorides.

END OF SECTION

SECTION 02601 BORE AND ENCASEMENT

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The work under this Section consists of furnishing all materials, labor, equipment, and services required for the complete installation of encasement pipe and carrier pipes under highways and railroads by boring and jacking as shown on the Drawings and specified herein.

B. All work in connection with constructing encasement pipes under highways and railroads shall comply with all current requirements of governing highway and railroad agencies. The Contractor shall be familiar with these requirements.

C. The Contractor shall inspect the locations at the proposed crossings and shall familiarize himself with the conditions under which the work will be performed, and with all necessary details and the suitability of his equipment and methods for the work required.

PART 2: PRODUCTS

2.01 MATERIALS

A. Encasement pipe shall be smooth wall welded steel conforming to ASTM Designation A139, Grade B. Minimum pipe diameter and wall thickness for casing installation under roadways shall be as follows:

Pipe - Nominal Diameter Inches	Casing - Nominal Diameter Inches	Wall Thickness - Inches
6	12	0.250
8 -10	16	0.375
12	18	0.375
14	22	0.375
16	24	0.375
18 - 20	30	0.375
24	36	0.375

B. CASING SPACERS

Casing spacers shall meet one (1) of the following requirements and shall be installed no more than seven feet (7') apart:

1. Casing spacers shall be flanged, bolt-on style with a two-section stainless steel shell lined with a PVC liner, minimum 0.09-inch (.09") thick and 85-90 durometer hardness. Runners shall be attached to stainless steel risers, which shall be properly welded to the shell. The height of the runners and risers shall be manufactured such that the pipe does not float within the casing. Casing spacers shall be Cascade Waterworks Manufacturing Company or Advanced Products Systems, Inc.

2. Casing spacers shall be a two-section, flanged, bolt-on style constructed of heat-fused, PVC-coated steel, minimum 14-gauge band and 10-gauge risers, with two inch (2") wide glass reinforced polyester insulating skids, heavy duty PVC inner liner, minimum 0.09-inch thick and 85-90 durometer hardness, and all stainless steel or cadmium plated hardware shall be Pipeline Seal and Insulator, Inc.

C. GROUT

Grout and brick shall be used for filling the void between the end of the casing pipe and the carrier pipe. Cement shall conform to ASTM C 150, Type I or Type II. Grout shall have a minimum compressive strength of two thousand (2,000) psi within twenty-four (24) hours.

PART 3: EXECUTION

3.01 INSTALLATION

A. Encasements shall be installed by boring and jacking unless field conditions require otherwise. It shall be the Contractor's responsibility to notify Erwin Utilities immediately if conditions do not permit a jack and bore installation.

B. Installation of encasement pipe shall include all related work and services such as mobilization of equipment, constructing and maintaining working pits, right-of-way maintenance and restoration, traffic maintenance, mining, excavations, dewatering, sheeting, shoring and bracing for embankments, and operating pits, and, as elsewhere required, shall be placed and maintained in order that work may proceed safely and expeditiously.

C. Installation of the casing pipe shall be carried out without disturbance of the embankment, pavement, tracks, or other railroad or highway facilities and without obstructing the passage of traffic at any time.

D. The driven portions of the casing shall be advanced from the lower end of the casing unless specific permission to do otherwise is obtained by the Contractor from Erwin Utilities.

E. The alignment and grade shall be carefully maintained and the encasement pipe installed in a straight line.

F. The space outside the encasement and the ground shall be filled with grout, sand or pea gravel, as directed by Erwin Utilities. Erwin Utilities will direct that this space be filled if the space is large enough to cause any earth settling.

END OF SECTION

SECTION 02730 SANITARY SEWER PIPE AND APPURTENANCES

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, equipment, materials, and incidentals necessary to install and complete the sanitary sewer and/or force main installation in accordance with the Plans. All pipe and appurtenance material shall be of the type and class specified herein.

B. All sewer pipe and force main excavation, bedding, pipe laying, jointing and coupling of pipe joints, and backfilling shall be completed as described herein.

1.02 SUBMITTALS

Shop drawings or submittals shall be required for the following:

A. All sizes and types of pipe on the project;

B. Pipe fittings and couplings; and

C. All valves, valve boxes, manholes, manhole frames and covers, air release valves, or any other appurtenances required for completion of the project.

1.03 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall unload pipe and appurtenances so as to avoid deformation or other injury thereto.

B. Pipe shall not be placed within pipe of a larger size and shall not be rolled or dragged over gravel or rock during handling.

C. The Contractor shall store the pipe and appurtenances on sills above storm drainage level and deliver for laying after the trench is excavated.

D. When any material is damaged during transporting, unloading, handling, or storing, the undamaged portions may be used as needed, or, if damaged sufficiently, Erwin Utilities will reject the material as being unfit for installation.

1.04 CONSTRUCTION APPROVAL

A. In general, construction of new sewer existing systems will be allowed only if system and the receiving sewage treatment systems or extensions of the downstream conveyance plant is either:

1. Capable of adequately conveying or processing the added hydraulic and organic load, or

2. Capable of providing adequate conveyance or treatment facilities on a time schedule acceptable to the Department.

1.05 OWNERSHIP

A. Sewer systems including pumping stations will not be approved unless ownership and responsibility for operation are by a public entity.

1.06 DESIGN

A. Sewer systems shall be designed and constructed to achieve total containment of sanitary wastes and maximum exclusion of infiltration and inflow. No combined sewers will be approved.

1.07 OVERFLOWS

A. No overflows in separate sewers or new overflows in existing combined sewers shall be permitted. Overflows in new interceptor sewers intercepting existing combined sewers will not be permitted. An alarm system to signal existing overflow conditions and procedures for reporting overflows may be required.

1.08 CALCULATIONS

A. Computations and other data used for design of the sewer system shall be submitted to the Department.

PART 2: DESIGN

2.01 DESIGN PERIOD

A. Collection sewers (Laterals and Submains)

1. Collection sewers should be designed for the ultimate development of the tributary areas.

B. Main, Trunk, and Interceptor Sewers

Selection of the design period for trunk and interceptor sewers should be based on evaluation of economic, functional, and other considerations. Some of the factors that should be considered in the evaluation are:

a. Possible solids deposition, odor, and pipe corrosion that might occur at initial flows.

b. Population and economic growth projections and the accuracy of the projections.

c. Comparative costs of staged construction alternatives.

d. Effect of sewer sizing on land use and development.

2.02 DESIGN BASIS

A. New sewer systems shall be designed on the basis of per capita flows or alternative methods. Documentation of the alternative method shall be provided upon request.

1. Per Capita Flow – New sewer systems designed on the basis of an average daily per capita flow may be designed for flow equal to that set forth in the tables below from Appendix 2-A (http://www.tn.gov/assets/entities/environment/attachments/wr-wq_pub_design-criteria-ch2.pdf) of the Tennessee Design Criteria Chapter 2. These figures are assumed to cover normal infiltration, but an additional allowance should be made where conditions are unfavorable. If there is an existing water system in the area, water consumption figures can be used to help substantiate the selected per capita flow. Generally, the sewers should be designed to carry, when running full, not less than the following:

Table 2-A.1. Typical Wastewater Flow Rates from Commercial Sources
(Source: Crites and Tchobanoglous, 1998)

FACILITY	UNIT	Flow, gallons/unit/day	
		Range	Typical
Airport	Passenger	2 - 4	3
Apartment House	Person	40 - 80	50
Automobile Service Station	Vehicle served	8 - 15	12
	Employee	9 - 15	13
Bar	Customer	1 - 5	3
	Employee	10 - 16	13
Boarding House	Person	25 - 60	40
Department Store	Toilet Room	400 - 600	500
	Employee	8 - 15	10
Hotel	Guest	40 - 60	50
	Employee	8 - 13	10
Industrial Building (Sanitary waste only)	Employee	7 - 16	13
Laundry (self-service)	Machine	450 - 650	550
	Wash	45 - 55	50
Office	Employee	7 - 16	13
Public Lavatory	User	3 - 6	5
Restaurant (with toilet)	Meal	2 - 4	3
Conventional	Customer	8 - 10	9
Short order	Customer	3 - 8	6
Bar/cocktail lounge	Customer	2 - 4	3
Shopping Center	Employee	7 - 13	10
	Parking Space	1 - 3	2
Theater	Seat	2 - 4	3

Table 2-A.2. Typical Wastewater Flow Rates from Institutional Sources
(Source: Crites and Tchobanoglous, 1998)

FACILITY	UNIT	Flow, gallons/unit/day	
		Range	Typical
Assembly Hall	Seat	2 - 4	3
Hospital, Medical	Bed	125 -240	165
	Employee	5 - 15	10
Hospital, Mental	Bed	75 - 140	100
	Employee	5 - 15	10
Prison	Inmate	80 - 150	120
	Employee	5 - 15	10
Rest Home	Resident	50 - 120	90
	Employee	5 - 15	10
School, day-only:			
With cafeteria, gym, showers	Student	15 - 30	25
With cafeteria only	Student	10 - 20	15
Without cafeteria, gym, or showers	Student	5 - 17	11
School, boarding	Student	50 - 100	75

Table 2-A.3. Typical Wastewater Flow Rates from Commercial Sources
(Source: Crites and Tchobanoglous, 1998)

FACILITY	UNIT	Flow, gallons/unit/day	
		Range	Typical
Apartment, resort	Person	50 - 70	60
Bowling Alley	Alley	150 - 250	200
Cabin, resort	Person	8 - 50	40
Cafeteria	Customer	1 - 3	2
	Employee	8 - 12	10
Camps:			
Pioneer Type	Person	15 - 30	25
Children's, with central toilet/bath	Person	35 - 50	45
Day, with meals	Person	10 - 20	15
Day, without meals	Person	10 - 15	13
Luxury, private bath	Person	75 - 100	90
Trailer Camp	Person	75 - 125	125
Campground-developed	Person	20 - 40	30
Cocktail Lounge	Seat	12 - 25	20
Coffee Shop	Customer	4 - 8	6
	Employee	8 - 12	10
Country Club	Guests on-site	60 - 130	100
	Employee	10 -15	13
Dining Hall	Meal Served	4 - 10	7
Dormitory/bunkhouse	Person	20 - 50	40
Fairground	Visitor	1 - 2	2
Hotel, resort	Person	40 - 60	50
Picnic park, flush toilets	Visitor	5 - 10	8
Store, resort	Customer	1 - 4	3
	Employee	8 - 12	10
Swimming Pool	Customer	5 - 12	10
	Employee	8 - 12	10
Theater	Seat	2 - 4	3
Visitor Center	Visitor	4 - 8	5

a. Lateral and Submains: Minimum peak design should be not less than 400% of the average design flow. “Lateral” is defined as a sewer that has no other common sewers discharging into it. “Submain” is defined as a sewer that receives flow from one or more lateral sewers.

b. Main, Trunk, and Interceptor Sewers: Minimum peak design flow should be not less than 250% of the average design flow. “Main” or “trunk” is defined as a sewer that receives flow from one or more submains. “Interceptor” is defined as

a sewer that receives flow from a number of main or trunk sewers, force mains, etc.

2. Alternative Methods – New sewer systems may be designed by alternative methods other than on the basis of per capita flow rates. Alternative methods may include the use of peaking factors of the contributing area, allowances for future commercial and industrial areas, separation of infiltration and inflow from the normal sanitary flow, and modification of per capita flow rates (based on specific data). Documentation of the alternative method used shall be provided upon request. When infiltration is calculated separately from the normal sanitary flow, the maximum allowable infiltration rate shall be 200 gallons per day per inch diameter of the sewer per mile of sewer.

3. Design Factors – The following factors must be considered in the design of sanitary sewers:

   a. Peak sewage flows from residential, commercial, institutional, and industrial sources

   b. Groundwater infiltration

   c. Topography and depth of excavation

   d. Treatment plant location

   e. Soils conditions

   f. Pumping requirements

   g. Maintenance, including manpower and budget

   h. Existing sewers

   i. Existing and future surface improvements

   j. Controlling service connection elevations

   k. Proximity to surface streams, including minimizing the potential for draining or diversion of stream water into the pipe trench

   l. Watertight and exclude groundwater and surface water

PART 3: DESIGN AND CONSTRUCTION DETAILS

3.01 GRAVITY SEWERS

A. MINIMUM SIZE

1. No sewer shall be less than 8 inches in diameter.

B. DEPTH

1. Generally, sewers should not be less than 2 ½ feet deep, but should be sufficiently deep to prevent freezing and physical damage and should receive sewage from existing dwellings by gravity.

C. ROUGHNESS COEFFICIENT

1. The roughness coefficient should be documented for the type of pipe used. However, for ease of calculations, an "N" value of 0.013 may be used in Manning's formula for the design of all sewer facilities.

D. SLOPE

1. All conventional gravity sewers shall be designed and constructed to give mean velocities, when flowing full, of not less than 2.0 feet per second. The following minimum slopes should be provided; however, slopes greater than these are desirable:

Sewer Size (inches)	Minimum Slope (feet per 100 feet)
8	0.40
10	0.28
12	0.22
14	0.17
15	0.15
16	0.14
18	0.12
21	0.10
24	0.08
27	0.07
30	0.06
36	0.05

2. Under special conditions, slopes slightly less than those required for the 2.0 feet-per-second velocity when flowing full may be permitted. Such decreased slopes will only be considered where the depth of flow will be 0.3 of the diameter or greater for design average flow. Whenever such decreased slopes are proposed, the design engineer shall furnish with his report his computations of the depths of flow in such pipes at minimum, average, and daily or hourly rates of flow. The maintaining sewage agency must recognize and accept in writing the problems of additional maintenance caused by decreased slopes.

3. Sewers shall be laid with uniform slope between manholes.

4. Sewers on 20 percent slope or greater shall be anchored securely with concrete anchors or equal. Suggested minimum anchorage spacing is as follows:

   a. Not over 36 feet center to center on grades 20 percent and up to 35 percent.

   b. Not over 24 feet center to center on grades 35 percent and up to 50 percent.

   c. Not over 16 feet center to center on grades 50 percent and over.

E. ALIGNMENT

1. Generally, gravity sewers shall be designed with straight alignment between manholes. However, curved sewers may be approved where circumstances warrant, but only in large (i.e., 24” and larger) diameter segments.

F. INCREASING SIZE

1. Where a smaller sewer joins a larger one, the invert of the larger sewer should be lowered sufficiently to maintain the same energy gradient. An approximate method for securing these results is to match the crowns of the sewers entering/exiting the manhole or junction structure.

G. HIGH-VELOCITY PROTECTION

1. Where velocities greater than 15 feet per second are expected, special provision shall be made to protect against internal erosion or displacement by shock.

3.02 MATERIALS

A. PIPE

1. All materials shall be first quality with smooth interior and exterior surfaces, free from cracks, blisters, honeycombs, and other imperfections, and true to theoretical shapes and forms throughout.

2. All materials shall be subject to the inspection of Erwin Utilities at the plant, trench, or other point of delivery, for the purpose of culling and rejecting materials that do not conform to the requirements of these specifications. Such material shall be marked by Erwin Utilities and the Contractor shall remove it from the project site upon notice of its rejection.

3. As particular Specifications are cited, the designation shall be construed to refer to the latest revision under the same specification number, or to superseding Specifications under a new number.

4. Polyvinyl Chloride (PVC) Sewer Pipe

a. Gravity

PVC pipe shall be as manufactured in accordance with ASTM D-3034, latest edition, and shall be suitable for use as a gravity sanitary sewer pipe. The standard dimension ratio (SDR) shall be 26 at installation depths up to seventeen feet (17') deep and ductile iron (DIP) at depths beyond seventeen feet (17') deep.

b. All PVC pipe joints shall be of an integral bell and spigot of the same material as the pipe. It shall have a solid cross-section with rubber "O"-ring securely locked in place at the point of manufacture.

c. Force Main

PVC pipe shall be as manufactured in accordance with ASTM D-2241, latest edition, and shall be suitable for use as a sanitary sewer force main pipe. The standard dimension ratio (SDR) shall be 17, as shown on the Drawings.

d. Where PVC pipe is installed in iron pipe size (IPS), an IPS gasket shall be furnished with each fitting to insure compatibility.

5. Ductile Iron Sewer Pipe (DIP)

a. DIP shall be as manufactured in accordance with ASTM A 746, ANSI Specification A21.50 and A21.51, and shall be Class 350, unless otherwise indicated in the Specifications or on the Drawings.

b. The pipe interior shall be lined with epoxy or Protecto 401.

c. The exterior of all pipe shall be coated with either a coal or asphaltic base bituminous pipe coating in accordance with ANSI Specification A21.8.

d. Pipe shall be furnished with slip joints, mechanical joints, or flanged joints as indicated on the Drawings and in accordance with the Specifications described below:

3.03 PIPE BEDDING

A. All sewers shall be designed to prevent damage from superimposed loads. Proper allowance for loads on the sewer shall be made because of the width and depth of trench. Trench widths should be kept to a minimum. Backfill material up to three feet above the top of the pipe should not exceed 6 inches in diameter at its greater dimension.

B. The Division requires ductile iron pipe in roadways where cover is less than 4 feet. In such cases, a minimum cover of six inches is required. The Division requires ductile iron pipe or relocation when the top of the sewer is less than 18 inches below the bottom of a culvert or conduit.

C. Uncased borings are not permitted for pipe larger than 3 inches

D. Special care shall be used in placing bedding in the haunching region.

1. Rigid Pipe – Bedding Classes A, B, or C as described in ASTM C-12 or WPCF MOP No. 9 (ASCE MOP No. 37) shall be used for all rigid pipe, provided the proper strength pipe is used with the specified bedding to support the anticipated load. Bedding and backfill shall be placed as described in ASTM C-12.

2. Semi-Rigid Pipe – Bedding Classes I, II, III, or IV as described in ASTM D-2321 shall be used for all semi-rigid pipe provided with the

specified bedding to support the anticipated load. Underground installation of ABS composite pipe shall be in accordance with ASTM D-2680. Ductile iron shall be installed as per ASTM A-746.

3. Flexible Pipe – Bedding Classes I, II, III, or IV as described in ASTM D-2321shall be used for all flexible pipe provided, the proper strength pipe is used with the specified bedding to support the anticipated load. Bedding, haunching, initial backfill, and backfill shall be placed in accordance to ASTM D-2321. It is recommended that polyethylene pipe be installed in Class I bedding material for bedding, haunching, and initial backfill as described in 2.3.3.4.

4. Alternate Bedding Option - The Division will allow all sewers bedded and backfilled with a minimum of **12 inches** of Class I material over the top and below the invert of the pipe.

5. Deflection Testing – Deflection testing of all flexible pipe shall be required. The test shall be conducted after the backfill has been in place at least 24 hours. No pipe shall exceed a deflection of 5%. The test shall be run with a rigid ball or an engineer-approved 9-arm mandrel having a diameter equal to 95% of the inside diameter of the pipe. The test must be performed by manually pulling the test device through the line.

3.04 JOINTS

A. SLIP JOINTS

1. This pipe joint shall be done by guiding the plain end of the pipe into the bell end until contact is made with a gasket and by exerting a sufficient compressive force to drive the plain end through the gasket until the plain end makes full contact with the base of the bell.

   a. Bells of slip-joint pipe shall be contoured to receive a circular rubber gasket, and plain ends shall have a slight taper to facilitate installation.

   b. The circular gasket shall be furnished by the pipe Manufacturer and shall be manufactured in accordance with ANSI Specification A21.11.

   c. The pipe Manufacturer shall also furnish the lubricant used to assist in the pipe installation.

B. Mechanical Joints

1. This pipe joint is essentially the same as the slip joint except that it is furnished with a cast iron clamp that acts as a retainer to hold circular rubber gasket in place.

   a. All mechanical joints shall be furnished by the pipe manufacturer and manufactured in accordance with ANSI Specification A21.11.

   b. All bolts shall be tightened by means of torque wrenches in such a manner that the following shall be brought up toward the pipe evenly. If effective sealing is not obtained by tightening the bolts to the specified torques, the joint shall be disassembled and reassembled after thorough cleaning.

C. Flanged Joints

1. The flanged pipe joint is composed of a flat steel plate shop-fitted on the threaded end of the ductile iron pipe. The flanges shall be accurately faced at right angles to the pipe axis and shall be drilled smooth and true.

   a. Flanged joints shall be furnished with one hundred twenty-five pound (125 lb.) flanges drilled in accordance with ANSI Specification B16.1.

   b. In general, flanged joints shall be made up with through bolts of the required size. Stud or tap bolts shall be used only where shown or required.

   c. Gaskets for flanged joints shall be the ring type of cloth inserted rubber or rubber with a minimum thickness of one-eighth of an inch (1/8”).

   d. Connecting flanges shall be in proper alignment, and no external force shall be used to bring them together. Bolts and gaskets for joints connecting the piping with equipment and for joints between pipe and fittings shall be provided by Contractor, whether or not Contractor supplies such equipment and piping.

D. Restrained Joints

1. Restrained joints four inches (4”) and larger shall be EBAA Iron Megalug, without exception.

E. The method of making joints and the materials used should be included in the specifications. Sewer joints shall be designed to eliminate infiltration and to prevent the entrance of roots.

F. Elastomeric gaskets, other types of pre-molded (factory made) joints and ABS solvent-cement welded joints are required. The butt fusion joining technique is acceptable for polyethylene pipe. Cement mortar joints are not acceptable. Field solvent welds for PVC and PE pipe and fittings are not acceptable.

3.05 FITTINGS AND FLEXIBLE COUPLINGS

A. Whenever the sanitary sewer force main has a significant change in alignment or grade, it will be necessary to furnish and install a fitting made of cast/ductile iron that meets the Specifications below:

1. All cast iron and ductile iron fittings shall be mechanical joints manufactured in accordance with ANSI Specification A-21.1 and AWWA Standard C-153 for underground piping.

2. Where flanged pipe is used, ductile iron fittings shall be manufactured in accordance with AWWA C110 for exposed piping. All flanges shall be Class 125, unless otherwise noted.

3. The interior of the fittings shall be lined with epoxy or Protecto 401.

4. Whenever it becomes necessary to join gravity service connections of dissimilar materials or pipe sizes, Contractor shall be required to use a flexible coupling.

5. The coupling shall be made of PVC and shall not harden and shall be impervious to all known soil conditions.

6. The coupling shall provide a permanent, leakproof seal approved by the Southern Building Code Congress and manufactured in accordance with ASTM #C-594-70.

7. The coupling shall be Kor-N-Seal Connector Assembly as manufactured by NPC, Inc., or an approved equal.

3.06 VALVES

A. All valves shall be designed for a working pressure of two hundred (200) psi unless otherwise specified and shall have a clear waterway equal to

the full nominal diameter of the pipe and shall be opened by turning counterclockwise (left).

B. Each valve shall have the initials of the maker, pressure rating and year of manufacture cast on the body. Prior to shipment from the factory, each valve shall be tested by hydraulic pressure equal to twice the specified working pressure.

C. Valves shall be operated by handwheel or operating nut as herein specified and shall have an arrow cast in the metal indicating the direction of opening.

D. Valves to be installed underground shall be non-rising stem type while valves installed above ground or in buildings and structures shall have rising stems.

E. BALLCENTRIC PLUG VALVE

1. Plug valves shall be of the non-lubricating, eccentric type and shall be designed for a working pressure of 175 psi for valves 12” and smaller, 150 psi for valves 14” and larger. Valves shall provide tight shut-off at rated pressure. Valve shall be the Pratt Ballcentric Plug Valve, or equal approved by Erwin Utilities. Valves 12” and smaller shall have round port design. 14” and larger valves shall have a rectangular port design.

2. The plug valve body shall be cast iron ASTM A126 Class B with welded-in overlay of 90% nickel alloy content on all surfaces contacting the face of the plug. Sprayed, plated, nickel welded rings, or seats screwed into the body are not acceptable.

3. The valve plug shall be ductile iron ASTM A-536, Grade 65-45-12, in valve sizes up to 20”, and ASTM A126 Class B cast iron in sizes 24” and larger, with Buna N resilient seating surface to mate with the body seat.

4. Valve flanges shall be in strict accordance with ANSI B16.1, Class 125.

5. Plug valve shall be furnished with permanently lubricated sleeve type bearings conforming to AWWA C517. Bearings shall be of sintered, oil impregnated type 316 stainless steel ASTM A-743 Grade CF-8M or bronze ASTM B-127.

6. Valve shaft seals shall be of the “U” cup type, in accordance with AWWA C517. Seals shall be self-adjusting and repackable without moving the bonnet from the valve.

7. 6” and smaller exposed valves shall be provided with wrench actuators. 8” and larger exposed valves shall be provided with worm gear type manual actuators. All buried valves shall be provided with worm and gear actuators suited for the intended service. Valve actuators shall be fully grease packed and have stops in the open/close position. The actuator shall have a mechanical stop which will withstand an input torque of 450 lbs against the stop. The actuator shall be able to provide 1.25 times the required operating torque under full rated line pressure combined with a flow velocity of 8 feet per second.

F. BRONZE PLUG VALVES

1. Valves two inches (2”) and smaller shall be bronze plug valves built to Manufacturer's standards with material and construction conforming to AWWA C-500.

2. Each valve shall have a two-inch (2”) operating nut. Valves shall have screwed ends conforming to National Pipe Thread (NPT) standards.

G. SEWAGE AIR RELEASE VALVES

1. The air/vacuum release valve shall be designed specifically for use on sanitary sewer pressure (force) mains. It shall exhaust large volumes of air that may be present in a system during filling of the main or on pump start-up. It shall also allow air to re-enter when the system is drained intentionally or due to a break in the main (prevents vacuum from forming).

   a. The valve shall feature stainless steel trim as standard manufacture with stainless steel floats and Buna-N seating.

   b. Sewage air release valves shall be as manufactured by APCO or as approved by Erwin Utilities.

3.07 MANHOLES

A. Precast concrete manhole bases, risers, and cones shall conform to ASTM C-478, latest revision of “Precast Reinforced Concrete Manhole Sections.”

B. Tapered section and transition sections, where required, shall be of eccentric cone design, having the same wall thickness and reinforcement as the cylindrical ring sections.

C. Flat slab tops shall be required for very shallow manholes and where shown or specified. Cast iron manhole covers and assemblies shall be cast into slab tops for access into manholes.

D. Minimum compressive strength of concrete shall be four thousand (4,000) psi, and the maximum permissible absorption shall be six and one-half percent (6.5%).

E. Risers shall be reinforced with a single cage of steel placed within the center third of the wall. The tongue or the groove of the joint shall contain one (1) line of circumferential reinforcement equal in area to that in the barrel of the manhole riser. The minimum cross-sectional area of steel per linear foot shall be 0.12 square inches for larger sizes.

F. Precast manhole section shall fit together readily and shall have a self-contained “O”-ring rubber gasket conforming to ASTM C-443.

G. The manhole sections shall be perpendicular to their longitudinal axis within the limits listed in ASTM C 478.

H. The quality of materials, the process of manufacture, and the finished manhole sections shall be subject to inspection and approval by Erwin Utilities and their inspector.

I. FRAMES AND COVERS

1. Frames and covers shall be cast iron of superior quality, tough, and evenly textured.

2. The bearing surface between frame and cover shall be machined to prevent rocking and rattling.

3. Castings shall be gray iron conforming to ASTM A 48, size as indicated, free from blow holes, porosity, hard spots, shrinkage distortion, or other defects, well-cleaned, and coated with asphalt paint. This paint will result in a smooth coating, tough and tenacious when cold, not tacky and not brittle.

a. The standard manhole casting shall be designed for heavy duty use with a one hundred ninety pound (190 lb.) frame and one hundred twenty-five pound (125 lb.) cover.

b. Acceptable products include U.S. Bouchard 1155, Vulcan, Sigma, or approved equal.

c. Rain Guard or Rain Sentry waterproofing devices shall be installed only at those manholes indicated by Erwin Utilities.

d. The frame and cover shall be properly set in a bed of mortar and aligned to fit the top section of the manhole.

J. MANHOLE INVERTS AND BENCHES

1. Manhole inverts and benches shall be constructed in accordance with the Standard Details shown on the Drawings.

2. Invert shall be a “U”-shaped channel with a height of 0.8 of the diameter and be a smooth continuation of the pipe.

3. The benches shall be constructed with a slope of one inch (1”) per foot to the channel.

4. The channel and invert shall be constructed with a minimum of two thousand (2,000) psi concrete.

5. Where sewer changes directions at the manhole, channel shall be constructed with a smooth curve and as large a radius as the diameter of the manhole will allow.

K. Manhole Drops

1. Standard drop manholes will be constructed only at those locations shown on the Drawings or as approved by Erwin Utilities.

2. The design of the drop connection shall be in accordance with the Standard Detail Drawing.

3. The cost of the extra pipe, labor, etc., required to construct a drop manhole will be included in the unit price for the drop manhole at the depths listed.

4. Precast drop assemblies shall be utilized at all locations where drop manholes are required, unless the slope of the inlet pipe is steeper than recommended by the drop assembly Manufacturer.

L. Manhole Vents

1. Where designated on the Drawings, a four-inch (4") diameter vent pipe shall be installed as an integral part of the manhole.

2. The vent pipe is to be tapped in to the uppermost section of the manhole, anchored in concrete and extended vertically to the elevation shown on the Drawings.

3. The pipe shall have a reverse bend and screen to prohibit rain and foreign materials from entering pipe.

4. The pipe material shall be ductile iron coated with epoxy or Protecto 401.

M. Manhole Coatings

1. Interior - Precast manholes within six hundred feet (600') of a force main discharge point shall be lined with a protective coating. Manholes will also be lined if infiltration is observed. The coating shall contain a moisture barrier made of modified polymer, and surfacer made of polyurethane/polymeric blend foam, and a final corrosion barrier made of modified polymer. SpectraShield Liner Systems, or approved equal will be used.

2. Exterior - The exterior of all precast manholes shall be coated with a bituminous coating.

PART 4: EXECUTION

4.01 INSTALLATION

A. EXCAVATION

Excavation shall be done in strict accordance will the procedures detailed in Section 02220 – Excavation and Backfill.

1. Pipe Foundations

a. The preparation of the pipe bedding shall be in accordance with the typical trench cross-sections shown on the Plans for the type of pipe being installed.

b. If SDR 26 PVC sewer pipe is used, Contractor shall install six inches (6") of TDOT No. 57 crushed stone below the pipe, hand haunch No. 57 stone around the pipe, and install

six inches (6”) of No. 57 stone above the pipe, in accordance with the Standard Details.

c. The pipe foundation shall be prepared to be uniformly firm and shall be true to the lines and grades as shown on the Plans. Any deviation or field adjustment will require the approval of Erwin Utilities. When a representative of Erwin Utilities is present on the site and is so requested by the Contractor, he may check the position of grades and lines, but the Contractor shall be responsible for the finished work conforming to exact and proper line and grade.

d. Whenever the nature of the ground will permit, the excavations at the bottom of the trench shall have the shape and dimensions of the outside lower third of the circumference of the pipe, and care shall be taken to secure a firm bearing support uniformly throughout the length of the pipe. A space shall be excavated under and around each bell to sufficient depth to relieve it of any load and to allow ample space for filling and finishing the joint. The pipe, when bedded firmly, shall be on the exact grade.

e. In case the bed shaped in the bottom of the trench is too low, the pipe shall be completely removed from position, and earth of suitable quality shall be placed and thoroughly tamped to prepare a new foundation for the pipe. In no case shall the pipe be brought to grade by blocking up under the barrel or bell of same, but a new and uniform support must be provided for the full length of the pipe.

f. Where rock or boulders are encountered in the bottom of the trench, the same shall be removed to such depth that no part of the pipe, when laid to grade, will be closer to the rock or boulders than six inches (6”). A suitably tamped and shaped foundation of approved material shall be placed to bring the bottom of the trench to proper subgrade over rock or boulders.

g. Whenever the bottom of the trench shall be of such nature as to provide unsatisfactory foundation for the pipe, Erwin Utilities will require the pipe to be laid on a flowable fill or concrete cradle foundation. Such foundations, whether washed stone or a poured concrete cradle, shall be placed by the Contractor.

h. The Contractor shall remove all water that may be encountered or that may accumulate in the trenches by pumping or bailing, and no pipes shall be laid until the water has been removed from the trench. Water so removed from the trench must be disposed of in such a manner as not to cause damage to work completed or in progress.

B. INSTALLING PIPE AND APPURTENANCES

1. Laying Pipe

a. The layout of gravity sanitary sewer lines and invert elevations at governing points are as shown on the Drawings.

b. The Contractor shall do all layout work for lines and grades from that information shown on the Drawings.

c. A laser beam instrument shall be used to set line and grade. The unit must be maintained in good working order, and the calibration checked daily for both alignment and percent grade twice a day at temperatures above 90º F.

d. Pipe shall be laid with bell ends facing in the direction of pipe laying (opposite the direction of flow), unless directed otherwise by Erwin Utilities. In all cases, pipe is to be installed in strict accordance with the Manufacturer's recommendations and the contract material specifications. Erwin Utilities may augment any Manufacturer's installation recommendations if it will best serve the interest of Erwin Utilities.

e. Proper tools, implements, and facilities satisfactory to Erwin Utilities shall be provided and used for the safe and convenient execution of pipe laying. All pipe and other materials used in the laying of pipe will be lowered into the trench piece by piece by means of suitable equipment in such a manner to prevent damage to the pipe, materials, to the protective coating on the pipe materials, and to provide a safe working condition to all personnel in the trench. Each piece of pipe being lowered into the trench shall be clean, sound, and free from defects. It shall be laid on the prepared foundation, as specified elsewhere, to produce a straight line on a uniform grade, each pipe being laid so as to form a smooth and straight inside flow line. Pipe shall be

removed at any time if broken, injured, or displaced in the process of pipe laying or of backfilling the trench.

f. When cutting short lengths of pipe, a pipe cutter, as approved by Erwin Utilities, will be used, and care shall be taken to make the cut at right angles to the centerline of the pipe or on the exact skew as shown on the Plans. In the case of push-on pipe, the cut ends shall be tapered with a portable grinder or coarse file to match the manufactured taper.

g. During times when pipe laying is not in progress, the open ends of pipe shall be closed, and no trench water or other material shall be permitted to enter the pipe.

h. Where the pipe is laid on a grade of ten percent (10%) or greater, the laying shall start at the bottom of the slope and proceed upward with the bell end of the new pipe upgrade. All pipe laid on a grade of twenty percent (20%) or greater shall require thrust blocking or keying as shown on the Drawings and Standard Details.

i. All gravity sewer shall have a minimum of twelve inches (12”) of vertical separation from the storm sewer; a minimum of ten feet (10’-0”) of horizontal separation from water main; or eighteen inches (18”) of vertical separation with the sewer line passing below the bottom of the water main. In the event that these separations cannot be met, sanitary sewer and the water main shall both be constructed of ductile iron pipe or be encased in steel casing. Ductile Iron Pipe or Encasement shall be extended a minimum of 10 feet (10’) beyond the utility crossing. In addition, all gravity sewer shall have a minimum of one hundred feet (100’-0”) of horizontal separation from wells or other water supplies.

2. Installing Manholes

a. Sanitary sewer manholes shall be installed at each break in line or grade in each sanitary sewer line as shown on the Drawings, not exceeding three hundred feet (300’) apart.

b. The manhole foundation shall be prepared so as to provide a firm, level area on which to place the precast concrete manhole base section. When poor foundation soil is encountered or excess groundwater exists, the foundation shall be excavated twelve inches (12”) below the final

subgrade elevation and backfilled with a minimum of twelve inches (12”) of #57 stone to provide a proper foundation.

c. The manhole sections shall be lifted from the side of the excavation to the bottom of the trench with equipment and support slings capable of safely handling the heavy concrete pieces. The manhole shall be set plumb.

d. Pipe openings shall be exactly aligned to that of the pipe entering and leaving the manhole. The gravity sanitary sewer pipe lines shall be placed in the manhole openings, properly aligned, and set to grade. Sanitary sewer shall be connected to the manholes using a watertight lock joint flexible manhole sleeves or equal.

e. For manhole steps, inverts, drops, vents, and coatings, refer to the precast manhole section above.

g. Manhole frame and cover shall be properly set in a bed of concrete and riser rings and ram neck aligned to fit to adjust the top of the frame and cover to finished grade.

3. Fittings (Force Main)

a. Thrust Blocks

i. All plugs, caps, tees, bends, and other fittings shall be provided with adequate thrust blocks.

ii. Thrust blocks shall be constructed to the minimum dimensions shown on the Drawings or as directed.

iii. Thrust blocks shall be made of concrete and shall bear directly against the undisturbed trench wall. Concrete for thrust blocks shall consist of a mix of Portland Cement, fine and coarse aggregate, and water to produce concrete with a minimum compressive strength at twenty-eight (28) days of not less than three thousand (3,000) psi when tested in accordance with ASTM Specifications C 39 or C 42. Sakrete or any similar material will not be permitted under any circumstances.

iv. Where possible, the backing shall be so placed that the fitting joints will be accessible for repair.

v. All bolts and pipe joints shall be protected against contact with thrust block concrete by the installation of a polyethylene film placed between the fittings and the poured concrete.

vi. Where any section of a main is provided with concrete thrust blocks, the hydrostatic pressure test shall not be made until three (3) days after installation of the concrete thrust blocks, unless otherwise approved by Erwin Utilities.

b. Where trench conditions are, in the opinion of Erwin Utilities, unsuitable for thrust blocks, the Contractor shall provide steel tie rods and socket clamps to adequately anchor the piping. All tie rods and clamps shall be given a bituminous protective coating or shall be galvanized.

4. Ballcentric Plug Valve and Valve Box (Force Main)

a. When shown on the Drawings, a standard ballcentric plug valve shall be installed in the sanitary sewer force main. Before setting each valve, the Contractor shall make sure the interior is clean and shall test the valve for proper opening and closing. Valves shall be set with stems plumb, unless horizontal installation is called for on the Drawings, and at the exact location(s) shown on the Drawings.

b. A standard type traffic rated valve box shall be installed over each underground sanitary sewer force main valve. All valve boxes shall be set plumb with their top set flush with the finished grade.

c. Trench backfill shall be properly tamped for a distance of three feet (3’-0”) on each side of the valve and valve box.

5. Sewage Combination Air Release Valve (Force Main)

a. If necessary, a sanitary sewage combination air release valve shall be installed at the locations shown on the Drawings and relocated to the actual high points in the line.

b. A combination air release valve installation, as shown in detail in the Drawings, shall consist of the force main tap, air release valve, and two-inch (2”) meter box with cast iron lid (painted green with epoxy paint, as specified below).

6. Exposed Pipe

a. Exposed pipe to be installed inside tank wetwells, vaults, and buildings shall be installed as shown on the Drawings and field painted as described below. All exposed DIP shall utilize flanged joints unless otherwise noted.

b. All exposed cast or ductile iron pipe, fittings, and valves shall be field painted with two (2) coats of epoxy paint as recommended by the paint Manufacturer. Color of paint shall be selected by Erwin Utilities.

C. BACKFILLING AND COMPACTION

All backfilling and compaction shall be done in strict accordance with the procedures outlined in Section 02220 – Excavation and Backfill.

4.02 QUALITY CONTROL

A. TESTING

1. Inspection and Testing (Gravity Sewer)

a. No testing shall be performed until the pipe has been laid and backfilled for thirty (30) days and cleaning and video inspection is completed.

b. PVC pipe shall pass a go/no go Mandrel sized to ninety-five percent (95%) of the pipe diameter with the pipe in place and properly backfilled.

i. The Mandrel size shall be based upon the maximum possible inside diameter for the type of pipe being tested, taking into account the allowable manufacturing tolerances of the pipe.

ii. The Mandrel shall have an odd number of legs, or vanes, with a quantity of such equal to or greater than nine (9). The legs of the Mandrel shall be permanently attached to the Mandrel.

iii The Mandrel shall be constructed of steel, aluminum, or other material approved by Erwin Utilities, and shall have sufficient rigidity so the legs of the Mandrel will not deform when pulling through a pipe.

iv. A Mandrel with variable sizes shall not be allowed. The Mandrel dimensions shall be checked by Erwin Utilities before use by the Contractor.

v. The allowable deflection shall be as shown in the table below and shall be calculated using the pipe stiffness formula in ASTM D 2321.

Nominal Pipe Diameter	Maximum Allowable Deflection
< 12-inches	5%
15 to 30-inches	4%
> 30-inches	3%

vi. Failure of any section of the pipeline to meet the requirements of this test shall cause the Contractor to determine, at his own expense, the source(s) of deformity, excavate, and repair or replace all defective materials or workmanship, and repeat all testing until results are satisfactory.

c. When the sewers are completed, they shall be inspected by Erwin Utilities for conformance with the provisions of the Plans and Specifications, particularly line and grade, and tested to determine the amount of ground water infiltration into the sewer. All visible and audible leaks will be stopped.

d. Leakage testing - Low pressure air-testing for all pipe shall be performed as per ASTM C-828. The time required for the pressure to drop from the 3.5 psig to 2.5 psig should be greater than or equal to the minimum calculated test time (The test criteria should be based on the air loss rate. The testing method should take into consideration the range in groundwater elevations projected and the situation during the test. The height of the groundwater should be measured from the top of the invert (one foot of H2O = 0.433 psi)). The table below shows the minimum test times and allowable air loss values for various pipe size per 100 ft:

Pipe Size (inches)	Time, T (sec/100 ft)	Allowable Air Loss, Q (ft^3/min)
6	42	2.0
8	72	2.0
10	90	2.5
12	108	3.0
15	126	4.0
18	144	5.0
21	180	5.5
24	216	6.0
27	252	6.5
30	288	7.0

i. All branch fittings and ends of lateral stubs shall be securely plugged at each manhole. All stoppers shall be adequately braced when required.

ii. Air shall be slowly supplied into the plugged pipe line until the internal air pressure reaches 4.0 pounds per square inch or 4.0 pounds per square inch greater than the average back pressure of any ground water that may submerge the pipe. At least two minutes shall be allowed for temperature stabilization before proceeding further.

iii. Calculate the pressure drop as the number of minutes for the air pressure within the pipeline to drop from a stabilized pressure of 3.5 to 2.5 psig.

iv. The time allowed for mixed pipe sizes of varying lengths should be calculated as described in ASTM C828-76T.

v. If the test fails, the Contractor will be required to locate the cause of the failure, make necessary repairs, and repeat all testing of the line until the test is passed. If required by Erwin Utilities, the Contractor shall repeat video inspection of any sections of the pipeline that have failed a portion of the testing.

2. Inspection and Testing (Force Main)

a. When the sanitary sewer force main is completed, Erwin Utilities shall inspect the line for conformance with the

provisions of the Plans and Specifications, particularly with respect to alignment and depth.

b. All newly constructed sanitary sewer force main and valved sections shall be subjected to a hydrostatic pressure-leakage test. Force mains shall be tested in sections not to exceed two thousand linear feet (2,000 LF) per test section. At no expense to Erwin Utilities, the Contractor shall install sufficient additional valves, if not shown on the Drawings, to allow testing.

c. Hydrostatic Testing Procedure

As a minimum, all sewer force mains shall be tested in accordance with the Hydrostatic Testing Requirements of AWWA C600.

After pipe has been laid and backfilled, all newly laid pipe or any valve section thereof shall be subject to a hydrostatic pressure of not less than 150 psi or 1-1/2 times the working pressure, whichever is greater. The duration of the pressure test shall be two hours. Each valve section of the pipe shall be slowly filled with water. All air shall be expelled from the pipe while the pipe is being filled and before the application of the specified test pressure. Taps may be required at points of highest elevation. These taps are to be tightly plugged after completion of the test.

The test pressure shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Design Engineer. The pump, pump connections, gauges, and all necessary apparatus and labor shall be furnished by the Contractor. The Contractor shall calibrate the gauges in the presence of the Design Engineer.

A test shall be made only after a part or all of the backfilling has been completed and at least 36 hours after the last concrete thrust block has been cast with high-early strength cement or at least seven (7) days after the last thrust block has been cast using standard cement.

Any cracked or defective pipes, fittings, or valves discovered during hydrostatic pressure tests shall be removed and replaced with sound material and the test repeated until satisfactory to the Design Engineer. No payment shall be

made for the removal and replacement of defective pipes and appurtenances.

Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain pressure within 5 psi of the specified test pressure. Leakage shall not be measured by a drop in pressure in a test section over a period of time.

Testing shall be conducted in accordance with Chapter 2 of the Tennessee Design Criteria. The Division requires testing, before backfilling, of all force mains at a minimum pressure of at least 50 percent above the design operating pressure for at least 30 minutes. Leakage should not exceed the amount given by the following formula: January 2016 2-26 Design Criteria Ch. 2

L = ND (P).5 /7,400
Where **L** is allowable leakage in gallons per hour
N is the number of pipe joints
D is the pipe diameter in inches
P is the test pressure in psi

The Contractor shall notify Erwin Utilities when the work is ready for testing, and all testing shall be done in the presence of a representative of Erwin Utilities. All labor, equipment, water, and materials, including meters and gauges, shall be furnished by the Contractor at his own expense.

3. Inspection and Testing (Manholes)

a. Manholes shall be constructed to provide a true circular inside diameter with properly corbeled tops, satisfactory inverts, and properly placed steps and castings. Any visible leaks in the manholes shall be completely stopped to the satisfaction of Erwin Utilities.

b. Vacuum Testing of Manholes

Prior to testing concrete manholes for airtightness, all liftholes, joints between precast sections, and pipe openings shall be plugged and the appropriate coating applied. Each manhole shall pass the following test:

i. A vacuum of ten (10) inches of Hg shall be drawn on the manhole, the vacuum pump shut off, and the appropriate valves closed.

ii. The following table shows duration times for the test to be held according to depth. NO LEAKAGE IS PERMITTED.

Depth of Manhole (feet)	Minimum Test Time (minutes)
0 – 8	1:00
8 – 10	1:15
10 – 12	1:30
12 – 14	1:45
14 – 16	2:00
Each additional 2 feet	Add 0:15

c. If the manhole fails the initial test, necessary repairs shall be made or the manhole shall be replaced, as directed by Erwin Utilities, and the manhole shall be retested until it passes. A significant number of leaks on a single manhole or a significant number of manholes leaking shall be considered as a basis for rejection and replacement of manholes. This shall be done at the Contractor's expense.

B. FINAL ACCEPTANCE

1. Erwin Utilities will notify the Contractor, in writing, as to the satisfactory completion of the work in any or all sections of gravity sanitary sewer pipe, force main, and manholes included in the project.

2. Upon such notification, the Contractor shall immediately remove all construction equipment, excess materials, tools, debris, etc., from the site(s) and leave the same in a neat, orderly condition acceptable to Erwin Utilities.

3. Final landscaping requirements and restoration of surfaces shall then be completed by the Contractor in accordance with their respective Specifications and as shown on the Drawings.

END OF SECTION

SECTION 02731 SANITARY SEWER SERVICE CONNECTION

PART 1: GENERAL

1.01 SCOPE OF WORK

The work covered under this Section shall consist of furnishing all materials, labor, equipment, and services for the complete installation of a sanitary sewer service connection from the sanitary sewer (gravity) main line to the edge of the property to be served as shown on the project Drawings.

PART 2: PRODUCTS

2.01 MATERIALS

A. Main line connections shall use a wye branch constructed by the same material as the main line.

B. Sewer service lines shall be constructed of either SDR 35 PVC or ductile iron (Class 350) as shown on the Plans. Ductile iron shall be lined with epoxy or Protecto 401.

C. When joining pipes of different materials, a flexible, watertight, rubber transition coupling shall be used.

PART 3: EXECUTION

3.01 INSTALLATION

A. CONNECTION TO MAIN

1. The standard sewer service connection shall be four inches (4") in diameter unless shown otherwise on the Drawings and shall connect to the main at a wye branch connection installed with the pipe line as it is being laid. The wye branch shall be of the same material as the main pipe line.

2. Direct taps into the sewer main will not be acceptable unless approved by Erwin Utilities prior to the laying of the main line.

B. CONNECTION TO MANHOLE

Unless specifically approved by the Erwin Utilities, no sewer service connections shall be made into a manhole.

C. SERVICE LINES

1. The service line shall be installed from the wye branch connection to the edge of the public or utility right-of-way as shown on the Drawings.

2. Less than three feet (3'-0") of cover shall require the use of ductile iron pipe.

D. CLEANOUT AND PLUG

At the edge of the public or utility right-of-way, a cleanout shall be installed. A watertight plug shall be installed at the end of this line until such time as Erwin Utilities directs the Contractor to connect his facilities to the Sewer System.

END OF SECTION

(see attached "Instructions for Installation of Sewer Service Lines")

ERWIN UTILITIES
WASTEWATER DEPARTMENT

INSTRUCTIONS FOR INSTALLATION OF SEWER SERVICE LINES

1. Applicant for sewer service must first make application, pay tapping fee and/or inspection fee in person at the office of Erwin Utilities.

2. Schedule a pre-construction visit with your contractor and Erwin Utilities' Engineering Department **prior** to installation of your sewer service line.

3. Sewer tap must be installed by Erwin Utilities before any portion of the sewer service line is installed.

4. **GLUE JOINT PIPE CANNOT BE USED.**

5. Materials that can be used are as follows:

   A. The sewer service line shall be constructed of four (4) inch PVC SDR 35 "O" ring slip joint pipe and shall be properly bedded per the attached drawing.

   B. All fittings (bends, wyes, and tees) shall be constructed of PVC SDR 35 "O" ring slip joint fittings.

6. A four (4) inch cleanout must be installed approximately five (5) feet from the building, at each bend (change of direction), and at no distance greater that 75 feet apart. (See attached drawing.)

7. Separate sewer service line and any water service line at least ten (10) feet horizontally.

8. **DO NOT COVER SEWER SERVICE LINE.**

   Ditch must be left open for inspection by Erwin Utilities before any portion of the pipe is covered.

For pre-construction scheduling, inspections, or questions, call:

Erwin Utilities' Engineering Department
743-1844

SECTION 02740 LOW PRESSURE SEWER SYSTEM

PART 1: GENERAL

1.01 SCOPE OF WORK

The work covered by this Section shall consist of furnishing all materials, labor, equipment, and services for the installation of a low pressure sewer system. The Contractor shall be responsible for the satisfactory operation of the entire system.

1.02 SUBMITTALS

The Contractor shall provide a minimum of five (5) sets of shop drawings detailing the equipment to be furnished, including dimensional data and materials of construction. Erwin Utilities shall endeavor to promptly review this data and shall return two (2) copies as accepted or pending requested modifications.

1.03 MANUFACTURER

Grinder pump stations, complete with all appurtenances, shall be supplied by Environment-One Corporation (E-One).

A. The Manufacturer shall:

1. Provide detailed installation and user instructions for its product;

2. Submit evidence of an established service program, including complete parts and service manuals;

3. Maintain a continuing inventory of grinder pump replacement parts; and

4. Provide a reference and contact list of ten (10) of its largest contiguous grinder pump installations of the type specified herein that have been in operation for at least ten (10) years.

1.04 OPERATING CONDITIONS

The pumps shall be capable of delivering fourteen (14) gpm against a rated total dynamic head of zero (0) feet (0 psig) and eight (8) gpm against a rated total dynamic head of one hundred eighty-five (185) feet (80 psig). The pump(s) must also be capable of operating at negative total dynamic head without overloading the motor(s). Under no conditions shall in-line piping or valving be allowed to create a false apparent head.

1.05. WARRANTY

The grinder pump Manufacturer shall provide a part(s) and labor warranty on the complete station and accessories, including, but not limited to, panel and redundant check valve for a period of sixty (60) months after notice of acceptance by Erwin Utilities, but no greater than sixty-three (63) months after receipt of shipment. Any manufacturing defects found during the warranty period will be reported to the Manufacturer by Erwin Utilities and shall be corrected by the Manufacturer at no cost to Erwin Utilities.

PART 2: PRODUCTS

2.01 PUMP

A. The pump shall be a custom-designed, integral, vertical rotor, motor-driven, solids-handling pump of the progressing-cavity type with a single mechanical seal.

B. The rotor shall be constructed of stainless steel. Plating on the rotor will not be acceptable due to its tendency to delaminate.

C. The stator shall be of a specifically compounded ethylene-propylene synthetic elastomer. The material shall be suitable for domestic wastewater service. Its physical properties shall include high tear and abrasion resistance, grease resistance, water and detergent resistance, temperature stability, excellent aging properties, and outstanding wear resistance. Buna-N is not acceptable as a stator material because it does not exhibit the properties as outlined above and required for wastewater service.

2.02 GRINDER

A. The grinder shall be placed immediately below the pumping elements and shall be direct-driven by a single, one-piece motor shaft.

B. The grinder impeller assembly shall be securely fastened to the pump motor shaft by means of a threaded connection attaching the grinder impeller to the motor shaft. Attachment by means of pins or keys will not be acceptable.

C. The grinder shall be of the rotating type with a stationary hardened and ground stainless steel shredding ring spaced in close annular alignment with the driven impeller assembly, which shall carry two (2) hardened-type 400 series stainless steel cutter bars. This assembly shall be dynamically balanced and operate without objectionable noise or vibration over the entire range of recommended operating pressures.

D. The grinder shall be constructed so as to eliminate clogging and jamming under all normal operating conditions, including starting.

E. Sufficient vortex action shall be created to scour the tank free of deposits or sludge banks that would impair the operation of the pump.

F. The grinder shall be capable of reducing all components in normal domestic sewage, including a reasonable amount of "foreign objects," such as paper, wood, plastic, glass, rubber, and the like, to finely divided particles that will pass freely through the passages of the pump and the one and one quarter inch (1-¼") diameter discharge. These requirements shall be accomplished by the following, in conjunction with the pump:

1. The grinder shall be positioned in such a way that solids are fed in an upward flow direction.

2. The maximum flow rate through the cutting mechanism must not exceed four feet (4') per second; this critical design element will prevent jamming.

3 The inlet shroud shall have a diameter of no less than five inches (5"). Inlet shrouds that are less than five inches (5") in diameter will not be accepted due to their inability to

maintain the specified four feet (4') per second maximum inlet velocity.

4 The impeller mechanism must rotate at a nominal speed of no greater than 1,800 rpm.

2.03 ELECTRIC MOTOR

A. As a maximum, the motor shall be a one (1) horsepower (hp), 1,725 rpm, 240 volt (V), 60 hertz (Hz), single-phase, capacitor start, ball bearing, air-cooled induction type with a low starting current not to exceed 30 amperes (A) and a high starting torque of 8.4 pound-feet (lb-ft).

B. Conditions for the pump motor shall be provided by the use of an automatic-reset, integral thermal overload protector incorporated into the motor. This motor protector combination shall have been specifically investigated and listed by Underwriters Laboratories, Inc., (UL) for the application.

C. Non-capacitor start motors or permanent split capacitor motors will not be accepted because of their reduced starting torque and consequent diminished grinding capability.

D. To reduce the potential of environmental concerns, the expense of handling and disposing of oil, and the associated maintenance costs, oil-filled motors will not be accepted.

2.04 MECHANICAL SEAL

The pump core shall be provided with a mechanical shaft seal to prevent leakage between the motor and pump. The seal shall have a stationary ceramic seat and carbon rotating surface with precision-lapped and held in position by a stainless steel spring.

2.05 TANK

A. The tank shall be made of high density polyethylene, with a melt index of 2.0 grams/10 minutes or lower to assure high environmental stress cracking resistance. Corrugated sections are to be made of a double wall construction with the internal wall being generally smooth to promote scouring. Corrugations of the outside wall are to be of a minimum amplitude of 1 1/2" to provide necessary transverse stiffness. Any incidental sections of a single wall construction are to be a minimum 0.250 inch thick. All seams

created during tank construction are to be thermally welded and factory tested for leak tightness. Tank wall and bottom must withstand the pressure exerted by saturated soil loading at maximum burial depth. All station components must function normally when exposed to 150 percent of the maximum external soil and hydrostatic pressure.

B. The tank shall be furnished with one EPDM grommet fitting to accept a 4.50" OD DWV or Schedule 40 pipe. Tank capacities shall be as shown on the contract drawings.

C. The accessway shall be an integral extension of the wet well assembly and include a lockable cover assembly providing low profile mounting and watertight capability. Accessway design and construction shall enable field adjustment of station height in increments of 4" or less without the use of any adhesives or sealants requiring cure time before installation can be completed.

D. The station shall have all necessary penetrations molded in and factory sealed. To ensure a leak free installation no field penetrations shall be acceptable.

E. All discharge piping shall be constructed of 304 Series Stainless Steel and terminate outside the accessway bulkhead with a stainless steel, 1 1/4 inch female NPT fitting. The discharge piping shall include a stainless steel ball valve rated for 200 psi water, oil, or gas (WOG); PVC ball valves will not be accepted. The bulkhead penetration shall be factory installed and warranted by the manufacturer to be watertight.

F. The accessway shall include a single NEMA 6P electrical quick disconnect (EQD) for all power and control functions, factory installed with accessway penetrations warranted by the manufacturer to be watertight. Plug-type connections of the power cable onto the pump housing will not be acceptable due to the potential for leaks and electrical shorts. The accessway shall also include a 2-inch PVC vent to prevent sewage gases from accumulating in the tank.

2.06 DISCHARGE HOSE AND DISCONNECT/VALVE

A. All discharge fittings and piping shall be constructed of 304 Series stainless steel.

B. The discharge hose assembly shall include a shut-off valve rated for two hundred (200) psi water, oil, or gas (WOG), a flexible coupling, and a quick disconnect feature to simplify installation and pump removal.

C. The bulkhead penetration shall be factory-installed and warranted by the Manufacturer to be watertight.

2.07 ELECTRICAL QUICK DISCONNECT

A. The grinder pump unit shall include a single NEMA 6P EQD for all power and control functions. J-box type disconnects will not be accepted due to their tendency to leak and inherent issues associated with J-box serviceability.

B. An integral tube shall allow venting of the control compartment to ensure proper operation of the pressure switch level system.

C. The grinder pump will be furnished with a length of 6-conductor, 14-gauge, type SJOW, electrical supply cable (ESC), pre-wired and watertight to meet UL requirements.

2.08 ANTI-SIPHON VALVE

The pump discharge shall be equipped with a factory-installed, gravity-operated, flapper-type integral anti-siphon valve built into the discharge assembly.

A. Moving parts will be made of 300 series stainless steel and fabric-reinforced synthetic elastomer to ensure corrosion resistance, dimensional stability, and fatigue strength.

B. A nonmetallic hinge shall be an integral part of the flapper assembly, providing a maximum degree of freedom to ensure proper operation even at a very low pressure.

C. The valve body shall be injection-molded from a glass-filled thermoplastic resin.

D. Holes or ports in the discharge piping are not acceptable anti-siphon devices, due to their tendency to clog from the solids in the slurry being pumped.

2.09 CHECK VALVE

The pump discharge shall be equipped with a factory installed, gravity operated, flapper-type integral check valve built into the discharge assembly.

A. The check valve will provide a full-ported passageway when open, and shall introduce a friction loss of less than six inches (6") of water at maximum rated flow.

B. Moving parts will be made of a 300 series stainless steel and fabric reinforced synthetic elastomer to ensure corrosion resistance, dimensional stability, and fatigue strength.

C. A nonmetallic hinge shall be an integral part of the flapper assembly, providing a maximum degree of freedom to ensure seating even at a very low back pressure.

D. The valve body shall be an injection molded part made of glass-filled PVC. The valve shall have a minimum working pressure of at least 225 psi.

E. Ball-type check valves are unacceptable due to their limited sealing capacity in slurry applications.

F. Each grinder pump installation shall also include one (1) separate check valve of the type detailed in this section for installation in the one and one quarter-inch (1¼") service lateral between the grinder pump station and the sewer main, preferably next to the curb stop.

2.10 CORE UNIT

A. The grinder pump station shall have an easily removable core assembly containing pump, motor, grinder, all motor controls, check valve, anti-siphon valve, EQD level controls, and wiring.

B. The pump core shall be suitably mounted on an integral stand of stainless steel with stainless steel quick release latch assembly.

C. The watertight integrity of the core unit shall be established by one hundred percent (100%) factory test at a minimum of five (5) pounds per square inch, gauge (psig).

2.11 CONTROLS

A. All necessary controls, including cast iron motor and high impact thermoplastic co-polymer level controls, shall be located in the top

housing of the core unit. The top housing will be attached with stainless steel fasteners.

B. Non-fouling wastewater level controls for controlling pump operation shall be accomplished by monitoring the pressure changes in an integral air column connected to a pressure switch. High-level sensing will be accomplished in the manner detailed above by a separate air-bell sensor and pressure switch of the same type.

C. The level detection device shall have no moving parts in direct contact with the wastewater.

D. Closure of the high-level sensing device will energize an alarm circuit as well as a redundant pump-on circuit.

E. For increased reliability, pump power and high-level alarm functions shall not be controlled by the same switch. Float switches of any kind, including float trees, will not be accepted due to the periodic need to maintain (rinsing, cleaning) such devices.

F. To ensure reliable operation of the pressure switches, each core shall be equipped with a breather assembly, complete with a suitable means to prevent accidental entry of water into the motor compartment.

G. The grinder pump will be furnished with a 6-conductor, 14-gauge, type SJOW cable, pre-wired and watertight to meet UL requirements with a factory-installed NEMA 6P EQD half attached to it.

2.12 ALARM PANEL

Each grinder pump station shall include a NEMA 4X, UL-listed alarm panel suitable for wall mounting.

A. The NEMA 4X enclosure shall be manufactured of thermoplastic to assure corrosion resistance. The enclosure shall include a hinged, lockable cover, pad lock, and secured dead front. The enclosure shall not exceed 11.38” wide x 13.5” high x 5.63” deep.

B. For each core, the panel shall contain one (1) 15-A, double-pole circuit breaker for the power circuit and one (1) 15-A, single-pole circuit breaker for the alarm circuit. The panel shall contain terminal blocks, integral power bus, and a complete alarm circuit.

C. The alarm panel shall include the following features: audio and visual alarm, push-to-run switch, and high level (redundant) pump starting control. The visual alarm lamp shall be inside a red fluted lens at least 2-5/8” in diameter and 1-11/16” in height. Visual alarm shall be mounted to the top of the enclosure in such a manner as to maintain NEMA 4X rating.

D. The audio alarm shall be a printed circuit board in conjunction with an eighty-six (86) decibel (dB) buzzer with quick mounting terminal strip mounted in the interior of the enclosure. The audio alarm shall be capable of being deactivated by depressing a push-type switch encapsulated in a weatherproof silicone boot and mounted on the bottom of the enclosure.

E. The entire alarm panel shall be UL-listed.

F. The alarm sequence is to be as follows:

1. When liquid level in the sewage wetwell rises above the alarm level, visual and audio alarms will be activated. The contacts on the alarm pressure switch will close. The redundant pump starting system will be energized.

2. The audio alarm may be silenced by means of the externally mounted, push-to-silence button.

3. Visual alarm remains illuminated until the sewage level in the wetwell drops below the “off” setting of the alarm pressure switch.

2.13 SERVICEABILITY

A. The grinder pump core unit shall have two (2) lifting hooks, complete with nylon lift-out harness, to facilitate easy core removal when necessary.

B. All mechanical and electrical connections must provide easy disconnect capability for core unit removal and installation.

C. A push-to-run feature will be provided for field trouble shooting.

D. All motor control components shall be mounted on a readily replaceable bracket for ease of field service.

2.14 OSHA CONFINED SPACE

All maintenance tasks for the grinder pump station must be possible without entry into the grinder pump station as per OSHA 1910.146, “Permit-Required Confined Spaces.”

2.15 SAFETY

A. The grinder pump shall be free from electrical and fire hazards as required in a residential environment. As evidence of compliance with this requirement, the completely assembled and wired grinder pump station in its tank shall be UL-listed to be safe and appropriate for the intended use. UL listing of components of the station or third-party testing to UL standards will not be accepted.

B. The grinder pump shall meet accepted standards for plumbing equipment for use in or near residences; shall be free from objectionable noise, odor, or health hazards; and shall have been tested by an independent laboratory to certify its capability to perform as specified in either individual or low pressure sewer system applications. As evidence of compliance with this requirement, the grinder pump shall bear the National Sanitation Foundation (NSF) seal. Third-party testing to NSF standards will not be accepted.

PART 3: EXECUTION

3.01 FACTORY TESTING

A. Each grinder pump shall be submerged and operated for a minimum of five (5) minutes. Included in this procedure will be the testing of all ancillary components such as the anti-siphon valve, check valve, discharge line, and each unit's dedicated level and motor controls. All factory tests shall incorporate each of the above listed items.

B. Actual appurtenances and controls that will be installed in the field shall be particular to the tested pump only. A common set of appurtenances and controls for all pumps will not be acceptable.

C. The Manufacturer shall provide the Erwin Utilities with certified test results showing the operation of each grinder pump at two (2) different points on its curve, with the maximum pressure no less than sixty (60) psi. Erwin Utilities reserves the right to inspect such testing procedures at the grinder pump Manufacturer's facility.

D. Completed basins shall be factory leak tested to assure the integrity of all joints, seams, and penetrations.

3.02 DELIVERY

A. All grinder pump units shall be delivered to the job site one hundred percent (100%) completely assembled, tested, and ready for installation.

B. Grinder pump stations will be individually mounted on wooden pallets.

C. Grinder pump cores will be shipped in a separate container and are only required to be installed in the basin.

3.03 INSTALLATION

A. The Contractor shall be responsible for handling groundwater to provide a firm, dry subgrade for the structure and shall guard against flotation or other damage resulting from general groundwater or flooding.

B. The grinder pump stations shall not be set into the excavation until the installation procedures and excavation have been approved by Erwin Utilities.

C. Remove packing material. User's instructions shall be given to the Erwin Utilities. Hardware supplied with the unit, if required, shall be

used at installation. The basin will be supplied with a standard field-installed four-inch (4”) inlet grommet (fiberglass tank) or flange (for high-density polyethylene tank); both will accept a 4.50” outside diameter drain, waste, and vent (DWV) pipe for connecting the incoming sewer line. Appropriate inlet piping must be used. The basin may not be dropped, rolled, or laid on its side for any reason.

D. Installation shall be accomplished so that one to four inches (1”-4”) of access way, below the bottom of the lid, extends above the finished grade line. The finished grade shall slope away from the unit. The diameter of the hole must be large enough to allow for the concrete anchor.

E. A six-inch (6”) inch (minimum) layer of TDOT #57 stone shall be used as bedding material under each unit.

F. A concrete anti-flotation collar, as detailed on the drawings, and sized according to the Manufacturer’s instructions, shall be required and shall be precast to the grinder pump or poured in place. Each grinder pump station with its precast anti-flotation collar shall have a minimum of three (3) lifting eyes for loading and unloading purposes.

G. The unit shall be leveled and filled with water to the bottom of the inlet to help prevent the unit from shifting while the concrete is being poured and set. The concrete must be manually vibrated to ensure there are no voids. If it is necessary to pour the concrete to a level higher than the inlet piping, an eight-inch (8”) sleeve is required over the inlet prior to pouring the concrete.

H. The Contractor will provide and install a four-foot (4’) piece of four-inch (4”) SCH 40 PVC pipe with cap, to stub-out the inlet as depicted on the Contract Drawings.

I. The electrical enclosure shall be furnished, installed, and wired to the grinder pump station by the Contractor. An alarm device is required on every installation; there shall be no exceptions.

J. It will be the responsibility of the Contractor and Erwin Utilities to coordinate with the individual property owner(s) to determine the optimum location for the alarm panel. The Contractor shall mount the alarm device in a conspicuous location, as per Federal and Local codes.

K. The alarm panel will be connected to the grinder pump station by a length of 6-conductor, 14-gauge, tin coated stranded copper conductors (TC-type cable) as shown on the Contract Drawings. The power and alarm circuits must be on separate power circuits. The grinder pumps station will be provided with a minimum of thirty-two feet (32') total, twenty-five feet (25') of usable electrical supply cable outside the station, to connect to the alarm panel. This cable shall be provided with a factory-installed EQD half to connect to the mating EQD half on the core.

3.04 BACKFILL REQUIREMENTS

A. Backfill of clean, native earth, free of rocks, roots, and foreign objects, shall be thoroughly compacted in lifts not exceeding twelve inches (12") to a final Proctor Density of not less than eighty-five percent (85%).

B. The grinder pump station shall be installed at a minimum depth from grade to the top of the one and one quarter inch 1-1/4" discharge line to ensure maximum frost protection.

C. The finish grade line shall be one to four inches (1"-4") below the bottom of the lid, and final grade shall slope away from the grinder pump station.

3.05 START-UP AND FIELD TESTING

A. The Manufacturer shall provide the services of qualified factory trained technician(s) who shall inspect the placement and wiring of each station, perform field tests as specified herein, and instruct the Erwin Utilities personnel in the operation and maintenance of the equipment before the stations are accepted by Erwin Utilities.

B. All equipment and materials necessary to perform testing shall be the responsibility of the Contractor. This will include, as a minimum, a portable generator (if temporary power is required) and water in each basin.

C. The services of a trained factory-authorized technician shall be provided at a rate of two (2) days for each two hundred (200) grinder pump stations supplied. Projects with fewer than two hundred (200) units shall provide a trained factory-authorized technician for a minimum of one (1) day. Each day shall be ten (10) person hours in duration.

D. Upon completion of the installation, the authorized factory technicians will perform the following test on each station:

1. Make certain the discharge shut-off valve is fully open. This valve must not be closed when the pump is operating. In some installations, there may be a valve(s) at the street main that must also be open.

2. Turn on the alarm power circuit.

3. Fill the wetwell with water to a depth sufficient to verify the high level alarm is operating. Shut off water.

4. Turn on pump power circuit. Initiate pump operation to verify automatic power controls are operative. Pump should immediately turn on. Within one (1) minute, alarm light will turn off. Within three (3) minutes, the pump will turn off.

E. Upon completion of the start-up and testing, the Manufacturer shall submit to Erwin Utilities the start-up authorization form describing the results of the tests performed for each grinder pump station. Final acceptance of the system will not occur until authorization forms have been received for each pump station installed and any installation deficiencies corrected.

PART 4: OPERATION AND MAINTENANCE

4.01 SPARE CORE

The manufacturer will supply one (1) spare grinder pump core for every fifty (50) grinder pump stations installed, complete with all operational controls, level sensors, check valve, anti-siphon valve, pump/motor unit, and grinder.

4.02 MANUALS

The manufacturer shall supply four (4) copies of Operation and Maintenance Manuals to Erwin Utilities.

END OF SECTION

(Recommended form follows.)

WARRANTY CERTIFICATION

I, _____ , by and through my duly authorized signature below as its most senior operating executive, certify that _____ will provide a five (5) year warranty on grinder pump equipment manufactured and supplied by _____ _____ for the _____ project. I further certify that, other than failure to install equipment in accordance with manufacturer's instructions, no exclusions and/or cost items to maintain said equipment in warrantable condition, including labor, travel and shipping fees, exist.

_____ _____

Signature Date

_____

Title

PART 1: GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM D1248, Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable.

2. ASTM D2657, Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings.

3. ASTM D3034, Standard Specification for Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings.

4. ASTM D3035, Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter.

5. ASTM D3261, Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.

6. ASTM D3350, Standard Specification for Polyethylene Plastic Pipe and Fittings Materials.

7. ASTM F714, Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.

1.02 SUBMITTALS

A. Action Submittals:

1. Catalog cuts and specifications:

   a. Pipe.

   b. Electrofusion fittings.

   c. Joining equipment.

2. Dimensioned drawings including, installation details and sketches.

B. Informational Submittals:

1. Manufacturer's Certificates:

   a. Certificate of material compliance.

   b. CONTRACTOR Certifications:

      i. Certifications of training by pipe bursting system manufacturer stating that operators have been fully trained in the use of the pipe bursting equipment by an authorized representative of the equipment manufacturer.

      ii. Certification from pipe manufacturer of training in the proper method for handling and installing the new pipe.

      iii. Certifications of training by the pipe fusion equipment manufacturers that the operators have been fully trained in the use of the fusion equipment by an authorized representative of the equipment manufacturer.

2. Test Results: Certified factory.

3. Installation Instructions:

   a. Detailed construction procedures, and layout plans to include sequence of construction.

   b. Locations, sizes and construction methods for the service reconnection pits.

   c. Methods of construction, reconnection and restoration of existing service laterals.

   d. Detailed descriptions of the methods of modifying existing manholes.

   e. Detailed procedures for the installation and bedding of the new pipe in the launching and receiving pits.

   f. Description of the method to remove and dispose of the host pipe, if required.

4. Sewer Bypass Plan: Methods and list of equipment to be utilized, including:

a. Emergency response plan to be followed in event of bypass pumping system failure.

b. Backup bypass pump on construction site for the main sewer and sewer service laterals.

5. Contingency Plan: Provide for the following potential conditions at a minimum:

a. Unforeseen obstruction causing burst stoppage, such as unanticipated change in host pipe material, repair section, concrete encasement or cradle(s), buried or abandoned manhole or changes in direction not depicted on Drawings provided by Erwin Utilities.

b. Substantial surface heave occurs due to the depth of the existing pipe versus the amount of upsizing.

c. Damage to existing service connections or to the replacement pipeline's structural integrity.

d. Damage to other existing utilities.

e. Soil heaving or settlement.

f. Loss of and return to line and grade.

6. DVD Documentation:

a. Preinstallation DVD, original.

b. Post-installation DVD, original.

1.03 QUALITY ASSURANCE

A. The CONTRACTOR shall be certified by pipe bursting system manufacturer as a fully trained user of the pipe bursting system. Operation of the pipe bursting system shall performed by trained personnel. Such training shall be conducted by a qualified representative of the pipe bursting system manufacturer. The CONTRACTOR shall provide certificates of training for any employee directly involved in the supervision or operation of the pipe bursting system.

B. Polyethylene pipe jointing shall be performed by personnel trained in the use of butt-fusion equipment and the recommended methods for new pipe connections. Personnel directly involved with installing the new pipe shall receive training in the proper methods for handling and installing the polyethylene pipe. Such training

shall be certified and conducted by a qualified representative of the pipe manufacturer.

C. Installation of other materials shall be performed by personnel qualified by the specific product manufacturer.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping:

1. Markings: Pipe materials shall be legibly marked by manufacturer with the following:

   a. Name and trademark of manufacturer.

   b. Nominal pipe size.

   c. SDR.

   d. Letters PE, followed by polyethylene grade per ASTM D1248, followed by Hydrostatic Design Basis in hundreds of psi.

   e. Manufacturing standard reference.

   f. Production code from which date and place of manufacture can be determined.

B. Acceptance at Site:

1. After unloading and before installation, inspect pipe to verify its condition. Pipe condition inspection report shall be reviewed by Erwin Utilities prior to installation.

2. Unload and store pipe to ensure that pipe is not cut, gouged, scored, or otherwise damaged. Pipe segments with pipe wall cuts exceeding 10 percent of wall thickness shall be removed from Site.

C. Storage and Protection:

1. HDPE pipe without ultraviolet inhibitor shall not be stored unprotected against outside elements.

2. Store pipe so as not to be deformed axially or circumferentially.

1.05 SITE CONDITIONS

A. Provide adequately designed pipe bursting equipment to accomplish replacement of existing pipe under adverse conditions.

B. Determine location of receiving and insertion pit excavations needed due to existing manholes that are not designated to be replaced.

1.06 SEQUENCING AND SCHEDULING

A. Upon completion of pipe insertion and installation, expedite reconnection of lateral service connections so as to minimize inconvenience to customers.

PART 2: PRODUCTS

2.01 MATERIALS

A. Pipe:

1. Materials:

a. High molecular weight, high-density polyethylene pipe, in accordance with ASTM F714.

b. Virgin grade material.

c. Plastic Pipe Institute (PPI) designation of PE 3408.

d. Minimum cell classification of 345434C, D, or E (inner wall shall be light in color) as described in ASTM D3350.

e. Meet requirements for Type III, Class B or C, Category 5, Grade P34 material as described in ASTM D1248.

f. Shall contain no recycled compound except that generated in manufacturer's own plant from resin of same specification from same raw material.

g. Pipe (excluding black colored pipe) stored outside shall not be recycled.

h. Pipe shall be manufactured by the following:

i. Performance Pipe, Plano, TX.

ii. Rinker Polypipe, Gainesville, TX.

iii. Uponor North America.

iv. ARNCO, Elyria, OH.

2. Color:

a. Inside: Inner wall shall be light color interior (soft gray or white).

b. Outside: Outer wall black with a co-extruded green cover or extruded green stripes designating use for sanitary sewer. Color print lines are not an acceptable method for designation of sewer mains. Pipe with extruded green stripes shall have a minimum of three equally spaced stripes. Pipe shall have a heat indented print line containing the information required in ASTM D 3035.

3. SDR:

a. Nominal Size: 8 inches and larger with DIP outside diameters.

b. SDR: Minimum 17.

B. Fittings shall be HDPE butt fusion welded fittings in accordance with ASTM D3261 as modified for the specified material.

C. Joints:

1. Pipe jointing shall be by butt fusion welding, as specified in Paragraph Pipe Joining.

2. Electrofusion Couplings:

a. May be used for repairs or connecting pipe burst segments in the trench with approval of Erwin Utilities.

b. Manufacturer: Central Plastics Company, Shawnee, Oklahoma; Central Electrofusion System or Friatec, Aiken, NC.

D. Service Connections:

1. Service saddles shall be butt fusion or electrofusion saddle type fitting with DIP outside dimension branch connection:

a. Specifically designed for connection to type of HDPE being installed.

b. Manufactured by Central Plastics Company, Shawnee, Oklahoma; Central Electrofusion System or Friatec, Aiken, NC.

2. Option: For HDPE pipe sizes greater than 10 inches an Inserta Tee by Inserta Fittings Company may be used.

E. Equipment:

1. Pipe Bursting: Provide equipment of sufficient size and power to accomplish the specified pipe replacement under adverse conditions. Utilize hydraulically powered constant tension static pull pipe bursting system or pneumatic hammer.

2. Joining: Capable of meeting conditions recommended by pipe manufacturer, including, but not limited to, fusion temperature, alignment, and fusion pressure.

2.02 SOURCE QUALITY CONTROL

A. Certify laboratory data confirming that said tests have been performed on sample of pipe to be provided under this Contract, or pipe from that production run, and that satisfactory results were obtained prior to shipping.

B. Pipe shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, or other injurious defects. It shall be uniform in density and other physical properties. Pipe not meeting these criteria shall be rejected.

PART 3: EXECUTION

3.01 PREPARATION

A. Work shall be supervised by personnel experienced in installation of similar pipe and shall be onsite at all times from time of commencement to time of completion.

B. Existing pipe shall be clean and free of obstructions so as not to prohibit pipe bursting operations.

1. The CONTRACTOR shall perform a Pre-Installation CCTV inspection.

2. If the Pre-installation CCTV inspection reveals obstructions in the existing sewer (heavy solids, dropped joints, protruding service taps or collapsed pipe) which will prevent completion of the pipe bursting process, and that

cannot be removed by conventional sewer cleaning equipment, then a point repair shall be made by the CONTRACTOR, with the approval of Erwin Utilities.

C. CCTV inspections shall be completed in accordance with Section 02830, CCTV Sewer Inspection.

3.02 LOCATING UTILITIES

A. Erwin Utilities will provide the CONTRACTOR with all documents relating to the location of utilities adjacent to the pipe to be replaced.

B. The CONTRACTOR shall, prior to starting work, verify the location of all adjacent utilities. The minimum clearance from other utilities shall be approximately two feet. Erwin Utilities may at its discretion reduce the minimum clearance with justification from the CONTRACTOR.

C. The CONTRACTOR shall expose all interfering and crossing utilities by spot excavating at the planar intersection of the pipe and removing the soil from around the utility. The cost of exposing these utilities shall be borne by the CONTRACTOR as part of the pipe bursting operation.

3.03 SUB-SURFACE CONDITIONS

A. Erwin Utilities will furnish the CONTRACTOR with available information listed in the Contract Documents, if any are available. The CONTRACTOR shall verify this information in the field. All additional subsurface investigations deemed necessary by the CONTRACTOR to complete the work shall be included in the Contract at no additional cost to Erwin Utilities.

B. Copies of all reports and information obtained by additional subsurface investigations by the CONTRACTOR shall be provided to Erwin Utilities.

C. The minimum depth of cover over the installed pipe shall be 4 feet for size on size pipe bursting, and shall be 8 feet for increased pipe size pipe bursting. The CONTRACTOR may request approval of Erwin Utilities to reduce the minimum depth of cover.

D. A minimum amount of ground heaving may be allowed, as determined by Erwin Utilities, if soil conditions are not favorable and up-sizing of the pipe is required.

E. Unless otherwise noted, settlement or heaving of the ground surface during or after construction will not be allowed. The CONTRACTOR is solely responsible for the costs for repairing any surface heaving, unless specified otherwise.

3.04 LOCATING SERVICE CONNECTIONS

A. Sewer service connections shall be identified and located by CCTV prior to start of pipe bursting operation and pipe insertion.

B. The CONTRACTOR shall locate all and expose all sewer service connections prior to pipe insertion to expedite reconnection.

C. The CONTRACTOR shall exercise due diligence in excavating the existing pipe sufficiently to allow for uniform circumferential expansion of the existing pipe through the service connection pit. Upon commencement of the bursting process, pipe insertion shall be continuous and without interruption from one entry point to another, except as approved by Erwin Utilities.

D. Upon completion of insertion of the new pipe, the CONTRACTOR shall expedite the reconnection of services to minimize any inconvenience to the customers.

3.05 PIPE JOINING

A. The HDPE pipe shall be assembled and joined at the Site using the butt-fusion method to provide a leak proof joint. Threaded or solvent-cement joints and connections are not permitted.

B. All equipment and procedures used in shall be in strict compliance with ASTM D2657 and with the pipe manufacturer's recommendations.

C. Fusion shall be preformed by technicians certified by a manufacturer of pipe fusion equipment.

D. Prior to pipe installation, two trial fusion welds shall be performed, and reviewed and approved by Erwin Utilities. Full penetration welds shall provide homogeneous material across the cross section of weld. Fusion machine employed for trial welds shall be same machine utilized for project installation.

E. The butt-fused joint shall be true alignment and shall have uniform rollback beads resulting from the use of proper temperature and pressure. The joint shall be allowed adequate cooling time before removal of pressure.

F. The fused joint shall be watertight and shall have tensile strength equal to or greater than that of the pipe.

G. All joints shall be subject to acceptance by Erwin Utilities prior to insertion.

H. The CONTRACTOR shall cut out and replace defective joints at no additional cost to Erwin Utilities.

I. Any section of the pipe with a gash, blister, abrasion, nick, scar, or other deleterious fault greater in depth than 10 percent of the wall thickness (ASTM 585), shall not be used and shall be removed from the Site. However, a defective area of the pipe may be cut out and the joint fused in accordance with the procedures stated above.

J. Any section of the pipe having other defects such as concentrated ridges, discoloration, excessive spot roughness, pitting, variable wall thickness or any other defect of manufacturing or handling as determined by Erwin Utilities shall be discarded and not used.

K. Terminal sections of pipe that are joined within the insertion pit shall be connected with an electrofusion coupling (e.g., Central Plastics couplings).

L. All connections shall be in conformance with the manufacturer's installation procedures.

3.06 BYPASSING OF FLOWS

A. When blocking flow in upstream sewers is not appropriate, use flow bypass pumping for reducing flow below the maximum depth or for completely bypassing flow.

3.07 PIPE INSTALLATION

A. Pipe insertion shall be continuous and without interruption from one manhole to another, except as approved by Erwin Utilities.

B. Advancement of bursting head with "chain" shall be prohibited.

C. Void created by bursting device shall be sufficient in size to accommodate HDPE pipe.

D. Rescue Shafts:

1. In the event that the pipe-bursting machine encounters an obstruction and is halted, the CONTRACTOR will be required to excavate down to the machine to free the obstruction and continue the installation.

2. The CONTRACTOR is notified that the construction of such shafts will be considered incidental to the installation by the pipe bursting construction method.

3. Any rescue shafts will be properly braced, shored, or utilize trench boxes to meet applicable Federal, State, and local requirements.

4. Backfill and compaction for such rescue shafts shall be in accordance with Section 02220, Excavation and Backfill.

3.08 LUBRICATION

A. Lubrication shall be used if in the opinion of CONTRACTOR such lubrication is necessary to ensure the successful completion of the job.

B. The CONTRACTOR shall make arrangements for the injection of bentonite into the annular space behind the pipe bursting head, as the lubricant if required.

3.09 SERVICE RECONNECTION

A. The installed pipe shall be allowed the manufacturer's recommended amount of time but not less than 4 hours, for cooling and relaxation due to tensile stressing prior to any reconnection of service lines.

B. Prior to reconnecting sewer services, installed pipe shall have been successfully tested.

C. The CONTRACTOR, after a suitable relaxation period and testing shall reconnect all service connections as approved by Erwin Utilities.

D. Sewer service connections shall be connected to new pipe and installed in a hole drilled to the full inside diameter of the outlet. Service connections shall be an Inserta-T or an electrofusion saddles per the requirements above.

E. The slope of the existing lateral toward the newly installed sewer main shall be maintained at the existing slope. For reconstructed laterals, a minimum pipe slope of 1 percent is required.

3.10 RESTORATION

A. Restoration of Manholes:

1. The CONTRACTOR shall restore all manholes and associated surface areas to their original condition.

2. Prior to restoring manholes the installed pipe shall be allowed the manufacturer's recommended amount of time, but not less than 4 hours, for cooling and relaxation due to tensile stressing prior to the sealing of the annulus or backfilling of the insertion pit.

3. Sufficient excess length of new pipe, but not less than 2 inches to 4 inches, shall be allowed to protrude into the manhole.

B. Restoration of Pits:

1. The CONTRACTOR shall restore all lateral, launching pits and associated surface areas to their original condition.

2. Prior to backfilling lateral and launching pits the CONTRACTOR shall ensure that the new pipe is properly supported and on the required grade.

3. Backfill per Section 02220, Excavation and Backfill shall be used for the new pipe as support in order to avoid sagging after backfill and compaction.

3.11 POST INSTALLATION CCTV INSPECTIONS

A. The CONTRACTOR shall perform post-installation CCTV inspections in accordance with Section 02830, CCTV Sewer Inspection.

1. Post construction video tapes shall be submitted to Erwin Utilities on DVD's in GraniteXP software format for review prior to final payment. Should any portion of the inspection video be of inadequate quality or coverage, as determined by Erwin Utilities, the CONTRACTOR will have that portion re-videotaped at no additional expense to Erwin Utilities.

2. All original DVD's remain property of Erwin Utilities. The CONTRACTOR may retain a second copy, if desired.

B. From the CCTV inspection, the newly installed pipe shall be visibly free of defects, which may affect the integrity or strength of the pipe. If in the opinion of Erwin Utilities such defects exist, the pipe shall be repaired or replaced at the CONTRACTOR's expense.

C. If the CCTV inspection reveals a sag in the new sewer after pipe bursting has been completed, the CONTRACTOR shall notify Erwin Utilities to determine if a point repair is necessary to correct the sag. At the direction of Erwin Utilities, the CONTRACTOR shall take the necessary measures to eliminate these sags by performing a point repair and bringing the bottom of the newly installed pipe to a uniform grade by excavating the pipe, lifting it, and placing compacted crushed stone bedding under and around the pipe to eliminate the sag.

3.12 TESTING OF GRAVITY SEWERS

A. Testing of gravity sewers shall be in accordance with Section 02730, Sanitary Sewers Pipe and Appurtenances.

3.13 FIELD QUALITY CONTROL

A. Low pressure air testing from manhole to manhole section of sanitary sewer shall be performed after the pipe has been bursted and prior to service lines being connected. Air testing shall be in accordance with ASTM F1417.

3.14 FINAL CLEANING

A. Prior to inspection and acceptance of pipe by Erwin Utilities, flush and clean system to remove accumulated construction debris, rocks, gravel, sand, silt, and other foreign material.

END OF SECTION

PART 1: GENERAL

1.01 SCOPE

A. Rehabilitation of existing gravity sanitary sewer lines by the Cured-in-Place Pipe (CIPP) process.

B. The CIPP process is defined as the reconstruction of gravity sewer pipe by the installation of polyester or an epoxy vinylester, thermosetting resin, vacuum impregnated flexible polyester felt fiber tube, having an impermeable inner surface. The resin-impregnated tube is formed to the host pipe by means of a water column. Curing is accomplished by circulating hot water throughout the length of the tube in accordance with the specified curing schedule supplied by the resin manufacturer. The CIPP shall extend the full length of the pipe reach being rehabilitated and shall provide a structurally sound, impermeable, jointless, and close fitting pipe that when cured is mechanically bonded to the host pipe.

1.02 REFERENCES

A. The following is a list of standards that may be referenced in this Section:

1. ASTM D543, Standard Practices for Evaluating Resistance of Plastics to Chemical Reagents.

2. ASTM D790, Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

3. ASTM D3839, Standard Guide for Underground Installation of Fiberglass (Glass-Fiber Reinforced Thermosetting-Resin) Pipe.

4. ASTM F1216, Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube.

5. National Association of Sewer Service Companies (NASSCO): Recommended Specification Guidelines for Sewer Collection System Rehabilitation.

1.03 DESIGN CRITERIA

A. Design liner thickness upon the following criteria:

1. Pipes considered to be fully deteriorated.

2. Pipes subjected to full soil load with applicable live load and with water table at the top of the ground. Under pavement, live load shall include AASHTO HS20-44 Truck Loading in each pavement lane.

3. Minimum Ovality of Pipe: 3 percent of circumference.

4. Design calculations shall be based upon Appendix X1 of ASTM F1216 with a Factor of Safety of 2.

5. Pipe Thickness:

   a. Pipe 10 inches in Diameter or Less: Rounded to the next higher multiple of 0.5 mm, with a minimum thickness of 6 mm.
   b. Pipe Greater than 10 inches in Diameter: Rounded to the next higher multiple of 0.5 mm, with a minimum thickness of 7.5 mm.

6. Creep Retention: Not less than 50 percent.

7. Poisson's Ratio: 0.3.

8. Enhancement Factor: K = 7.

9. Liner shall be watertight.

B. Provide analysis of design criteria and calculations for liner thickness to Erwin Utilities for approval. Erwin Utilities may vary liner thickness for same size sewer depending upon field condition of pipes or depths.

1.04 SUBMITTALS

A. Action Submittals: Product data.

B. Informational Submittals:

1. Design calculations.

2. Manufacturer's installation instructions and procedures. Furnish information, essentially in the same format as below, or give details of the procedure and the steps to be followed for the installation of the CIPP, even if the process is named in the Specification.

   a. Wet Out.

b. Insertion.

c. Curing

d. Cool Down.

e. Finished Pipe.

3. "Wet out" schedule.

4. Installer's statement of qualifications.

5. Manufacturer's Certificate of Compliance certifying compliance with the applicable specifications and standards.

6. Certified copies of test reports of factory tests required by the applicable standards and this Section.

7. DVD of CCTV inspection.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Keep products safe from damage. Promptly remove damaged products from Site. Replace damaged products with undamaged products.

B. Maintain resin-impregnated tubes in refrigerated truck trailers at a temperature below 45 degrees F to prevent premature curing. Prior to beginning inversion, no portion of the resin-impregnated liner shall be subjected to sunlight or ultraviolet radiation. Resin-impregnated tubes with signs of premature curing shall not be installed and shall be removed from the Project Site.

1.06 SPECIAL GUARANTEE

A. Provide manufacturer's extended guarantee or warranty, with Erwin Utilities named as beneficiary, in writing, as special guarantee. Special guarantee shall provide for correction, or at the option of Erwin Utilities, removal and replacement of Work specified in this Specification section found defective during a period of 5 years after the date of Substantial Completion. Duties and obligations for correction or removal and replacement of defective Work shall be as specified in the General Conditions.

PART 2: PRODUCTS

2.01 MATERIALS

A. Resin: Unless otherwise specified, CONTRACTOR shall furnish a general purpose, unsaturated, polyester or thermosetting vinylester resin and catalyst system compatible with the reconstruction inversion process that provides the cured physical strengths and properties specified herein.

Physical Characteristic	Minimum Values	Test Method
Flexural Strength	4,500 psi	ASTM D790 mod.
Modulus of Elasticity	250,000 psi	ASTM D790 mod.

B. Resins shall be shipped directly to the wet-out facility from the resin manufacturer and shall be one of the following:

1. Reichhold; Polylite #33420 or DION 9800-20.

2. Interplastic Corporation; #COR72-AA-455HV or #CORVE8190.

3. Ashland Specialty Chemical Company; #AROPOL MR12018 or HETRON Q6405.

4. AOC; 701, Vipel; L704NET-11, or Vipel; L704AAP-12.

C. PET resins, resin fillers, resin additives, and resin enhancement agents are prohibited. Only neat resins are acceptable. Old resins and reworked resins are prohibited, regardless of whether or not they are mixed with new resin.

D. Tube:

1. In accordance with ASTM F1216.

2. Liner tube shall consist of layers of flexible nonwoven polyester felt.

3. Sewage-contact inside layer of tube shall be coated with an impermeable material compatible with resin and felt.

4. Manufacturers:

a. Applied Felt.

b. Insituform Technologies.

c. Liner Products.

E. Catalysts:

1. Primary catalyst shall not exceed 1 percent of the resin by volume.

2. Secondary catalyst shall not exceed 1/2 percent of the resin by volume.

3. Catalysts shall be:

a. Primary Catalyst: Akzo; Perkadox 16 or Norox 600.

b. Secondary Catalyst: Akzo; Trigonox C or Norox TBPB.

2.02 ACCESSORIES

A. Hydrophilic Rubber Joint Seal: Greenstreak, Inc.; Hydrotite.

B. PVC Saddle Tees: Solvent welded type for 8-inch CIPP sewer main connection. Tee shall fit the existing pipe and have an integral 6-inch branch connection with gasket. The saddle shall include two stainless steel straps. Saddle tees shall meet the requirements of ASTM D3034 and ASTM F477.

C. Coupling: Flexible PVC coupler, 3/8-inch thick, with multiple sealing ribs and stainless steel T-bolt clamps as manufactured by Fernco, Inc.

PART 3: EXECUTION

3.01 PRE-INSTALLATION PREPARATIONS

A. Complete the following activities, unless approved otherwise by Erwin Utilities:

1. Safety: Perform operations in accordance with applicable OSHA Standards. Particular attention shall be paid to those safety requirements involving work on an elevated platform and entry into a confined space.

2. Pre-Insertion Cleaning: Rewash, reclean and ready existing sewer pipe immediately before the pre-insertion television inspection.

3. Pre-Insertion CCTV Inspection: Inspect sewer pipe before insertion of resin impregnated tube to ensure pipe is clean and existing pipe conditions are acceptable for lining. Provide a DVD of the CCTV inspection.

4. Dye Testing: Where sewer line segments may contain abandoned services, CONTRACTOR may be directed to perform dye testing to determine if the services are live and require re-instatement.

5. Bypassing Sewage

6. Line Obstructions: If pre-insertion video CCTV inspection reveals an obstruction in the existing pipe (such as heavy solids, dropped joints, protruding service taps or collapsed pipe which may prevent completion of the inversion process), that cannot be removed by sewer cleaning equipment, then a point repair using flexible coupling may be made with the approval of Erwin Utilities.

3.02 PRIVATE SERVICE LATERAL SHUTDOWN

A. Notify Erwin Utilities at least 1 week prior to the shutdown when it is necessary to shut down a private service line while Work is in progress and before the service lines are reconnected.

B. Notify building occupants regarding service lateral disconnection by placing a door hanger approved by Erwin Utilities. Place door hangers between 1 and 3 days prior to disconnection.

C. When a service lateral will be disconnected from the main for more than 1 day, lateral shall be positively drained or pumped a minimum of once every 24 hours. Monitor status of flow and storage. Pump lateral more frequently where flows exceed the storage capacity of the lateral or temporary storage as may be provided by CONTRACTOR.

D. Temporarily restore services in uncompleted sections during nonworking hours.

E. Notify building occupants when Work is complete and full uninterrupted service restored.

F. No service is to remain shut down for more than a period of 8 hours, unless CONTRACTOR provides substitute services for the residents. If the service is to be shut down for more than 8 hours and CONTRACTOR cannot provide substitute services, then CONTRACTOR shall provide temporary living quarters (i.e., hotel) for the resident at no additional cost to Erwin Utilities or the resident. Temporary living quarters shall be approved by Erwin Utilities and coordinated through Erwin Utilities' Customer Support Representative.

G. Maintain commercial sewer services while businesses are open. No sewage from the services or main line shall be allowed to be discharged on the ground or in waterways. Holding pits or tanks are not allowed unless permitted by TDEC.

3.03 INSTALLATION PROCEDURES

A. Liner shall be water cured only. Steam curing is prohibited.

1. Curing Time: 3 hours minimum.

2. Minimum interface temperature between liner and tube shall be 120 degrees F.

3. Water Temperature: 180 degrees F minimum.

B. The finished CIPP shall:

1. Be continuous over entire length from manhole to manhole and be free from visual defects such as foreign inclusions, dry spots, keel, boat hull, pinholes, wrinkles, and other deformities.

2. When passing through or terminating in a manhole shall be carefully cut out in a shape and manner approved by Erwin Utilities.

3. Annular space between existing pipe and the CIPP shall be sealed.

4. Meet leakage requirements of pressure test as specified in Section 02730, Sanitary Sewer Pipe and Appurtenances.

C. Erwin Utilities requires a continuous, uniform liner for a pipeline section. Erwin Utilities will not allow intermediate excavation for new manhole.

3.04 SEALING AND BENCHES IN MANHOLE

A. CIPP shall make a tight fitting seal with existing pipe(s) in manhole. For CIPP that is installed continuous through manhole, the top half of the pipe shall be neatly cut off and not broken or sheared off at least 2 inches away from wall. The channel in the manhole shall be a smooth continuation of the pipe(s) and shall be merged with other pipes or channels, if any. Channel cross-section shall be U-shaped.

B. At each pipe opening into manhole, hydrophilic rubber joint seal shall be bonded with adhesive to the host sewer pipe or to the opening in the manhole barrel to hold it in place during inversion.

C. Seal CIPP and existing pipe in manhole as stated above before proceeding on to next manhole section. Manholes shall be individually inspected for liner cut-offs, benches, and sealing of liner annular space.

3.05 SERVICE REINSTATEMENTS

A. The exact location and number of service connections shall be determined from CCTV. Field locate existing service connections. Perform service cut outs at active service connections immediately after liner has cured. Initial internal service cut outs shall be made to the lesser of a 6-inch diameter opening or 90 percent of the original diameter of the connection. If the service cannot be replaced through excavation, internally reinstate the service to 100 percent of original opening, and provide a smooth opening with no ragged edges. Services shall not be reconnected from abandoned or vacant lots, unless directed otherwise by Erwin Utilities. Restore and correct missed or faulty reconnections as well as damage caused to property owners for not reconnecting the services soon enough or for not giving notice to the owners. Services which are reconnected to rehabilitated liner shall be shown on "as-built drawings" with the distance from the nearest downstream manhole.

3.06 SERVICE CONNECTION BY EXCAVATION

A. Excavate existing active service connections. Disconnect at joints and existing sewer (now the carrier pipe for the liner) and remove to expose the liner to the extent necessary. Do not damage liner pipe, or allow liner to normalize to ambient temperature and cool down before 6-inch diameter hole is drilled out. Coat cut out hole in liner with approved resin/epoxy that will cure at the ambient temperature.

B. Install PVC saddle tee with gasketed PVC connection for the new sewer service lateral over the cut out. Saddle shall be a one-piece saddle attached to the liner with epoxy and equipped with a neoprene gasket so that a complete seal is accomplished when the strap-on saddle is tightened with two stainless steel bands; one on each side. The stub-out attached to the saddle shall protrude into liner a distance equal to the wall thickness of liner.

C. Replace sewer service laterals per Section 02731, Sanitary Sewer Service Connection.

3.07 TESTING FOR ACCEPTANCE

A. Sampling and Measuring: One minimum 12-inch long restrained pipe section shall be cut from the cured liner installation. Measurements of sample thickness will be taken by Erwin Utilities from four locations on each section. The average thickness

of the measurements shall be equal to or greater than the required design thickness.

B. Laboratory Testing: One sample from each CIPP liner installation, or as otherwise specified by Erwin Utilities, shall be sent to an independent laboratory and tested for modulus of elasticity and flexural strength. Preparation and testing standards shall be performed in accordance with the approved submittals. Failure of any test can be grounds for rejection of the CIPP liner. At the direction of Erwin Utilities, a second sample shall be tested.

C. Destructive Testing: In cases where test results of samples from the 12-inch long pipe section are lower than required values, at the direction of Erwin Utilities, CONTRACTOR shall cut samples from liner along length of pipe. The size and shape of the samples shall be determined by Erwin Utilities. The CONTRACTOR shall repair the CIPP liner and host pipe at no additional cost to Erwin Utilities. Failure of the thickness test shall be grounds for rejection for the CIPP liner.

D. Resin Sampling: "Wet-out" facility resin mixing equipment shall have a valve downstream of the mixing functions and immediately upstream of the application of the mixed resin to the tube where Erwin Utilities can draw resin samples. CONTRACTOR's batch mix facilities, if any, shall provide for sampling of the mixed batch. Submitted "wet-out" schedule cannot be modified without 24-hour notice to Erwin Utilities. Resin samples shall be drawn at times determined by Erwin Utilities. The Erwin Utilities drawing the samples will arrive unannounced and shall be afforded immediate access to the equipment.

E. CCTV shall be as specified in Section 02830, CCTV Sewer Inspection. Televising shall be done after service connections have been made, unless required earlier by Erwin Utilities. Provide CCTV DVD's after liner has been installed in existing sewer pipe.

F. No visible leak around liner at manhole connections will be allowed.

G. Correct failed liner or liner deemed unacceptable by Erwin Utilities as a result of the post-video inspection or test reports for structural values and thickness.

1. Remedy shall be defined as shown in the following table and shall be based upon lowest test in each test category. Where pipe replacement is required, payment shall be made in full for the cured-in-place pipe. No payment will be made to construct a new sewer segment.

PIPE CORRECTION			
TEST	**REQ'D VALUE**	**TEST RESULT**	**REMEDY**
Flexural Strength	4,500 psi	4,300 to 4,490 psi	10% Unit Price Reduction
	4,500 psi	4,100 to 4,290 psi	30% Unit Price Reduction
	4,500 psi	Less than 4,100 psi	Pipe Replacement
Flexural Modulus	250,000 psi	238,000 to 249,000 psi	10% Unit Price Reduction
	250,000 psi	225,000 to 237,900 psi	30% Unit Price Reduction
	250,000 psi	Less than 225,000 psi	Pipe Replacement
Thickness	6.0 mm	5.7 to 5.9 mm	10% Unit Price Reduction
	6.0 mm	5.4 to 5.6 mm	30% Unit Price Reduction
	6.0 mm	Less than 5.4 mm	Pipe Replacement
	7.5 mm	7.1 to 7.4 mm	10% Unit Price Reduction
	7.5 mm	6.7 to 7.1 mm	30% Unit Price Reduction
	7.5 mm	Less than 6.7 mm	Pipe Replacement

END OF SECTION

PART 1: GENERAL

1.01 SCOPE

A. This Section covers the cleaning of sewers to remove all debris, solids, sand, grease, grit, roots, etc. from the sewers and manholes to improve pipe flow, facilitate television inspection for sewer evaluation, for proper application of root control chemical, or as required for other specified rehabilitation.

B. The Work covered by this section includes furnishing all labor, equipment, and materials required to clean and inspect sanitary sewer lines as specified.

1.02 SUBMITTALS

A. Action Submittals: Catalog and manufacturer's data sheets for cleaning equipment.

B. Informational Submittals:

1. Sample of the finished picture from the picture capture system.

2. Equipment manufacturer's operational manual and guidelines.

3. Liquid Waste Manifest.

PART 2: PRODUCTS

2.01 EQUIPMENT

A. Sewer television equipment shall be in compliance with Section 02830, CCTV Sewer Inspection.

B. Hydraulically-Propelled Equipment: The equipment used shall be of a movable dam type and be constructed in such a way that a portion of the dam may be collapsed at any time during the cleaning operation to protect against flooding of the sewer. The movable dam shall be equal in diameter to the pipe being cleaned and shall provide a flexible scraper around the outer periphery to ensure removal of grease. If sewer cleaning balls or other equipment, which cannot be collapsed, is used, special precautions to prevent flooding of the sewers and public or private property shall be taken.

C. Cleaning:

1. All high-velocity sewer cleaning equipment shall be constructed for ease and safety of operation. The equipment shall have a selection of two or more high velocity nozzles. The nozzles shall be capable of producing a scouring action from 15 to 45 degrees in all size lines designated to be cleaned. Equipment shall also include a high-velocity gun for washing and scouring manhole walls and floor and produce at least 2,000 psi pressure. The gun shall be capable of producing flows from a fine spray to a solid stream.

2. Sewer line cleaning equipment shall be a combination of high-velocity (hydro cleaning) jet and vacuum system, truck-mounted for mobility and ease of operation. The hydro-cleaning equipment for sewer lines shall include a minimum 1,000-gallon water storage tank, auxiliary engines and pumps, and include a minimum of 600 feet of 1-1/4-inch I.D. high-pressure hose on a power driven hose reel. Pump nozzle combinations shall be capable of producing water flow rates up to 120 gpm, and a minimum of 60 gpm at a working pressure up to 2,000 psi. The vacuum system shall be a positive displacement blower with a minimum of 4,200 cfm at 15 inches of mercury. Erwin Utilities must approve any variations to this pumping rate, in advance.

3. A working pressure gauge shall be used on the discharge of all high-pressure water pumps.

4. CONTRACTOR shall use in addition to conventional nozzles, a nozzle which directs the cleaning force to the bottom of the pipe for sewers 18-inch and larger.

D. Heavy Cleaning: Bucket machines shall be in pairs with sufficient power to perform the work in an efficient manner. Machines shall be belt operated or have an overload device. Machines with direct drive that could cause damage to the pipe will not be allowed. A power rodding machine shall be either a sectional or continuous rod type capable of holding a minimum of 750 feet of rod. The rod shall be specifically heat treated steel. To ensure safe operation, the machine shall be fully enclosed and have an automatic safety clutch or relief valve.

PART 3: EXECUTION

3.01 GENERAL

A. Prior to the start of any Work under this Project, CONTRACTOR shall make available to Erwin Utilities all equipment that is to be utilized in the execution of this contract. Erwin Utilities will hold a preconstruction conference at which the sequence of work, methods, inspection, and monitoring requirements and debris disposal shall be discussed.

B. When sewer flow depth is greater than 25 percent, flow depth shall be decreased by plugging or bypass pumping. Plugs shall be designed to pass any desired portion of sewage flow. If bypass pumping is required, CONTRACTOR shall provide all necessary equipment, manpower, and expertise. CONTRACTOR shall be responsible for all damage to public or private property resulting from these operations.

C. Designated sanitary sewers and manholes shall be cleaned using mechanical hydraulically propelled or high velocity sewer cleaning equipment. The cleaning process shall remove all grease, roots, sand, silt, solids, rags, debris, etc. from each sewer segment, including the manhole(s).

D. Selection of cleaning equipment and the method for cleaning shall be based on the condition of the sanitary sewer mains at the time work commences and will be subject to Erwin Utilities' approval.

E. All cleaning equipment and devices shall be operated by experienced personnel.

F. Satisfactory precautions shall be taken to protect the sanitary sewer mains and manholes from damage that might be inflicted by the improper use of the cleaning process or equipment. Any damage done to a sewer by CONTRACTOR shall be repaired by the CONTRACTOR at no additional cost to Erwin Utilities and to the satisfaction of Erwin Utilities.

G. Cleaning shall also include the initial manhole wall washing by high-pressure water jet.

H. CONTRACTOR, when instructed by Erwin Utilities, will be required to demonstrate the performance capabilities of the cleaning equipment proposed for use on the Project. If the results obtained by the proposed sanitary sewer cleaning equipment or attachments are not satisfactory, CONTRACTOR shall use different equipment/attachments, as required, to meet Specifications. More than one type of equipment/attachments may be required at a location.

I. When hydraulic or high velocity cleaning equipment is used, a suitable sand trap, weir, dam, or suction shall be constructed in the downstream manhole in such a manner that all the solids and debris are trapped for removal.

J. If water backups a lateral and enters a building or residence during cleaning, the CONTRACTOR shall notify Erwin Utilities of the occurrence. It is the CONTRACTOR's responsibility to clean any backups which occur. If prior knowledge of backups is available, the CONTRACTOR shall take measures to prevent another backup from occurring (i.e., plugging the lateral) before cleaning.

3.02 HYDRAULIC CLEANING

A. Prior to televising, CONTRACTOR shall thoroughly clean the pipelines of debris, grease, roots, sediment, broken pipe, or other obstructions that could retard the movement of the television camera. Precautions shall be taken to protect the sewer lines being cleaned from damage by the cleaning equipment.

B. Hydraulically propelled devices, which require a head of water to operate, shall utilize a collapsible dam. The dam shall be easily collapsible to prevent damage to the sewer, property, etc.

C. When using hydraulically propelled devices, precautions shall be taken to ensure that the water pressure created does not cause damage or flooding to public or private property.

D. CONTRACTOR shall not increase the hydraulic gradient of the sanitary sewers beyond the elevation that could cause overflow of sewage into area waterways or into structures.

3.03 HIGH-VELOCITY CLEANING

A. CONTRACTOR shall operate the equipment so that the pressurized nozzle continues to move at all times.

B. The pressure nozzle shall be turned off or water pressure be reduced anytime the hose is held or delayed in order to prevent damage to the line. In heavy debris the step cleaning method should be used.

3.04 MECHANICAL CLEANING

A. Mechanical cleaning, in addition to normal cleaning when required by Erwin Utilities, shall be approved equipment and accessories driven by power winching devices.

B. All equipment and devices shall be operated by experienced operators in an effort to prevent pipe damage during the cleaning process.

C. Buckets, scrappers, scooters, porcupines, kites, heavy duty brushes, metal pigs and other debris removing equipment/accessories shall be used as appropriate and necessary in the field, in conjunction with the approved power machine(s).

D. The use of cleaning devices such as rods, metal pigs, porcupines, root saws, snakes, scooters, sewer balls, kites and other approved equipment, in conjunction with hand winching device, or, gas, electric rod propelled devices, shall be considered normal cleaning equipment.

3.05 WATER USAGE

A. CONTRACTOR shall be responsible for preventing contamination of the potable water system. CONTRACTOR when drawing water from a public hydrant shall use a backflow preventer or an air gap of at least 3 pipe diameters.

B. No fire hydrant shall be obstructed or used when there is a fire in the area.

C. It shall be CONTRACTOR's responsibility to obtain approval to use Erwin Utilities' fire hydrants.

D. CONTRACTOR shall remove the water meter(s)/piping etc. from all fire hydrants at the end of each working day.

3.06 REMOVAL AND DISPOSAL OF DEBRIS

A. All materials removed from the sewer lines during cleaning operations shall be trapped and removed from the system at the downstream manhole of the section being cleaned. All materials shall be disposed of in compliance with all applicable laws and regulations and in a manner approved by Erwin Utilities.

B. Passing of debris from upstream manhole section to downstream manhole section will not be allowed.

C. All debris from the manholes shall be loaded into an enclosed container that is permitted by Erwin Utilities and the Tennessee Department of Environment and Conservation (TDEC) for liquid waste hauling.

D. All solids or semi-solids resulting from the cleaning operations shall be removed from the Site at the end of each workday, hauled to and disposed of at the Erwin Utilities Wastewater Treatment Plant.

E. CONTRACTOR shall not be allowed to accumulate debris, or liquid waste, sludge, etc. on the Site except in totally enclosed containers approved by Erwin Utilities.

F. All waste shall be hauled to the disposal Site by a transporter, which is arranged for by CONTRACTOR and holds a valid Liquid Waste Transporter Permit.

G. CONTRACTOR shall submit and maintain a "Liquid Waste Manifest" as per Erwin Utilities and TDEC requirements. Erwin Utilities' and TDEC's copies of the completed manifest shall be sent to Erwin Utilities within 24 hours after the disposal of the waste materials.

I. Under no circumstances shall sewage or solids removed in the cleaning process be dumped onto streets or into ditches, catch basins, storm drains, sanitary sewer manholes, cleanouts, or dumps.

END OF SECTION

PART 1: GENERAL

1.01 SCOPE

A. The Work covered by this section includes furnishing all labor, equipment, and materials required to clean and inspect the designated sanitary sewer lines specified.

B. Closed-circuit television inspection of sanitary sewers as follows:

1. TV inspection on all lines proposed for rehabilitation, including root control chemical application, under this contract, shall be performed where no videotape of the sewer is available from Erwin Utilities.

2. TV inspection of line segments specified for chemical root removal, shall be required to confirm cleaning and location of service connections. TV inspection shall also be required to confirm the need for mechanical root removal and to determine its location.

3. CONTRACTOR shall use the Television Inspection Form and Rehabilitation Tables approved by Erwin Utilities prior to beginning of any inspection.

4. Digital videos, data, photos shall be delivered to Erwin Utilities with an external hard drive which will be returned to the CONTRACTOR.

1.02 SUBMITTALS

A. Action Submittals: Catalog and manufacturer's data sheets for television equipment.

B. Informational Submittals:

1. References: Contact names and telephone numbers.

2. List of staff and equipment to be used on Project.

3. Crew chief qualifications.

4. Traffic control plan.

5. Look-ahead inspection schedules, minimum of 7 days in advance of the Work.

6. Initial first days' CCTV digital videos and inspection logs within 24 hours of start of CCTV inspection.

7. Certification that staff to be used for the Work is properly trained in confined space entry and hazardous atmospheres.

8. Training and inspection plan, 7 days prior to manual inspection.

9. Final report.

1.03 QUALITY ASSURANCE

A. Qualifications:

1. CONTRACTOR: Performed work successfully for at least three other projects, within last 5 years, with pipe lengths and pipe diameters similar to this Project.

2. Crew Chief: Minimum of 5 years' experience on projects similar to this Project and experienced using proposed equipment for this Project.

B. Pre-startup Meeting: At least 5 days prior to beginning CCTV inspection work, schedule with Erwin Utilities to review proposed sewer flow bypassing plan, traffic control plans, and inspection methods.

C. Submit digital videos, photos and logs for quality review and comment to Erwin Utilities within 24 hours after the first days' work is completed. Submit tapes and logs on a routine basis within 7 days after completing each tape. Picture quality and definition shall be to the satisfaction of Erwin Utilities. Inspection equipment that fails to produce satisfactory inspection quality shall be removed.

1.04 NOTIFICATIONS

A. Notify Erwin Utilities:

1. A minimum of 5 days prior to the anticipated commencement of inspections in any one area and 24 hours in advance of actual start.

2. When obstruction, restricting flow in pipeline, is discovered.

3. If depth of flow in pipeline exceeds 33 percent of pipe diameter.

4. If conditions for CCTV inspection are found to be unsafe or impractical.

5. Pipe configuration in field is different than shown on maps. Notification shall include diagram clearly indicating location of structure in relation to immediately adjacent structures.

PART 2: PRODUCTS

2.01 TELEVISION INSPECTION EQUIPMENT

A. CONTRACTOR shall provide a mobile vehicle with video monitoring equipment specifically compatible with the camera equipment being used. The equipment shall include dual video recorders, dual monitors, and picture capture capability. The vehicle shall be large enough to accommodate at least three people at any time for viewing of the monitor. Erwin Utilities shall have unrestricted access to observe the television screen and all other operations at all times.

B. The basic equipment for use in cleaning and inspection operations shall consist of hydraulically propelled or mechanical cleaning equipment and a self-propelled full color television inspection camera with footage meter, pan, and tilt functions.

C. The television camera used for the inspection shall be one specifically designed and constructed for such inspection. Lighting for the camera shall be suitable to allow a clear color picture of the entire periphery of the pipe. The camera shall be capable of a 360 degree viewing area. Backup camera shall be available on the Project Site. The camera shall be operative in 100% humidity conditions. Camera shall be operative in a hazardous and/or corrosive environment.

D. The camera, television monitor, and other components of the video system shall be capable of producing picture quality to the satisfaction of Erwin Utilities.

E. The television inspection equipment shall have an accurate footage counter that shall display on the monitor the exact distance of the camera from the centerline of the starting manhole.

2.02 SONAR INSPECTION

A. Sonar inspection may be used if the technology is proven in the industry and with the approval of the Erwin Utilities.

B. If sonar inspection is approved, it will be done in exception to the requirements of this section.

PART 3: EXECUTION

3.01 PREPARATION

A. Prior to televising, CONTRACTOR shall thoroughly clean the pipelines of debris, grease, roots, sediment, broken pipe, or other obstructions that could retard the movement of the television camera. Precautions shall be taken to protect the sewer lines being cleaned from damage by the cleaning equipment.

B. Immediately after cleaning, the sewer line section shall be visually inspected by means of closed-circuit television to determine the condition of the line and to locate existing service connections. The inspection will be done one manhole section at a time and the flow in the section being inspected will be suitably controlled as specified.

C. All internal pipe damage shall be photographed in color by CONTRACTOR utilizing picture capture equipment, and shall be clearly labeled as to date, each number, footage, and type of defect. The photographs shall be the property of Erwin Utilities.

3.02 TELEVISION INSPECTION

A. The camera shall be moved through the line in either direction at a moderate rate, stopping when necessary to permit proper documentation of the sewer line section condition. In no case will the television camera be pulled at a speed greater than 30 feet per minute. Manual winches, power winches, TV cable, and powered rewinds or other devices that do not obstruct the camera view or interfere with proper documentation of the sewer conditions shall be used to move the camera through the sewer line.

B. When manually operated winches are used to pull the television camera through the line, telephones or other suitable means of communication shall be set up between the two manholes of the section being inspected to insure good communications between members of the crew.

C. The importance of accurate distance measurements is emphasized. Measurement for location of defects shall be above ground by means of a meter device. Marking on the cable, or the like, which would require interpolation for depth of manhole, will not be allowed. Accuracy of the distance meter shall be checked by use of a walking meter, roll-a-tape, or other suitable device, and the accuracy shall be satisfactory to Erwin Utilities.

D. The camera height shall be adjusted such that the camera lens is always centered (2 I.D. or higher) in the pipe being televised.

E. Lighting system shall be adequate for quality pictures. A reflector in front of the camera may be required to enhance lighting in black pipe.

3.03 PASSAGE OF TV CAMERA

A. There may be occasions during the TV inspection of a sewer line section, when the camera will be unable to pass an obstruction even though flow is continuing. CONTRACTOR shall televise the manhole section from the other direction in order to obtain a "full" video of this manhole section. Whenever such condition arises, Erwin Utilities shall be notified to determine if a point repair is necessary. No additional payment shall be made for reverse set-ups required due to an obstruction.

B. TV videos shall be submitted in one continuous section from manhole to manhole, and not in broken pieces, unless specifically approved by Erwin Utilities.

C. When the camera is being pulled from the "other end" and a second repair location is encountered away from the first repair/obstruction location, Erwin Utilities shall be notified and allowed to review the TV DVD at the Site in a timely manner. Obtain Erwin Utilities' permission to make the two point repairs. No downtime shall be allowed.

D. If the two point repairs are allowed and completed, CONTRACTOR shall again proceed to re-televise the sewer line section. Generally, up to 20 feet of the line from each of the ends of the two point repairs may be lamped or physically inspected at the Site, to verify the condition of the line without further TV.

E. Erwin Utilities makes no guarantee that all of the sanitary sewer mains proposed to be TV inspected after the cleaning, are clear for the passage of the camera set-up. The equipment, tools and method(s) used for securing the passage of the camera are to be at the discretion of CONTRACTOR, with the approval of Erwin Utilities. The decision to repair or not to repair a location shall always be made by Erwin Utilities.

F. If cleaning of an entire section cannot be successfully performed from one manhole, the equipment shall be reset on the other manhole and cleaning again attempted. If again, successful cleaning cannot be performed or the equipment fails to traverse the entire pipeline section, it will be assumed a major blockage exists and the cleaning effort shall be terminated only at the direction of Erwin Utilities.

G. During all sewer-cleaning operations, satisfactory precautions shall be taken to protect the sewer lines from damage that might be inflicted by the improper use of cleaning equipment. Whenever hydraulically-propelled cleaning tools, which depend on water pressure to provide their cleaning force or any tools which retard

the flow of water in the sewer line are used, precautions shall be taken to ensure that the water pressure created does not cause any damage to or flooding of public or private property being serve by the sewer section involved.

H. Roots shall be removed in the sections where root intrusion is a problem. Special precautions should be exercised during the cleaning operation to assure complete removal of visible roots from the joint area. Any visible roots that may impact rehabilitation efforts shall be removed. Procedures may include the use of mechanical devices such as rodding machines, expanding root cutters and porcupines, and hydraulic procedures such as high-pressure jet cleaners.

I. To aid in the removal of roots and at the option of CONTRACTOR, sewer sections that have root intrusion may be treated with an Erwin Utilities-approved herbicide. The application of the herbicide to the roots shall be done in strict accordance with the manufacturer's recommendations and specifications in such a manner to preclude any damage to the surrounding vegetation. CONTRACTOR shall replace any damaged vegetation so designated by Erwin Utilities, at no additional cost to Erwin Utilities. All safety precautions as recommended by the manufacturer shall be strictly adhered to concerning handling and application of the herbicide.

J. CONTRACTOR, after cleaning a section of pipe, shall utilize the television camera to inspect the main. No line shall be considered cleaned until Erwin Utilities approves.

K. The television camera shall be moved through the line in either direction at a uniform rate, stopping when necessary to insure proper documentation of the sewer's condition, but in no case shall the television camera travel at a speed greater than 30 feet per minute.

L. The television camera shall travel through the lines using its own power. The pictures taken of the entire inside periphery of the pipe shall be clear and visible. Picture quality and definition shall be to the satisfaction of Erwin Utilities, and if unsatisfactory, the equipment shall be removed and no payment made for the unsatisfactory inspection.

M. At all service laterals the camera shall be stopped and panned to such an angle that an internal view of the service lateral is available to determine if the lateral is active or dead or plugged. Where other pipe deficiencies are noted, the camera shall be stopped to observe the condition, record information and take photographs. Any service lateral or deficiency observed in the sewer line shall be photographed and described on the photograph.

3.04 FLOW CONTROL

A. TV inspection shall be done one sewer line section at a time, and the flow in the section being televised shall be suitably controlled. The depth of wastewater flow shall not exceed that shown below:

6" - 10" Pipe:	20% of pipe's diameter
12"- 24" Pipe:	25% of pipe's diameter
Over 24" Pipe:	30% of pipe's diameter

B. When the depth of flow in the section being worked is above the maximum allowable for the television inspection, the flow shall be reduced to allowable levels by performing the inspection during minimum flow hours, with diversion pumping or by pulling camera with swab or a high velocity jet nozzle, as approved by Erwin Utilities.

C. No separate payment shall be made for sewer flow control.

D. CONTRACTOR shall not be allowed to float the camera unless permitted by Erwin Utilities.

E. When flow in a sewer line is plugged, blocked, or bypassed; sufficient precautions must be taken to protect the sewer lines from damage that might result from sewer surcharging. Further, precautions must be taken to insure that sewer flow control operations do not cause flooding or damage to public or private property being served by the sewers involved.

3.05 DOCUMENTATION

A. CONTRACTOR shall submit in electronic format digital videos, photos, and evaluation reports, to Erwin Utilities for review. Erwin Utilities' review and comment period may require up to 10 working days from the date of submittal.

B. The digital video shall be recorded at Standard Play and each digital video segment information entered in the software as required under Article Basic Module (1) – Survey/Logging Report.

C. If digital videos are of such poor quality that Erwin Utilities is unable to evaluate the condition of the sanitary sewer main, locate the sewer service connections, or verify the cleaning CONTRACTOR shall be required to re-televise the sanitary sewer and provide new digital videos of good quality, at no additional cost to Erwin Utilities.

D. All digital videos will become the property of Erwin Utilities.

E. Payment deduction of $50 per digital video shall apply for poor and unacceptable quality digital videos or for portions of sewer not televised. Camera distortions, inadequate lighting, dirty lens or blurred/hazy picture will be cause for rejection of the Work.

3.06 BASIC MODULE - SURVEY/LOGGING REPORT

A. The software's core module shall be capable of providing complete survey reports and be PACP (Pipeline Assessment and Certification Program) certified by NASSCO. The software shall be the latest version of GraniteXP.

B. There shall be PACP Complaint codes pre-programmed and grouped by PACP Groups.

C. The software shall be capable of customization with the ability to modify or add to the pipeline condition and group them for ease of use.

D. The footage reading from the camera equipment shall be automatically entered into the Survey Log through RS232 cable and shall directly correspond to the noted defect location throughout the pipe graphic and tabular reports generated.

E. The inspection and reporting software program shall be menu-driven and shall have a complete on-screen help file.

F. Drop-down boxes shall be utilized to quickly reference common information such as defects, pipe materials, survey purpose, locations, pipe usage, etc.

G. The browser screen shall allow quick viewing of:

1. Sequential survey/segment as setup number (automatic input by software).

2. User-selected categories.

3. Up-stream and down-stream manhole numbers.

4. Street name.

5. Pipe segment details.

6. Drainage basin number.

H. All relevant pipe segment information shall be entered prior to the actual survey. The below listed minimum pipe details must be supplied in the software for proper system management. The graphic and tabular survey reports generated shall include the following information:

1. Pipe diameter.
2. Starting manhole number.
3. Ending manhole number.
4. Starting manhole depth.
5. Ending manhole depth.
6. Direction of survey.
7. Pre-clean (y/n).
8. Total surveyed length.
9. Pipe material.
10. Pipe section length.
11. Pipe shape.
12. Road name.
13. Address or place name.
14. Inspection of survey date.

I. GraniteXP software shall maintain a database of underground pipe and manhole assets. The database(s) shall have structure similar to the one referencing pipe usage (i.e., sanitary storm drainage, etc.) sections (i.e., projects, areas, or quadrants). Surveys shall include a method of pipe segment numbering and a chronological survey set-up numbering system.

J. GraniteXP's basic module database shall have the means to sort in ascending and descending order according to date, pipe segment, reference number, road name, manhole number(s), observed footage, pipe materials, pipe diameters, work order numbers, etc. A filtering system shall also be made available.

K. The basic module software shall have search capabilities in order to find information about past surveys located in the database(s).

L. A summary paragraph shall be made available for a conclusive pipe segment assessment.

M. The graphical reports shall print in color for quick glance referencing of the defect category. The color-coding scheme shall allow for quick reference as to the quality of service, structural, hydraulic, and constructional defects within a particular survey.

N. A scoring system incorporated in the software will assist the user/management personnel in making proper assessment of pipe conditions. Scoring is to be based upon defect severity entered by the operator.

O. An inspection "health check" feature shall be incorporated to insure that the information has been correctly entered. The health check allows for verification of essential information to complete a survey. This feature can be implemented individually or on a total selection basis.

P. A Site sketch feature shall also be supplied so that a drawing or sketch shall indicate special details or locations about a particular set-up Site.

Q. The software shall also have the capability to import and export survey results in a variety of industry standard formats.

3.07 BASIC MODULE - SUMMARY REPORTING

A. Summary reports compiling data from multiple inspections shall be available. Such reports shall indicate individual survey results in tabular from and list (sort) surveys based on a user-defined description field.

B. Defect report shall be programmable to list specific defects observed with corresponding footage, starting and ending manhole number, structural pipe defects (i.e., cracks, offsets, defective laterals, collapsed pipe, etc.) and service-oriented defects (i.e., roots, grease, obstructions, infiltration, etc.).

C. A drainage schedule report shall include starting and ending manhole numbers, depths, pipe material, total survey length, and pipe diameter.

D. The grading scores report shall summarize the manhole numbers, pipe material, pipe diameter, and the grade scores for each survey with totals.

E. Service and structural aspect scoring reports are to list the pipe segment, reference number, total observed length, number of defects, and total score with reference to the condition of the total pipe, average of the pipe, total defects, and average of defects.

F. Section summary reports are to be made available so that all surveys within a section are listed showing purpose of inspection, date, work order numbers, manholes, road names, and total lengths.

G. All software shall be compatible with Erwin Utilities' current system.

3.08 EVALUATION REPORTS

A. Each video shall be accompanied by a TV inspection report, which shall be a written/narrated log of all pipe defects, sags, service connection locations and conditions, etc., recorded on a footage basis. Report shall be provided in an electronic (computer usable) format that is transferable to a Microsoft Access database.

B. The pipe defects shall include separate codes for the following: Radial Cracks, Longitudinal Cracks, Misaligned Joints, Broken Joints, Root Intrusion, Laterals, and Infiltration. The size/length of the defect shall be reported. The beginning of all sags of the pipe, the length that is underwater as well as where the camera pulls out of the sag shall be reported. The clock position of each service connection and the condition shall be reported. The condition of each service connection will include the distance protruding when appropriate and the type. All other information required for analysis such as degrees of deterioration, deformation or collapsed pipe shall be reported. All reports and/or submittals shall adhere to Pipeline Assessment Certification Program (PACP) Standards.

C. This log shall also identify the section being televised, flow and camera direction, type of pipe, pipe condition, weather conditions, type of surface cover, or any other information required by Erwin Utilities.

D. Erwin Utilities may provide CONTRACTOR a log form that utilizes codes for the above-mentioned defects.

E. At the end of the Project CONTRACTOR shall provide a summary listing of all videos provided under this Project.

END OF SECTION

SECTION 02905 RESTORATION OF SURFACES

PART 1: GENERAL

1.01 SCOPE OF WORK

A. This Section covers the furnishing of all labor, equipment, and materials necessary for the proper restoration of existing surfaces disturbed or damaged as a result of construction operations that are not specifically scheduled or specified for topsoil and seeding, paving, landscaping, or other surfacing.

B. In general, the types of replacement included in this section are seeding along pipelines, concrete sidewalks, driveways, roadways, ditches, lawns and landscaped areas, and curb and gutter.

C. Any damage to existing structures shall be repaired using materials and workmanship equal to those of original construction.

PART 2: NOT USED

PART 3: EXECUTION

3.01 RESTORATION OF SURFACES

A. SEEDING ALONG PIPELINES

1. All ground surfaces along pipelines that are not classified as lawns, landscaped areas, or pavement areas, but would be classified as open fields, shall be raked smooth and seeded in accordance with Section 02931 – Seeding, Mulching, and Fertilizing. Large rocks, clumps of earth, and excessive spoil material shall be removed from the area prior to seeding.

2. Shoulders of all roads shall be restored as specific for lawns and landscaped areas.

3. Wooded areas not classified as lawns shall be restored to as near their original condition as possible.

B. CONCRETE SIDEWALKS

1. Concrete walks removed in connection with, or damaged as a result of, construction operations under the Contract shall be replaced with new construction. Such walks shall be constructed of Class A concrete on a thoroughly compacted subgrade or mineral aggregate base as shown. Concrete walks shall have a vertical thickness of not less than four inches (4") or not less than the thickness of the replaced walk where greater than four inches (4").

2. Walks shall be float finished, edged with an edging tool, and grooved at intermediate intervals not in excess of the width of the walk, uniform throughout the length of the walk in any one direction.

C. DRIVEWAYS

1. Unpaved driveways shall be surfaced with not less than three inches (3") of mineral aggregate base, topped with three inches (3") of stone, gravel, or other materials equal to that found in the original driveway. Driveways shall be left in a condition better than their original condition.

2. Unless otherwise specified, concrete drives shall be replaced with Class A concrete and shall have equal thickness and reinforcing steel to that of the original drive. Prior to placing the concrete, a six-inch (6") layer of compacted mineral aggregate base shall be placed in the drive area.

3. Bituminous or asphaltic concrete drives shall be restored with a six-inch (6") layer of compacted mineral aggregate base and a two-inch (2") layer of compacted asphaltic concrete surface (hot mix), grading E.

D. ROADWAY REPLACEMENT

1. Bituminous or asphaltic pavements shall include all areas paved with blacktop, built-up pavements of oil and stone or tar and stone, and similar pavements constructed with bituminous or asphaltic and stone materials.

2. Immediately upon completion of installation of underground piping and structures, the trench shall be backfilled and the roadway shall be repaired. Unless otherwise noted, in the excavated area, the repair shall consist of a six-inch (6") aggregate base course, a four-inch (4") HB Binder Course, and a two-inch (2") surface course. If, in the opinion of the City, the area adjacent to the excavation has

not been damaged to the extent that the base course need to be replaced, restoration may consist of a surface course of sufficient thickness to meet the existing pavement.

3. Portland cement concrete roadways shall be replaced with Class A concrete and shall have equal thickness and reinforcing steel as the original roadway. A mineral aggregate base layer of six inches (6") compacted thickness shall be placed prior to the placing of concrete.

4. Differential settlement of restored pavements shall be corrected immediately.

5. The Contractor shall repair and restripe any traffic markings that were damaged, removed, or covered during construction. All work shall be done in accordance with TDOT requirements and specifications.

6. All existing manhole and valve covers shall be raised as required by the Contractor prior to paving. The cost of this work shall be included in the unit bid prices for other related work and no additional payment shall be made, unless otherwise noted.

E. DITCHES

Ditches shall be regraded to the original grade and line. The surface of all ditches shall be returned to the same condition as found before commencing work and provide positive drainage.

F. LAWNS AND LANDSCAPED AREAS

1. Lawns and landscaped areas shall be regraded and replaced as follows:

   a. Grading shall be to the grade existing before construction of the work under this Contract.

   b. Lawn replacement shall be in accordance with the Section 02931. Topsoiled areas shall be replaced with topsoil of equal quality and quantity.

2. Landscaped areas shall be replaced with shrubs, hedges, ornamental trees, flowers, or other items to original condition.

G. CURB AND GUTTER

Curb and gutter removed with, or damaged as a result of, construction operations or injured or disturbed by the Contractor, his agents, or employees shall be replaced with new construction to a condition equal to that existing before damage was incurred. Class A Concrete shall be used in curb and gutter replacement.

H. DAMAGE TO STRUCTURES

Any damage to existing structures shall be repaired of materials and workmanship equal to those of original construction. Extensively damaged structures, where the structural stability has been affected or that cannot be repaired in a suitable fashion shall be replaced entirely. Replacement shall not commence until approval of the plan of replacement has been given by the City. Replacement costs shall be responsibility of the Contractor.

END OF SECTION

SECTION 02931 SEEDING, FERTILIZING, AND MULCHING

PART 1: GENERAL

1.01 SCOPE OF WORK

A. This section covers the furnishing of all labor, equipment, and materials necessary for the landscaping of all areas of the site disturbed by construction operations and all earth surfaces of embankments, including rough and fine grading, topsoil if required, fertilizer, lime, seeding, and straw mulching.

B. The Contractor shall adapt his operations to variations in weather or soil conditions as necessary for the successful establishment and growth of the grasses or legumes.

PART 2: PRODUCTS

2.01 MATERIALS

A. FERTILIZER

1. The quality of fertilizer and all operations in connection with the furnishing of this material shall comply with regulations adopted by the Tennessee Department of Agriculture and maximum application rates shall conform to the University of Tennessee's Agricultural Extension Service's Publication PB1038.

2. Fertilizer shall be 10-10-10 grade. Upon written approval of Erwin Utilities, a different grade of fertilizer may be used, provided the rate of application is adjusted based on soil conditions and cover requirements.

3. During handling and storing, the fertilizer shall be cared for in such a manner that it will be protected against hardening, caking, or loss of plant food values. Any hardened or caked fertilizer shall be pulverized to its original condition before being used.

B. LIME

1. The quality of lime and all operations in connection with the furnishing of this material shall comply with the requirements of the Tennessee Department of Agriculture.

2. During the handling and storing, the lime shall be cared for in such a manner that it will be protected against hardening and caking. Any hardened or caked lime shall be pulverized to its original condition before being used.

3. Lime shall be agriculture grade ground dolomitic limestone. It shall contain not less than eighty-five percent (85%) of the calcium and magnesium carbonates and shall be of such fineness that at least ninety percent (90%) will pass a No. 10 sieve and at least fifty percent (50%) will pass a No. 100 sieve.

C. SEED

1. The quality of seed and all operations in connection with the furnishing of this material shall comply with the regulations adopted by the Tennessee Department of Agriculture.

2. Seed shall have been approved by the Tennessee Department of Agriculture or any agency approved by Erwin Utilities before being sown, and no seed will be accepted with a date of test more than nine (9) months prior to the date of sowing. Such testing however, will not relieve the Contractor from responsibility for furnishing and sowing seed that meets these specifications at the time of sowing. When a low percentage of germination causes the quality of the seed to fall below the minimum pure live seed specified, the Contractor may elect, subject to the approval of Erwin Utilities, to increase the rate of seeding sufficiently to obtain the minimum pure live seed contents specified, provided that such an increase in seeding does not cause the quantity of noxious weed seed per square yard to exceed the quantity that would be allowable at the regular rate of seed.

3. During handling and storing, the seed shall be cared for in such a manner that it will be protected from damage by heat, moisture, rodents, or other causes.

4. Seed shall be entirely free from bulblets or seed of Johnson Grass, Nutgrass, Sandbur, Wild Onion, Wild Garlic, and Bermuda Grass. The specifications for restricted noxious weed seed refers to the number per pound, singly or collectively, of Blessed Thistle, Wild Radish, Canada Thistle, Corncockle, Field Bindweed, Quackgrass, Dodders, Dock, Horsenettle, Bracted Plantain, Buckhorn, or Wild Mustard; but in no case shall the number of Blessed Thistle or Wild Radish exceed twenty-seven (27) seeds of each per pound. No tolerance on weed seed will be allowed.

D. MULCH

Straw mulch shall be threshed straw of Oats, Rye, or Wheat free from matured seed of obnoxious weeds or other species that would grow and be detrimental to the specified grass.

E. TACKIFIER/ HYDROSEEDING

Emulsified asphalt or organic tackifier such as Reclamare R2400 shall be sprayed uniformly on mulch as it is ejected from blower or immediately thereafter. Tackifier shall be applied evenly over area creating uniform appearance. Rates of application will vary with conditions. Asphalt shall not be used in freezing weather.

PART 3: EXECUTION

3.01 PREPARATION

A. PROTECTION OF EXISTING TREES AND VEGETATION

1. Protect existing trees and other vegetation indicated to remain in place against unnecessary cutting, breaking, or skinning of roots; skinning and bruising of bark; smothering of trees by stockpiling construction materials or excavated materials within drip line; excess foot or vehicular traffic; or parking of vehicles within drip line. Provide temporary guards to protect trees and vegetation to be left standing.

2. Provide protection for roots over one and a half inch (1-1/2") diameter cut during construction operations. Coat cut faces with an emulsified asphalt, or other acceptable coating, formulated for use on damaged plant tissues. Temporarily cover exposed roots with wet burlap to prevent roots from drying out and cover with earth as soon as possible.

3. The Contractor shall not remove or damage trees and shrubs that are outside the Clearing Limits established by the Owner or those within the Clearing Limits designated to remain.

4. Repair trees scheduled to remain and damaged by construction operations in a manner acceptable to Erwin Utilities. Repair damaged trees promptly to prevent progressive deterioration caused by damage.

5. Replace trees scheduled to remain and damaged beyond repair by construction operations, as determined by Erwin Utilities with trees

of similar size and species. Repair and replacement of trees scheduled to remain and damaged by construction operations or lack of adequate protection during construction operations shall be at the Contractor's expense.

B. GRADING

1. Rough grading shall be done as soon as all excavation required in the area has been backfilled. The necessary earthwork shall be accomplished to bring the existing ground to the desired finish elevations as shown on the Contract Drawings or otherwise directed.

2. Fine grading shall consist of shaping the final contours for drainage and removing all large rock, clumps of earth, roots, and waste construction materials. It shall also include thorough loosening of the soil to a depth of six inches (6”) by plowing, discing, harrowing, or other approved methods until the area is acceptable as suitable for subsequent landscaping operations. The work of landscaping shall be performed on a section by section basis immediately upon completion of earthwork.

3. Upon failure or neglect on the part of the Contractor to coordinate his grading with seeding and mulching operations and diligently pursue the control of erosion and siltation, Erwin Utilities may suspend the Contractor's grading operations until such time as the work is coordinated in a manner acceptable to Erwin Utilities.

C. SEEDBED PREPARATION

1. The Contractor shall cut and satisfactorily dispose of weeds or other unacceptable growth on the areas to be seeded. Uneven and rough areas outside of the graded section, such as crop rows, farm contours, ditches and ditch spoil banks, fence line and hedgerow soil accumulations, and other minor irregularities that cannot be obliterated by normal seedbed preparation operations, shall be shaped and smoothed as directed by Erwin Utilities to provide for more effective seeding and for ease of subsequent mowing operations.

2. The soil shall then be scarified or otherwise loosened to a depth of not less than six inches (6”) except as otherwise provided below or otherwise directed by Erwin Utilities. Clods shall be broken and the top two to three inches (2”-3”) of soil shall be worked into an acceptable seedbed by the use of soil pulverizers, drags, or harrows; or by other methods approved by Erwin Utilities.

3. On 2:1 slopes, a seedbed preparation will be required that is the same depth as that required on flatter areas, although the degree of smoothness may be reduced from that required on the flatter areas if so permitted by Erwin Utilities.

4. On cut slopes that are steeper than 2:1, both the depth of preparation and the degree of smoothness of the seedbed may be reduced as permitted by Erwin Utilities, but in all cases the slope surface shall be scarified, grooved, trenched, or punctured so as to provide pockets, ridges, or trenches in which the seeding materials can lodge.

5. On cut slopes that are either 2:1 or steeper, Erwin Utilities may permit the preparation of a partial or complete seedbed during the grading of the slope. If at the time of seeding and mulching operations such preparation is still in a condition acceptable to Erwin Utilities, additional seedbed preparation may be reduced or eliminated.

6. The preparation of seedbeds shall not be done when the soil is frozen, extremely wet, or when Erwin Utilities determines that it is in an otherwise unfavorable working condition.

D. APPLICATION RATES

Seed shall be applied by means of a hydro-seeder or other approved methods. The rates of application of seed, fertilizer, and limestone shall be as stated below.

1. Lime and Fertilizer

In the absence of a soil test, the following rates of application of limestone and fertilizer shall be:

a. 4,000 pounds limestone per acre;
b. 1,000 pounds 10-10-10 (N-$P_2 0_5$-$K_2 0$) fertilizer per acre.

2. Mulch

Mulch shall be applied at the following rates per acre:

a. 3,000-4,000 pounds straw mulch;
b. 1,500-2,000 pounds wood cellulose fiber;
c. 35-40 cubic yards of shredded or hammermilled hardwood bark; or

d. 1,200-1,400 pounds of fiberglass roving.

3. Seed

The kinds of seed and the rates of application shall be as contained in this table. All rates are in pounds per acre. *See Notes 1 and 2*.

a. Fall and Winter (Normally September 1 to May 1)

80 pounds of Ky-31 Tall Fescue and 15 pounds of Rye Grain

b. Summer (Normally May 1 to September 1)

100 pounds of Ky-31 Tall Fescue

NOTE:

1. On cut and fill slopes having 2:1 or steeper slopes, add forty (40) pounds of Sericea lespedeza per acre to the planned seeding (hulled in spring and summer unhulled in fall and winter) plus fifteen (15) pounds of Sudangrass in summer seeding or twenty-five (25) pounds of Rye Cereal per acre in fall and winter seeding, if seeded September to February.

2. These seeding rates are prescribed for all sites with less than fifty percent (50%) ground cover and for sites with more than fifty percent (50%) ground cover where complete seeding is necessary to establish effective erosion control vegetative cover. On sites having fifty to eighty percent (50%-80%) ground cover where complete seeding is not necessary to establish vegetative cover, reduce the seeding rate at least one-half the normal rate.

E. APPLICATION

1. Equipment to be used for the application, covering, or compaction of limestone, fertilizer, and seed shall have been approved by Erwin Utilities before being used on the project. Approval may be revoked at any time if equipment is not maintained in satisfactory working condition or if the equipment operation damages the seed.

2. Limestone, fertilizer, and seed shall be applied within twenty-four (24) hours after completion of seedbed preparation unless otherwise permitted by Erwin Utilities, but no limestone or fertilizer shall be distributed and no seed shall be sown when Erwin Utilities determines that weather and soil conditions are unfavorable for such operations.

3. Limestone may be applied as a part of the seedbed preparation, provided it is immediately worked into the soil. If not so applied, limestone and fertilizer shall be distributed uniformly over the

prepared seedbed at the specific rate of application and then harrowed, raked, or otherwise thoroughly worked or mixed into the seedbed.

4. Seed shall be distributed uniformly over the seedbed at the required rate of application, and immediately harrowed, dragged, raked, or otherwise worked so as to cover the seed with a layer of soil. The depth of covering shall be as directed by Erwin Utilities. If two (2) kinds of seed are to be used that require different depths of covering, they shall be sown separately.

5. When a combination seed and fertilizer drill is used, fertilizer may be drilled in with the seed after limestone has been applied and worked into the soil. If two (2) kinds of seed are being used that require different depths of covering, the seed requiring the lighter covering may be sown broadcast or with a special attachment to the drill, or drilled lightly following the initial drilling operation.

6. When a hydraulic seeder is used for application of seed and fertilizer, the seed shall not remain in water containing fertilizer for more than thirty (30) minutes prior to application unless otherwise permitted by Erwin Utilities.

7. Immediately after seed has been properly covered the seedbed shall be compacted in the manner and degree approved by the Engineer.

8. When adverse seeding conditions are encountered due to steepness of slope, height of slope, or soil conditions, Erwin Utilities may direct or permit that modifications be made in the above requirements that pertain to incorporating limestone into the seedbed; covering limestone, seed, and fertilizer; and compaction of the seedbed.

9. Such modifications may include but not be limited to the following:

    a. The incorporation of limestone into the seedbed may be omitted on:

        i. cut slopes steeper than 2:1;

        ii. 2:1 cut slopes when a seedbed has been prepared during the excavation of the cut and is still in an acceptable condition; or

        iii. areas of slopes where the surface of the area is too rocky to permit the incorporation of the limestone.

b. The rates of application of limestone, fertilizer, and seed on slopes 2:1 or steeper or on rocky surfaces may be reduced or eliminated.

c. Compaction after seeding may be reduced or eliminated on slopes 2:1 or steeper, on rocky surfaces, or on other areas where soil conditions would make compaction undesirable.

F. STRAW MULCHING

1. All seeded areas shall be mulched unless otherwise indicated in the special provisions or directed by the Engineer.

2. It shall be spread uniformly at a rate of two (2) tons per acre in a continuous blanket over the areas specified.

3. Before straw mulch is applied on cut or fill slopes that are 3:1 or flatter and ditch slopes, the Contractor shall remove and dispose of all exposed stones in excess of three inches (3”) in diameter and all roots or other debris that will prevent proper contact of the mulch with the soil.

4. Straw mulch shall be applied within twenty-four (24) hours after the completion of the seeding unless otherwise permitted by Erwin Utilities. Care shall be exercised to prevent displacement of soil or seed or other damage to the seeded area during the mulching operations.

5. Straw mulch shall be uniformly spread by hand or by approved mechanical spreaders or blowers which will provide an acceptable application. An acceptable application will be that that will allow some sunlight to penetrate and air to circulate but also partially shade the ground, reduce erosion, and conserve soil moisture.

6. Straw mulch shall be held in place by applying a sufficient amount of asphalt or other approved binding material to assure that the mulch is properly held in place. The rate and method of application of binding material shall meet the approval of Erwin Utilities. Where the binding material is not applied directly with the mulch, it shall be applied immediately following the mulch operation.

7. The Contractor shall take sufficient precautions to prevent mulch from entering drainage structures through displacement by wind, water, or other causes and shall promptly remove any blockage to drainage facilities that may occur.

G. MAINTENANCE

1. The Contractor shall keep all seeded areas in good condition, reseeding and mowing if and when necessary as directed by Erwin Utilities, until a good lawn is established over the entire area seeded and shall maintain these areas in an approved condition until final acceptance of the Contract.

2. Grassed areas will be accepted when a ninety-five percent (95%) cover by permanent grasses is obtained and weeds are not dominant. On slopes, the Contractor shall provide against washouts by an approved method. Any washouts that occur shall be regraded and reseeded until a good sod is established.

3. Areas of damage or failure due to any cause shall be corrected by being repaired or by being completely redone as may be directed by Erwin Utilities. Areas of damage or failure resulting either from negligence on the part of the Contractor in performing subsequent construction operations or from not taking adequate precautions to control erosion and siltation as required throughout the various sections of the Specifications, shall be repaired by the Contractor at his cost and as directed by Erwin Utilities.

END OF SECTION

SECTION 11307 SUBMERSIBLE SEWAGE PUMP STATION

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The work covered by this Section shall consist of furnishing all materials, labor, equipment, and services for the installation of sewage pumps for use in lift stations. Contractor shall include all labor, materials, equipment, incidentals, and ancillary components to make a complete system.

B. Unless otherwise noted, all materials and equipment supplied under this Section shall be new, of good quality, and in good condition.

1.02 SYSTEM DESCRIPTION

A. DESIGN REQUIREMENTS

1. Pump(s) shall be installed in such a way that solids are fed in an upflow direction to the non-clog impeller with no feet, rails, or other obstructions below inlet. Pump shall not be intended to handle abrasive materials or sewage containing large amounts of sand, grit, or other stone-like compositions.

2. The principal items of equipment shall include two (2) submersible centrifugal sewage pumps, submersible electric motors, internal piping, valves, motor control panel, liquid level control system, and a magnetic flowmeter.

3. The sewage pump station wetwell and valve vault shall be precast concrete.

B. PERFORMANCE CRITERIA

Pumps must be designed to handle raw, unscreened, domestic sanitary sewage and capable of passing a three-inch (3") spherical solid. Each pump shall be selected to perform under following operating conditions, to be determined by the design engineer on a per-project basis:

Capacity (gpm)	To Be Determined for Specific Conditions
Total Dynamic Head (ft)	To Be Determined for Specific Conditions
Total Discharge Static Head (ft)	To Be Determined for Specific Conditions

C. UTILITY POWER REQUIREMENTS

Site power furnished to pump station shall be three-phase, 240 or 480 volt (V), 60 hertz (Hz), three (3) wire, and shall be maintained within industry standards. Erwin Utilities should be contacted to determine the available power. Voltage tolerance shall be plus or minus ten percent (+/- 10%). Phase-to-phase unbalance shall not exceed one percent (1%) average voltage as set forth in NEMA Standard MG-1. Control voltage shall not exceed 132 V.

1.03 QUALITY ASSURANCE

A. MANUFACTURER

The submersible pump shall be supplied by a reputable Manufacturer with at least five (5) years' experience in the manufacture of submersible solids handling pumps for wastewater applications. Acceptable manufacturers include Flygt, Fairbanks-Morse, ABS, and Gorman-Rupp, or approved equal.

B. PUMP STATION WIRING

1. The pump station shall be completely wired at the factory except for the power feeder lines. Wiring diagrams matching the unit wiring shall be provided to Erwin Utilities by the Manufacturer.

2. All components and workmanship shall be UL-certified and bear the UL serialized label.

B. FACTORY TESTS

1. The pumps shall be tested at the factory under simulated field conditions for excessive vibration, leaks, and operation of all automatic systems.

2. The controls shall be adjusted to start and stop the pumps to satisfy field conditions.

3. For each unit, a pump performance curve shall be produced from the factory testing. Its veracity shall be certified, and the curves shall be identifiable by serial numbers of pumps and motors. Manufacturer shall submit legible size copies of the certified curves to Erwin Utilities. Erwin Utilities will judge adequacy of performance and distribute copies of curves appropriately.

1.04 SUBMITTALS

A. SHOP DRAWINGS

The Contractor shall submit five (5) sets of shop drawings and/or wiring diagrams that satisfy the conditions of Subsection 01200, 1.04, for the major equipment to be installed such as the pump, motor starters, instrumentation, and controls.

B. OPERATION AND MAINTENANCE MANUALS

Three (3) copies of a standard operation and maintenance manual for the pump units shall be supplied by the Contractor.

1.05 DELIVERY, STORAGE, AND HANDLING

All equipment shall be delivered, stored, and handled in strict accordance with the Manufacturer's recommendations.

1.06 WARRANTY

A. The Contractor shall include in the bid price for this item a guarantee to Erwin Utilities from the Manufacturer(s), for one (1) year from the date of final acceptance by Erwin Utilities, that the pumps, including ancillary equipment, apparatus and parts, shall be free from defective materials, equipment, or workmanship, including with respect to equipment, the services of qualified factory trained servicemen, as may be required.

B. Under the guarantee, the Manufacturer shall furnish replacements for any component that proves defective, except those items that are normally consumed in service, such as light bulbs, oil, grease, packing, gaskets, "O"-rings, etc.

C. The pump Manufacturer shall be solely responsible for the warranty of the station and all components. Components failing to perform as specified by Erwin Utilities, as represented by the Manufacturer, or proved defective in service during the warranty period shall be replaced, repaired, or satisfactorily modified by the Manufacturer without cost of parts or labor to Erwin Utilities.

D. In addition to the one (1) year warranty provided by the contractor, the pump Manufacturer shall warrant the pump for a period of five (5) years. Warranty shall include one hundred percent (100%) coverage for shop labor and parts for all five (5) years.

1.07 PUMP PREQUALIFICATION SUBMITTAL

A. Contractors wishing to supply equipment by a manufacturer other than those listed in Subsection 1.03 A, must submit a prequalification submittal for approval to Erwin Utilities. The submittal shall demonstrate that the proposed equipment meets the requirements of the Contract Specifications and Drawings. The prequalification submittal shall include, as a minimum, the following information:

1. Literature and cut sheets from manufacturer(s) describing equipment;
2. Pump operating curves;
3. Proposed motor sizes and speeds;
4. Copy of warranties;
5. List of at least five (5) references for similar installations, including contact names and current telephone numbers; and
6. A written statement from the Manufacturer indicating that the Manufacturer has reviewed the proposed application as detailed in the Contract Drawings and Specifications, and that all equipment, materials, and systems proposed to be supplied are appropriate and compatible for this specific application.

B. The submittal of prequalification information does not omit the requirement for the Contractor and Manufacturer to submit complete shop drawing submittals to Erwin Utilities in accordance with Paragraph 1.04 of these Specifications.

1.08 MANUFACTURER AND SUPPLIER INFORMATION

A. MANUFACTURER NAMEPLATE

A manufacturer's nameplate shall be securely and permanently mounted to each individual piece of equipment furnished under this Section. The nameplate shall be constructed of a durable, non-corrosive material. Critical information shall be clearly engraved or otherwise permanently stamped on the nameplate, and shall be fully legible. Failure to meet these requirements will be cause for rejection of the equipment. The information contained on the manufacturer nameplate shall include at least the following:

1. Manufacturer's serial number;

2. Name, address, and telephone number of equipment Manufacturer;

3. Model and/or part number, including pump impeller sizes, when applicable;

4. Performance criteria (i.e., capacity, design point, etc.);

5. Motor size, speed, and voltage;

6. Enclosure type or rating; and

7. Any other pertinent information.

B. SUPPLIER AND SERVICE INFORMATION

A durable nameplate, stamp, or sticker shall be adhered to each individual piece of equipment containing the name, address, and telephone number of the local business that supplied the equipment and the name, address, and telephone number of the local business that can provide service and replacement parts for the equipment. A twenty-four (24) hour emergency service telephone number should also be included.

PART 2: PRODUCTS

2.01 PUMPS

A. The pump system shall be vertical, submersible non-clog type.

B. Each pump shall be mounted on a universal, stainless steel, guide rail system designed to permit removal without the need for personnel to enter the wetwell.

C. All openings and passages shall be large enough to permit the passage of a sphere three inches (3") in diameter.

D. The major pump components, including the pump volute impeller, motor, and seal housing shall be high quality gray cast iron, ASTM A-48, Class 25, free from rough spots or other irregularities.

E. All fasteners, washers, brackets, chain, cables, etc., within the wetwell shall be 300 series stainless steel.

F. All mating surfaces where watertight sealing is required shall be machined and fitted Buna-N "O"-rings. Sealing shall be accomplished by automatic compression.

G. Connections requiring specific torque limits or sealing compounds shall not be acceptable. An acceptable alternative is a metal-to-metal discharge connection with contact between two (2) machined surfaces.

H. The impeller shall be of the enclosed, double shroud, dynamically balanced with smooth waterways for non-clogging operation.

I. A bronze or stainless steel wear ring set shall be installed between volute and impeller to provide efficient sealing. The seal faces shall be tungsten carbide. Recessed impellers will be acceptable.

J. The pump shaft shall be one (1)-piece stainless steel or carbon steel shaft with stainless steel sleeve.

K. Each pump shall be provided with an in-tandem double mechanical shaft seal system. The seals shall operate in an oil reservoir, which provides constant lubrication and is easily accessible for draining and inspection. There shall be an electric probe or seal failure sensor installed in the seal chamber to send a signal providing the operator with an indication of impending seal failure.

L. The complete weight of the pump is to rest on the bottom support plate or base elbow. No weight is to be supported on the guide rails or the discharge elbow.

M. Mounting plate shall be stainless steel coated with coal tar epoxy system.

2.02 MOTORS

A. The maximum allowable speed shall be 3,400 rpm. Motors shall be designed for operation on three-phase, 240 or 480 V, 60 Hz electrical current. The pump motor shall be of NEMA B type and the stator windings shall have Class F moisture-resistant insulation rated for 155° C.

B. Each motor shall be protected by one (1) motor temperature switch embedded in each phase winding. Each switch shall be designed to operate at 140° C. Each switch shall be normally closed automatic reset type rated 5 amps (A) at 120 V alternating current (AC). The switches shall be wired in series with end leads wired to terminals within the motor housing.

C. Thrust bearings shall be protected by bearing temperature switches. The switches shall be normally closed automatic reset type rated 5 amps at 120 V AC.

D. Each motor housing shall be provided with a moisture detection system complete with all sensors, control power transformers, intrinsically safe control modules, and relays.

1. The moisture detection system shall be rated for a 120 V AC or 24 V AC supply.

2. The moisture detection system shall provide two (2) normally open dry output contacts rated 5 A at 120 V AC.

3. The contacts shall close when moisture is detected in the motor housing.

4. All moisture detection system components shall be furnished by the pump supplier and shall be shipped loose for installation into the adjustable frequency drive enclosure.

E. The motor horsepower shall be adequate so the pump is non-overloading throughout the entire pump performance curve from shut-off through run-out.

2.03 DISCONNECT SYSTEM

A. The design of the disconnect system shall permit the easy removal of each pumping unit for inspection and service. There shall be no need for personnel to enter the wetwell to inspect or service the pumps.

B. A cast iron discharge elbow, located on the floor of the wetwell, will receive the pump discharge when the pump is lowered into place. The pipe discharge shall be fitted with a resilient seal that provides a positive hydraulic seal for maximum pump system efficiency.

C. Each pumping unit shall be provided with a stainless steel lifting chain or cable of adequate strength for raising and lowering the pumps. The chain shall be properly secured in a convenient location near the top of the wetwell.

2.04 HOIST ASSEMBLY

A. A flush mounted portable hoist, rated at least one hundred fifty percent (150%) the weight of the pumping units, shall be provided for each lift station.

B. The hoist shall be provided with a zinc-plated winch with a disc brake, and at least thirty feet (30') of 5/16" stainless steel cable equipped with a hook and safety latch.

2.05 WIRING CHANNEL

A. A wiring channel shall be mounted below the pump well cover for the pumps and shall provide cord grip holders for the pump cords and the control cords.

B. The channel box shall have a removable cover for easy adjustment of cords.

C. All cords shall extend from one end of the box and be taken through conduit in the sump cover to the control panel.

D. No splices shall be made in the wiring channel. Continuous cords must be used from the control panel to the pumps and controls.

E. Wiring channel shall mount on supports fastened to access cover frame.

2.06 PUMP CONTROL SYSTEM

A. GENERAL

1. The operation of the pumps shall be controlled by a pump control system (PCS).

2. The PCS equipment shall be constructed in compliance with UL's Industrial Control Panels listing and following-up service, utilizing UL-listed and recognized components where applicable.
3. The pumps shall operate based on variations of the sewage level in the wetwell. An ultrasonic level transmitter shall be installed in the wetwell to provide the depth of sewage in the wetwell.

B. CONTROL PANEL

1. The control panels shall be built in an UL-listed manufacturing facility. The equipment shall be designed to have a useful operating life of no fewer than fifteen (15) years with standard servicing and replacement of parts.

2. Control panel for pumps shall have a NEMA 4X stainless steel low-profile enclosure suitable for pedestal or pole mounting with weather hood and shall be dead front with separate removable inside panel to protect electrical equipment. A lock hasp shall be provided on the outside door.

3. A circuit breaker, elapsed time meter, suitable controller, loss of phase protection, automatic pump alternator, power lightning arrestor, and an H-O-A switch shall be provided. Miniature relays shall not be accepted.

4. Motor status run light shall be provided along with a terminal strip for connecting pump and control wires.

5. Additional terminals shall be provided to connect alarm, heat sensors, and seal failure wires.

6. A transformer shall be supplied to give a 115-volt control circuit. A single weatherproof ground-fault-protected duplex convenience outlet shall be provided on the side of the control panel enclosure.

7. An emergency “Operator Assistance” red push button shall be provided on the outside of the control panel for easy access in an emergency.

8. The control panel shall be completely wired at the factory except for the power feeder lines. Wiring diagrams matching the unit wiring shall be provided.

9. The control panel shall include a digital display for identifying wetwell level and pump discharge flow and pressure. The display unit shall power the 4-20 mA transducer and shall obtain input from the transducers and transmitters. Level shall be displayed as depth in feet from the bottom of the wetwell. Flow shall be displayed in gallons per minute (gpm), and pressure shall be displayed in pounds per square inch (psi).

10. The control panel or remote terminal unit (RTU) shall be provided with a plug in connector for future connection to a data radio or similar external telemetry system.

11. The control panel shall be equipped with an alarm silence switch to provide maintenance personnel a means to silence the external alarm device while corrective actions are under way. After silencing the alarm, manual reset of the alarm signal shall provide automatic reset of the alarm silence relay.

12. The pump station Manufacturer shall supply one (1) 115 V AC alarm light fixture with vapor-tight, shatter-resistant red globe, conduit box, and mounting base. The design must prevent rainwater from collecting in the gasketed area of the fixture between the base and globe. The alarm light shall be shipped loose for installation by the Contractor.

13. The pump station Manufacturer shall supply one (1) 115 V AC weatherproof alarm horn with projector, conduit box, and mounting base. The design must prevent rainwater from collecting in any part of the horn. The alarm horn shall be shipped loose for installation by the Contractor.

C. INSTRUMENTATION INTERFACE

1. Pump Station Flow Metering

A magnetic flow meter shall be installed in the common discharge header of the Pumps. The flow meter shall provide an instantaneous flow and a pulse totalizing flow signal for monitoring in the pump control system (PCS). The instantaneous and totalized flow signals for the discharge header will be indicated and summed in the PCS to obtain pump station discharge instantaneous flow and pump station discharge total flow.

2. Pump Station Level

Ultrasonic level element and transmitter will be installed at the pumping station. The transmitter will send a signal to the pump control panel and then to the PCS for level indication. The pump control panel will use this level signal to control the pumps.

3. Pump Station Discharge Pressure

A pressure transducer and transmitter shall be installed in the common discharge header of the pumps. The transmitter will send a signal to the pump control panel for discharge pressure indication.

D. CONTROL DESCRIPTION

1. Each pump station pump shall have control modes “On,” “Off,” and “Auto.”

2. The On mode will energize the pumps until the switch is turned to the Off or Auto modes. The On mode will override any level interlocks calculated from the analog level signal.

3. In the Auto mode, the pumps will be controlled from the local wetwell level control panel. The ultrasonic level transmitter signal will be utilized for the control. The control panel will automatically alternate the lead, lag, and standby pumps. The controller will energize the standby pump if either the lead or lag pump fails to start or a preset level is reached on the controller.

4. In the Auto mode, seal failure detected in the pump will de-energize the respective pump and activate an alarm.

5. In the Auto mode, high temperature detected in the pump will de-energize the respective pump and activate an alarm.

6. In the Auto mode, moisture detected in the pump will de-energize the respective pump and activate an alarm.

7. The pump control system shall record and display the running status and moisture detected and shall have an alarm, a seal failure alarm, and a pump high temperature alarm.

2.07 INSTRUMENTATION

A. ULTRASONIC LEVEL TRANSMITTERS

1. Each ultrasonic level transmitter shall be a microprocessor-based electronic unit consisting of a sensor assembly, a signal converter/transmitter, and an interconnecting cable.

2. The sensor shall be encapsulated in a chemical and corrosion-resistant material such as kynar or CPVC, and shall be suitable for operation over a temperature range of -20° to +150° F and a relative humidity of ten to 100 percent (10-100%). The ultrasonic level transmitter shall have automatic compensation for changes in air temperature at the sensor location. If separate temperature sensing probes are provided, they shall be mounted with or adjacent to the ultrasonic sensor, as recommended by the Manufacturer.

3. The transmitter shall have a four (4)-digit LCD display scaled to read in engineering units. Digit height shall be approximately one-half inch (1/2").

4. The transmitter shall be designed to ignore momentary level spikes, false targets, or momentary loss-of-echo. A loss-of-echo condition shall be indicated on the transmitter unit and shall be available as an alarm contact output.

    a. The transmitter output shall be an isolated 4-20 mA DC signal linearly proportional to the measured level range.

    b. Calibration parameters shall be entered through a keypad on the unit and shall be stored in nonvolatile EEPROM memory.

    c. Accuracy of the transmitted signal shall be plus or minus one-half percent (±0.5%) of the level range.

    d. The transmitter shall contain four (4) independently adjustable level alarm contact outputs. Contacts shall be single-pole, double-throw rated not less than 5 A at 120 V AC.

    e. A sufficient length of sensor-to-transmitter signal cable shall be furnished with the instrument to locate the sensor twenty-five to two hundred feet (25-200') from the signal converter.

5. The signal converter electronics shall be housed in a weatherproof, corrosion-resistant NEMA Type 4 enclosure suitable for wall or pipestand mounting and for operating temperatures of -15° to +125°F and a relative humidity of ten to one hundred percent (10-100%).

6. A thermostatically controlled strip heater shall be provided in the signal converter enclosure.

7. The signal converter shall be of the AC-powered type.

8. The ultrasonic level transmitter shall be Labtronics, Milltronics HydroRanger Plus, Endress & Hauser Prosonic, or STI/Magnetrol "Echotel 344," or approved equal.

B. FLOAT SWITCHES

1. Switches shall be of the floating ball type, with a nominal five and one-half inch (5-1/2") diameter, Teflon-coated stainless steel float ball that contains a sealed switch assembly.

2. The float shall be supported with a flexible synthetic rubber hinge fastened to an adjustable mounting bracket. The hinge shall also act as housing for the lead wires from the alarm switch.

3. The lead wire shall be a waterproof cable of such length that no splice or junction box is required in the wetwell.

4. Stainless steel mounting accessories shall be furnished.

5. The switch contacts shall be single-pole-double-throw rated 4 A at 250 V AC.

6. Switches shall be U.S. Filter Control Systems "9G," Flygt "ENM-10 Level Sensors," ABS "Float Switches," or approved equal.

C. PRESSURE TRANSMITTERS

1. Transmitters shall have "smart" electronic circuitry and shall be of the 2-wire type.

2. Process fluid shall be isolated from the sensing elements by AISI Type 316 stainless steel, Hastelloy-C, ceramic, or cobalt-chromium-nickel alloy diaphragms, and the transducer may use a silicone oil fluid fill.

3. Transmitters shall have self-diagnostics and electronically adjustable span, zero, and damping.

4. Transmitters shall be enclosed in a NEMA Type 4X housing and shall be suitable for operation at temperatures from 0° to 180°F, and relative humidity of five to one hundred percent (5-100%).

5. All parts shall be cadmium-plated carbon steel, stainless steel, or other corrosion-resistant materials.

6. Transmitters shall have over-range protection to maximum line pressure.

7. Accuracy of the transmitter shall be one-tenth percent (0.10%) of span, and transmitter output shall be 4-20 mA DC without the need for external load adjustment.

8. Transmitters shall not be damaged by reverse polarity.

9. Transmitters shall have an elevated or suppressed zero as required by the application.

10. For calibrated spans of less than eight (8) psig, a differential pressure type transmitter with side vents shall be utilized.

11. Transmitters shall be provided with brackets for wall and pipe-stand mounting.

12. Transmitters shall be factory calibrated to the required range and provided with the Manufacturer's standard hand-held communications/calibration device.

13. One (1) device shall be furnished for all transmitters provided by a single Manufacturer.

14. Transmitters tagged on the Drawings or specified to be indicating type shall be furnished with LCD digital indicators.

15. Transmitters shall be ABB 600T Series, Foxboro Model IGP10-D, Rosemount Model 3051C, or approved equal.

D. MAGNETIC FLOWMETER

1. Magnetic flowmeters are required for all proposed pump stations. The magnetic flowmeter shall be a completely obstructionless, in-line flowmeter with no constrictions in the flow of fluid through the meter.

2. The meter shall consist of a metallic tube with flanged ends and with grounding rings. Flange diameter and bolt drilling pattern shall comply with ANSI/ASME B16.5, Class 150.

3. Flangeless wafer insert style meters may be used for pipe sizes up to six inches (6") where compatible with adjacent piping flanges.

4. Meters shall be suitable for the maximum range of working pressures of the adjacent piping.

5. Self-cleaning bullet-nosed electrodes shall be provided for all meters used for sludge metering. Electrode and liner materials shall be fully compatible with the process fluid and shall comply with the requirements specified in the instrument device schedules.

6. Each meter shall be factory calibrated, at a facility that is traceable to the National Institute of Science and Technology (NIST), and a copy of the calibration report shall be submitted as part of the operation and maintenance manual submittal.

7. The meter shall be capable of standing empty for extended periods of time without damage to any components.

8. The meter housing shall be of a splashproof and drip-proof design.

9. Meters shall be as manufactured by ABB/Fischer & Porter, Foxboro, Krohne, Rosemount, or approved equal.

E. MAGNETIC FLOWMETER SIGNAL CONVERTER

1. A separately mounted, microprocessor-based signal converter shall be provided for the magnetic flowmeter.

2. The signal converters shall include output damping, self-testing, built-in calibration capability, and an "empty pipe zero" contact input.

3. The overall accuracy of the magnetic flowmeter transmitter and signal converter shall be plus or minus one-half percent (±0.5%) of actual flow rate for full-scale settings of three to thirty (3-30) feet per second (fps).

4. The meter manufacturer shall furnish the signal cable between the converter and the magnetic flowmeter.

5. The signal converter shall be housed in a corrosion-resistant, weatherproof NEMA Type 4X housing and shall be suitable for operation over an ambient temperature range of -30° to +140°F, and relative humidity of ten to one hundred percent (10-100%).

6. The converter shall have an analog output of 4-20 mA DC.

7. When required, the converter shall also have a pulse output designed to operate a remote seven (7)-digit totalizer and scaled so that the totalizer will operate for sixty (60) days at one hundred percent (100%) flow without repeating. Scaling factors shall be field-adjustable and shall be selected to provide a totalizer multiplier of a power of ten (10).

8. Transmitters tagged on the Drawings or specified to be of the indicating type shall contain a local indicator with a minimum four(4)-digit LCD display, scaled to read in gpm.

9. Magnetic flowmeter systems shall provide zero flow stability by means of automatic zero adjustment of a DC-excited metering circuit.

10. Converters shall be capable of bidirectional flow measurement.

11. Signal converters shall be of the same brand as the magnetic flowmeters.

12. The signal converter shall have a non-reset seven (7)-digit, or a manually reset six (6)-digit, totalizer on the face of the enclosure.

13. The signal converter shall be of the “smart” type that can be diagnosed and recalibrated with the use of a hand-held communicator/calibrator device. One (1) device shall be furnished for all converters provided by a single Manufacturer.

2.07 EMERGENCY DIESEL ENGINE GENERATOR

The sewage pumping station shall be provided with a Square D, 100 amp, 3 phase, 600 volt, NEMA 3R, Cat# DTU 363 RB transfer switch and a Crouse Hinds, Cat# AR1041S22, 480 volt generator receptacle for connection of a portable emergency diesel engine generator.

2.08 PUMP STATION WETWELL AND VALVE VAULT

A. The pump station wetwell and valve vault shall be constructed of precast concrete.

B. The pump station wetwell and valve vault shall be equipped with aluminum access hatches. The access hatches for the pump station shall be provided with a safety net.

C. The following items shall be installed in the valve vault(s):

1. Pump check valves and resilient seated gate valves;
2. Pressure transmitter and flow meter; and
3. Pump-around connection for bypass of pump station pumps.

PART 3: EXECUTION

3.01 INSTALLATION

A. Installation of the pump station and all equipment shall be done in strict accordance with written instructions by the Manufacturer. Manufacturer shall provide four (4) bound copies of these instructions to Erwin Utilities.

B. The Contractor shall furnish the services of factory service personnel of the equipment manufacturer to supervise the final adjustments of the system, perform operating tests, assure Erwin Utilities that the equipment is in proper adjustment and satisfactory operating condition, and to instruct and train Erwin Utilities' personnel in the use of this equipment. This service will be rendered after installation of the equipment has been completed and the entire system is ready for operation.

3.02 QUALITY CONTROL AND FIELD TESTING

A. Contractor shall test all equipment for actual operating conditions to show that each unit operates satisfactorily without overheating or overloading and is free from excessive vibration and noise throughout the complete head and capacity range at rated speed.

B. Erwin Utilities shall observe all field tests. Contractor shall give three (3) days' written notice to Erwin Utilities before performing tests.

C. Successful operation shall be demonstrated to the satisfaction of Erwin Utilities.

D. The Contractor shall make, at his expense, all necessary changes, modifications, and/or adjustments required to assure satisfactory and efficient operation.

E. Pump and pump controls Manufacturers' authorized representatives shall provide written report(s) to Erwin Utilities noting that pumps and controls have been installed in accordance with Manufacturers' recommendations, the materials used in construction of the pumps and controls are the same as submitted for the shop drawing approval, are in conformance with project performance requirements, and are ready for operation.

F. An authorized representative(s) shall be present for start-up of the pumps and controls.

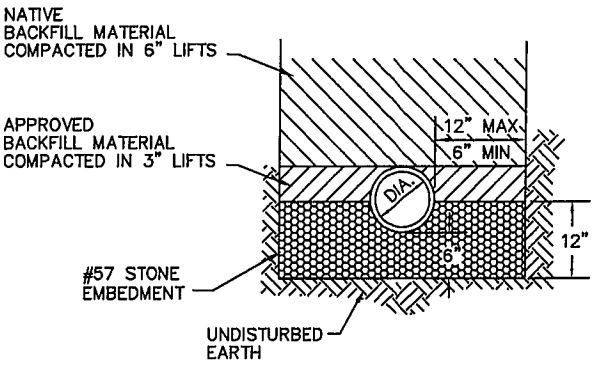
G. On-site training in the operation and maintenance of all equipment shall be performed by factory authorized personnel with personnel from Erwin Utilities.

3.03 SPARE PARTS

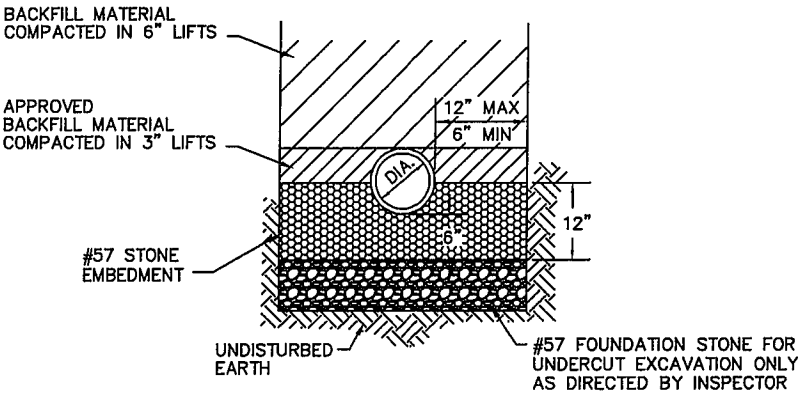
The Contractor shall furnish one (1) complete set of recommended spare parts for each size pump. All spare parts are to be conveyed to Erwin Utilities.

END OF SECTION

DUCTILE IRON GRAVITY SEWER

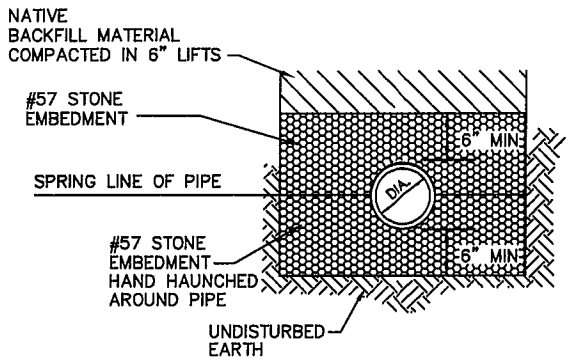


STANDARD EXCAVATION



UNDERCUT EXCAVATION
IN UNSTABLE SOILS TYPES

POLYVINYL CHLORIDE (PVC) SEWER PIPE



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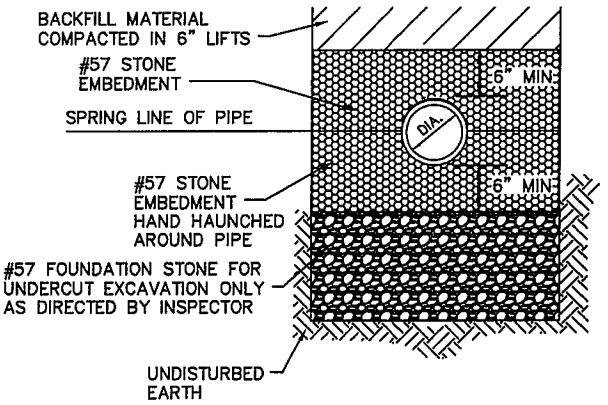

UNDERCUT EXCAVATION
IN UNSTABLE SOILS TYPES

TYPICAL GRAVITY SEWER TRENCHING DETAILS

NOT TO SCALE

NOTES:

1. CONSTRUCTION OF TRENCHES SHALL COMPLY WITH ALL FEDERAL, STATE AND LOCAL SAFETY AND HEALTH REGULATIONS WHICH HAVE JURISDICTION AT THE PROJECT SITE. IT IS THE CONTRACTOR'S RESPONSIBILITY TO BE FAMILIAR WITH THE APPLICABLE REGULATIONS AND FOLLOW THEM ACCORDINGLY.
2. THE BACKFILL MATERIAL SHALL CONSIST OF 100% #57 STONE IN AREAS UNDER PAVEMENT AND IN ROADWAYS.

Erwin Utilities

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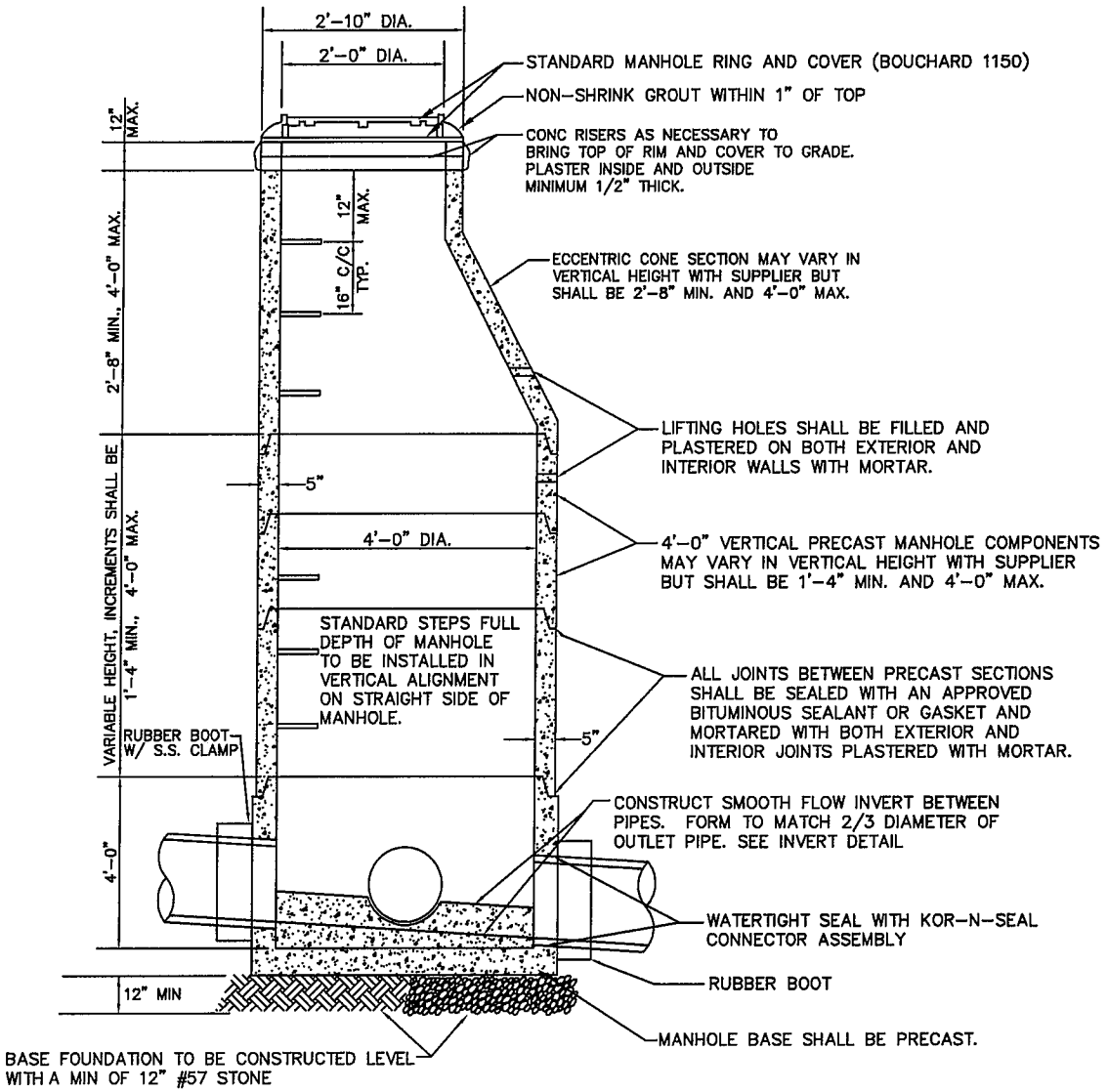
SANITARY SEWER SYSTEM
STANDARD DETAILS

REVISION NO: 2
DATE: MARCH 2013

STD-WW-01



ELEVATION VIEW

PRECAST MANHOLE NOTES:

1. ALL PRECAST MANHOLE COMPONENTS SHALL MEET REQUIREMENTS OF ASTM C-478, LATEST REVISION.
2. ALL MANHOLES SHALL BE CONSTRUCTED PLUMB.
3. ALL MANHOLE GRADES SHOWN ON THE PLANS ARE FOR THE INVERT OF THE MANHOLE CENTER.
4. IF MANHOLE IS SET IN LOCATION OF HIGH WATER TABLE OR UNDERGROUND WATER IS ENCOUNTERED, THE CONTRACTOR SHALL INSTALL UNDERDRAINS AND STONE AS DIRECTED IN THE FIELD BY THE INSPECTOR.
5. STEPS SHALL BE INSTALLED ON STRAIGHT SIDE OF MANHOLE.

PRECAST CONCRETE MANHOLE

NOT TO SCALE

Erwin Utilities

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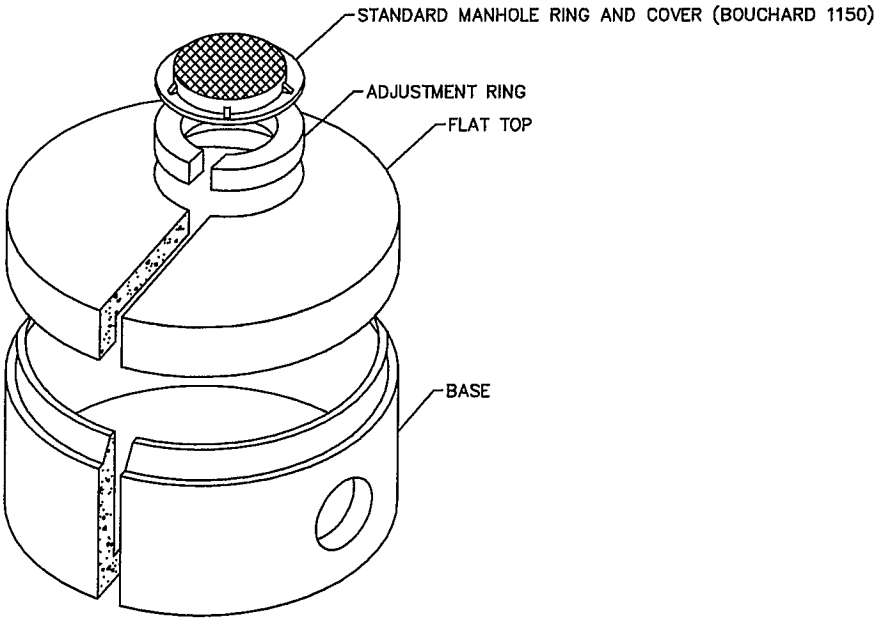
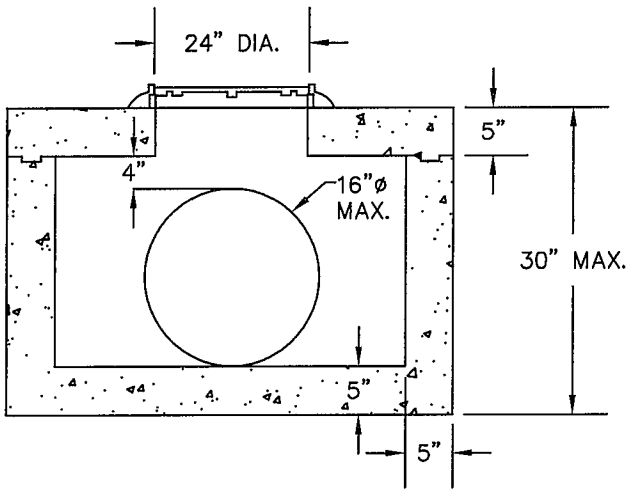
SANITARY SEWER SYSTEM
STANDARD DETAILS

REVISION NO: 1
DATE: MARCH 2013

STD-WW-02



STANDARD SHALLOW MANHOLE



SHALLOW FLAT TOP MANHOLE

NOT TO SCALE

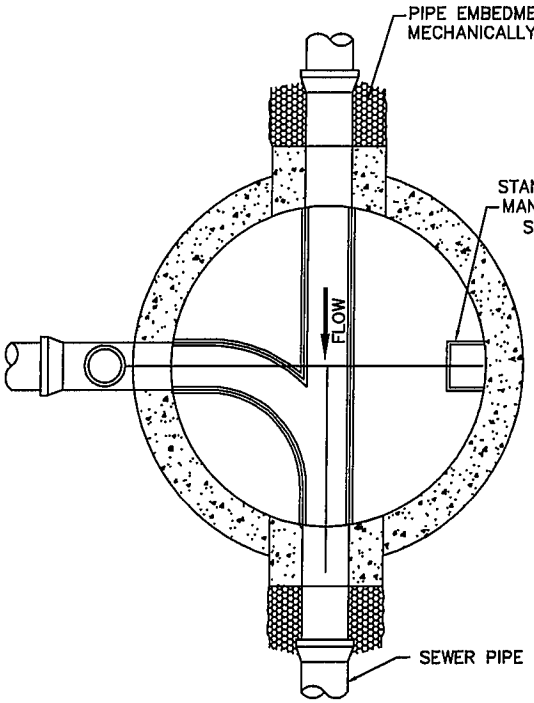
Erwin Utilities

ERWIN UTILITIES

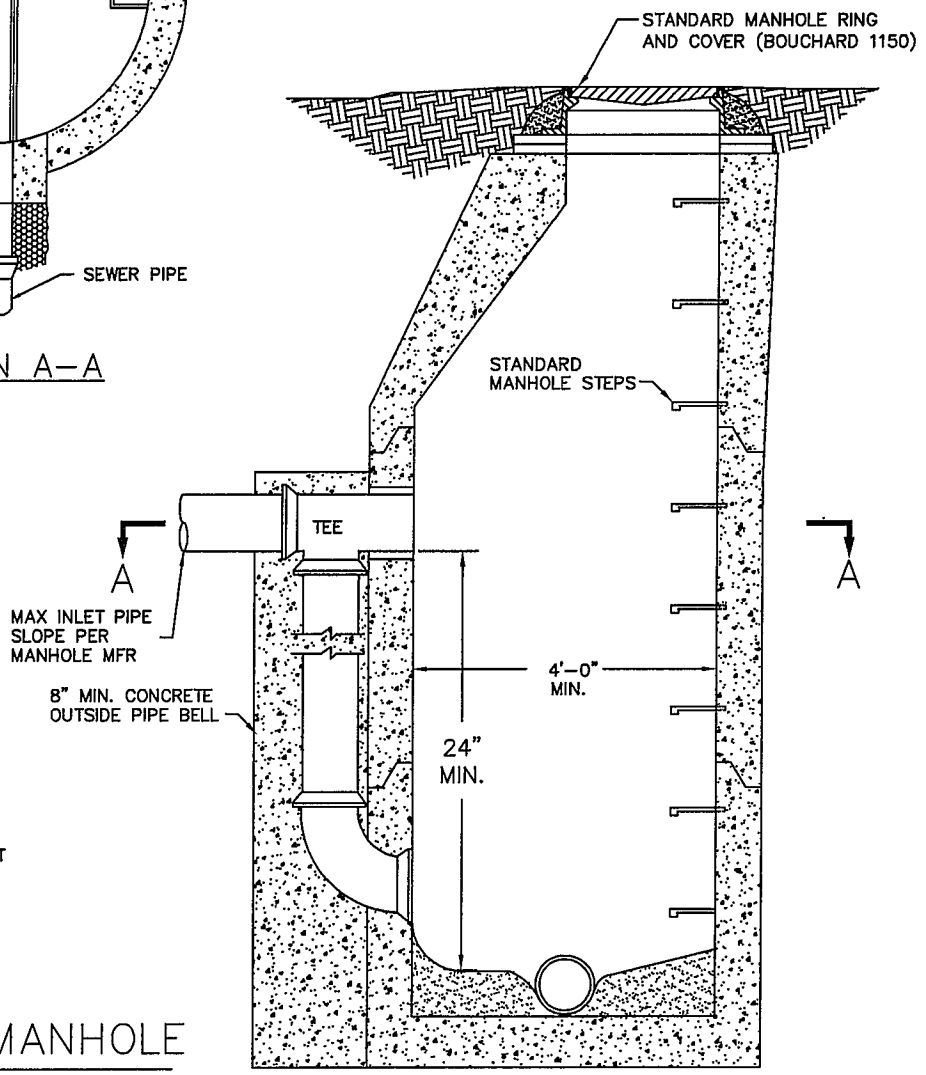
SANITARY SEWER SYSTEM
STANDARD DETAILS

REVISION NO: 1
DATE: MARCH 2013

STD-WW-03



SECTION A–A



NOTE:
1. PROVIDE DROP MANHOLE WHEN THE INLET PIPE IS 24" OR GREATER ABOVE THE MANHOLE INVERT.

OUTSIDE DROP MANHOLE

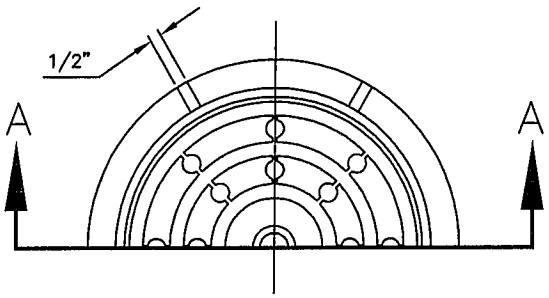
NOT TO SCALE

Erwin Utilities

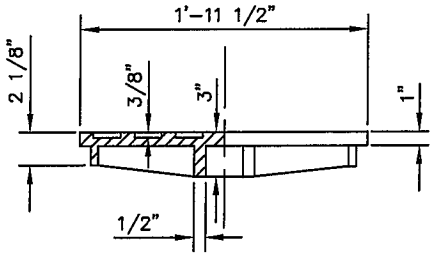
ERWIN UTILITIES
SANITARY SEWER SYSTEM
STANDARD DETAILS

REVISION NO: 1
DATE: MARCH 2013

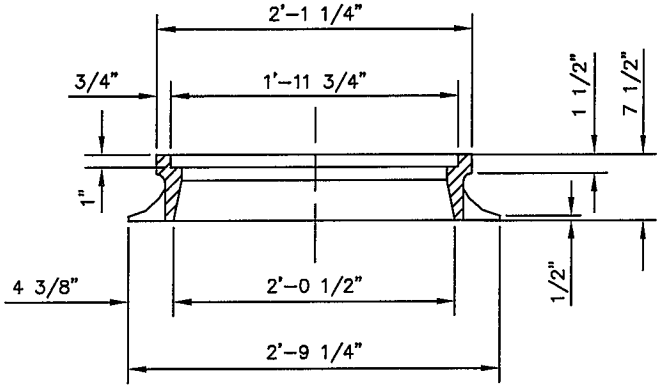
STD–WW–04



HALF PLAN OF MANHOLE
RING AND COVER



SECTION A–A
MANHOLE COVER



SECTION A–A
MANHOLE RING

MANHOLE RING AND COVER

NOT TO SCALE

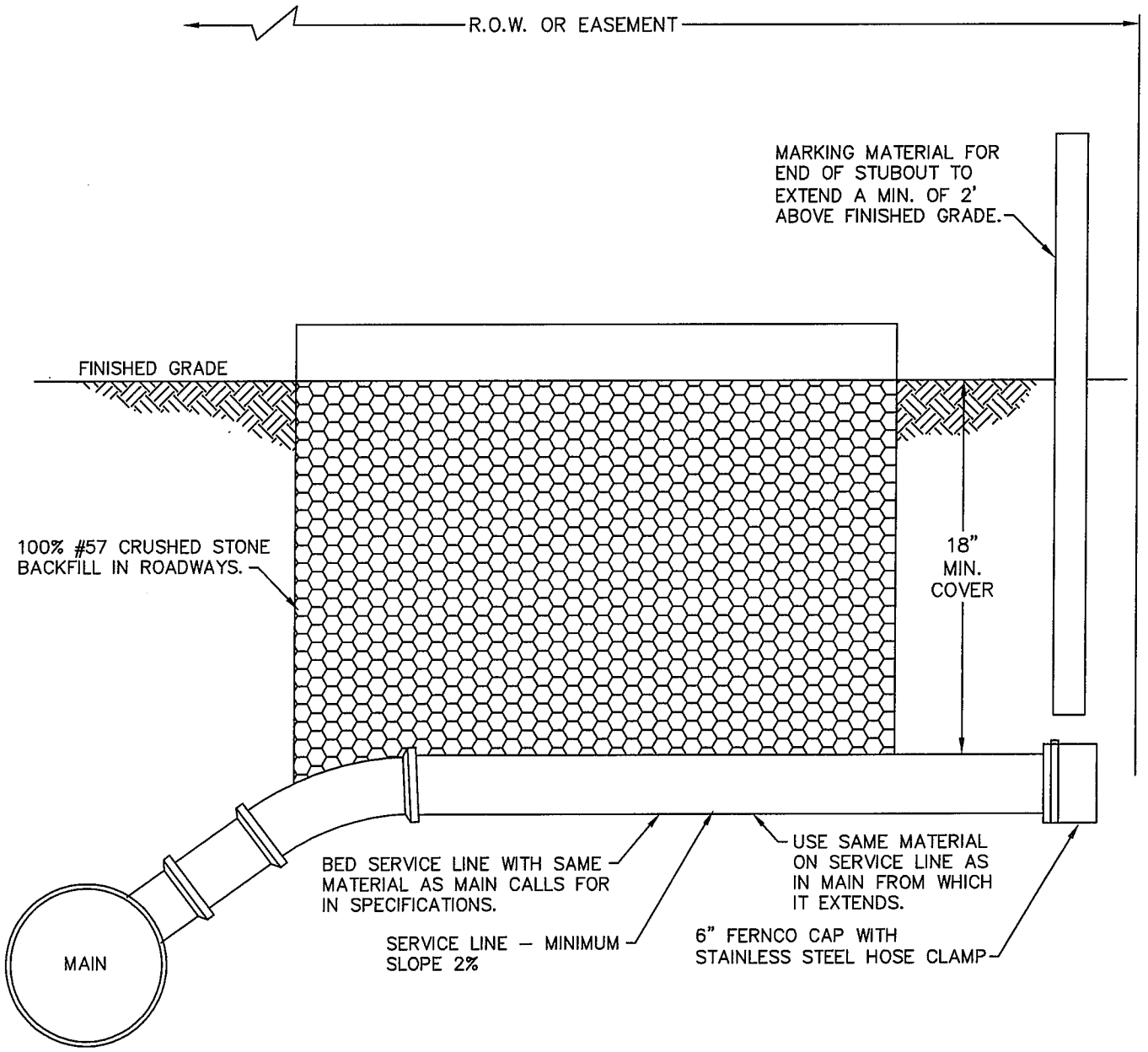
NOTE: TRAFFIC BEARING RING AND COVER.
MINIMUM WEIGHT 315 POUNDS

Erwin Utilities

ERWIN UTILITIES
SANITARY SEWER SYSTEM
STANDARD DETAILS

REVISION NO: 1
DATE: MARCH 2013

STD–WW–05



LONG TAP GRAVITY SERVICE LATERAL STUBOUT NEW CONSTRUCTION

NOT TO SCALE

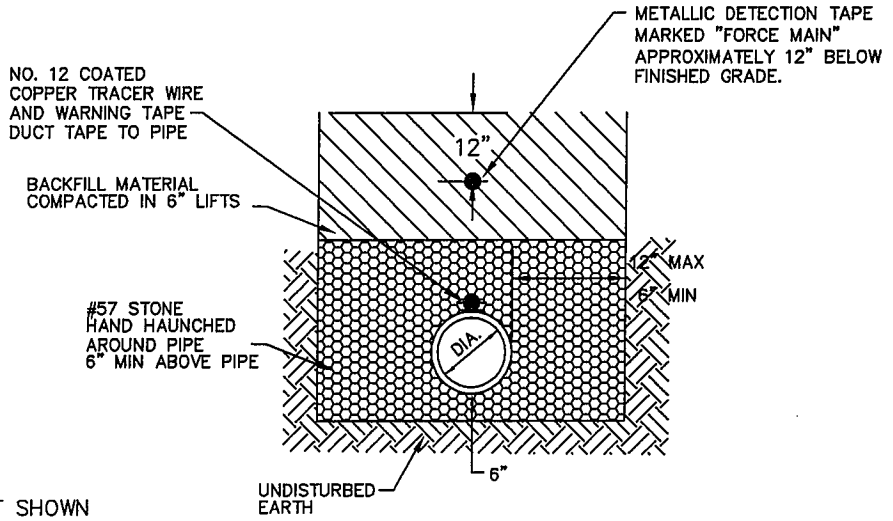
Erwin Utilities

ERWIN UTILITIES

SANITARY SEWER SYSTEM
STANDARD DETAILS

REVISION NO: 2
DATE: MARCH 2013

STD–WW–06



NOTE:
BELL HOLES NOT SHOWN

STANDARD EXCAVATION

NOTE: 1. CONSTRUCTION OF TRENCHES SHALL COMPLY WITH ALL FEDERAL, STATE AND LOCAL SAFETY AND HEALTH REGULATIONS WHICH HAVE JURISDICTION AT THE PROJECT SITE. IT IS THE CONTRACTOR'S RESPONSIBILITY TO BE FAMILIAR WITH THE APPLICABLE REGULATIONS AND FOLLOW THEM ACCORDINGLY.

TYPICAL SEWER FORCE MAIN TRENCHING DETAILS

NOT TO SCALE

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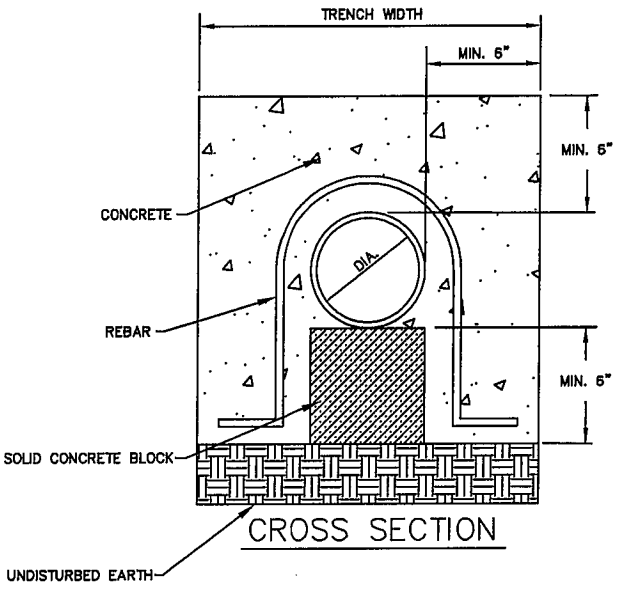
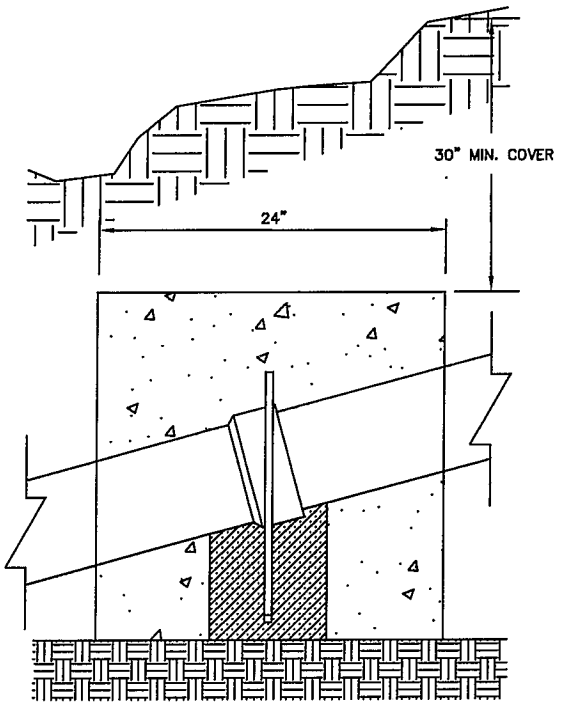
ERWIN UTILITIES
SANITARY SEWER SYSTEM
STANDARD DETAILS

REVISION NO: 1
DATE: MARCH 2013

STD-WW-07



CROSS SECTION



PROFILE

TYPICAL SEWER LINE SLOPE ANCHOR DETAILS

NOT TO SCALE

NOTE:
1. SLOPE ANCHOR TO BE USED WHEN SLOPES EXCEED 20% GRADE.
2. SLOPE ANCHORS SHALL BE INSTALLED AT EVERY JOINT
3. PIPE JOINT MUST BE COMPLETELY ENCASED IN CONCRETE

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STANDARD DETAILS

REVISION NO: 1
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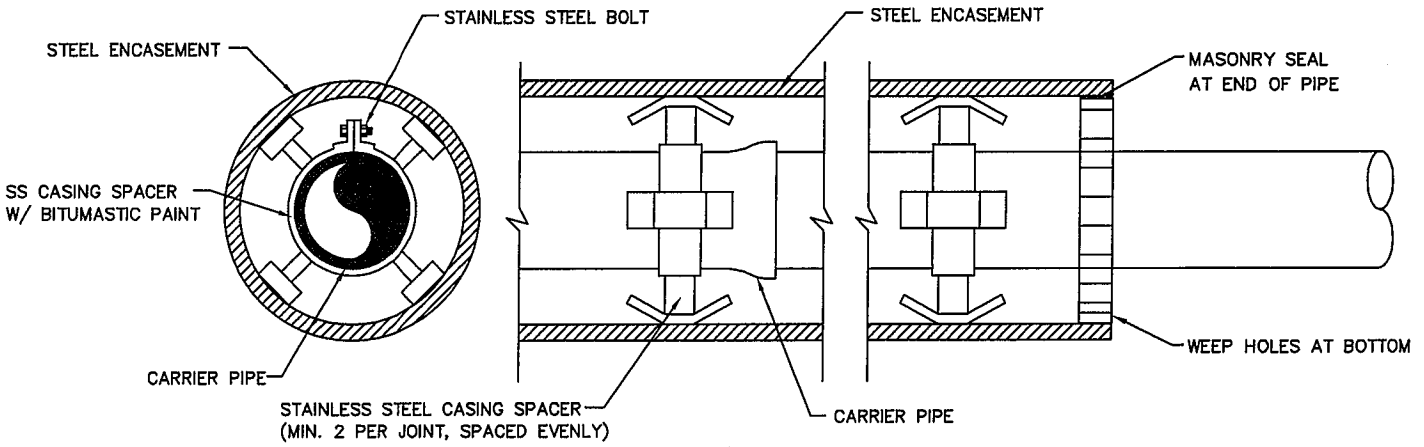
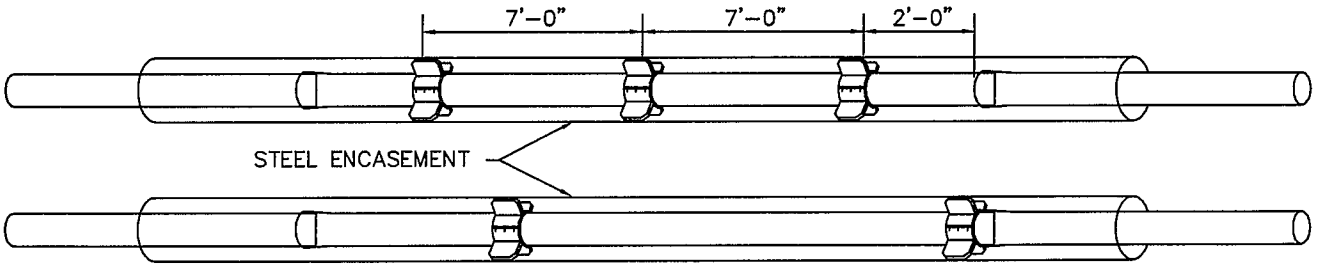
STD-WW-08





NOTE: STANDARD POSITIONING TO BE USED UNLESS OTHERWISE NOTED
ALL BELLS INSIDE CASING SHALL BE INSTALLED WITH A LOCKING GASKET
CASING SPACERS FOR GRAVITY SEWERS SHALL MAINTAIN SEWER LINE GRADE

CARRIER PIPE IN STEEL ENCASEMENT DETAIL

NOT TO SCALE

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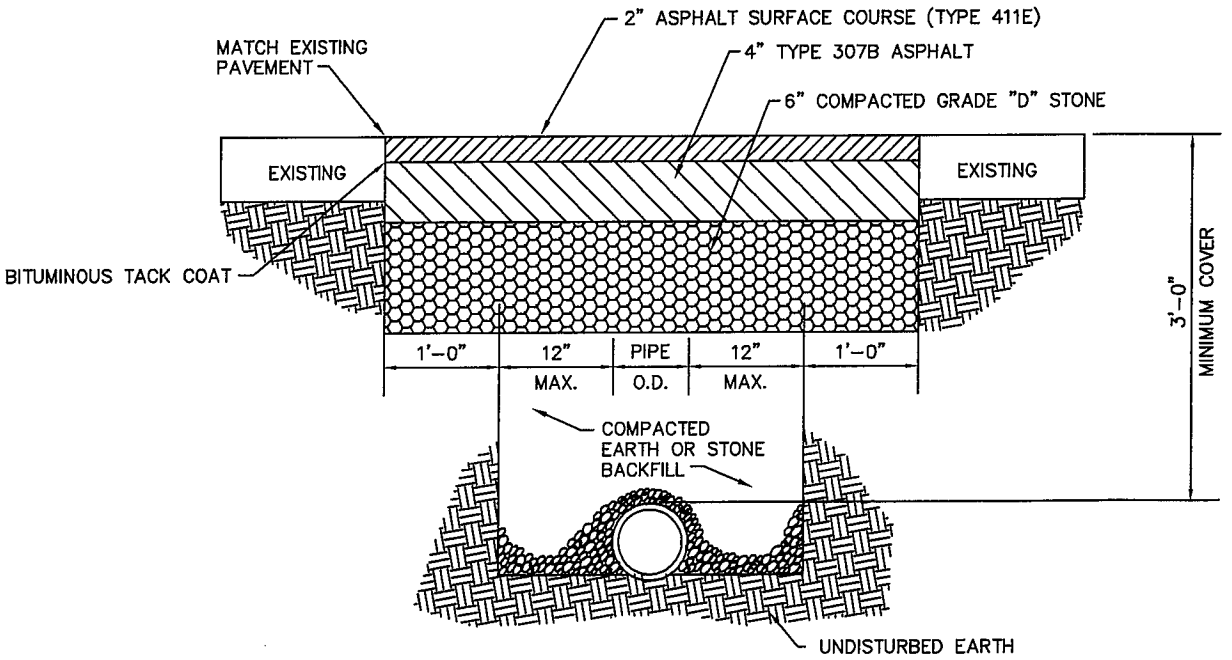
SANITARY SEWER SYSTEM
STANDARD DETAILS

REVISION NO: 1
DATE: MARCH 2013

STD-WW-09



NOTES:

1. EDGE TO BE SAWED WITH A CONCRETE SAW TO A NEAT SQUARED EDGE. BROOMED CLEAN OF DUST BEFORE TACK COAT IS APPLIED.
2. EDGES TO BE TACKED WITH CRS-I OR CRS-II.
3. CONTRACTOR RESPONSIBLE FOR REPLACEMENT OF ANY PAVEMENT MARKINGS DISTURBED OR COVERED BY OVERLAY.

TYPICAL PAVEMENT REPAIRS

NOT TO SCALE

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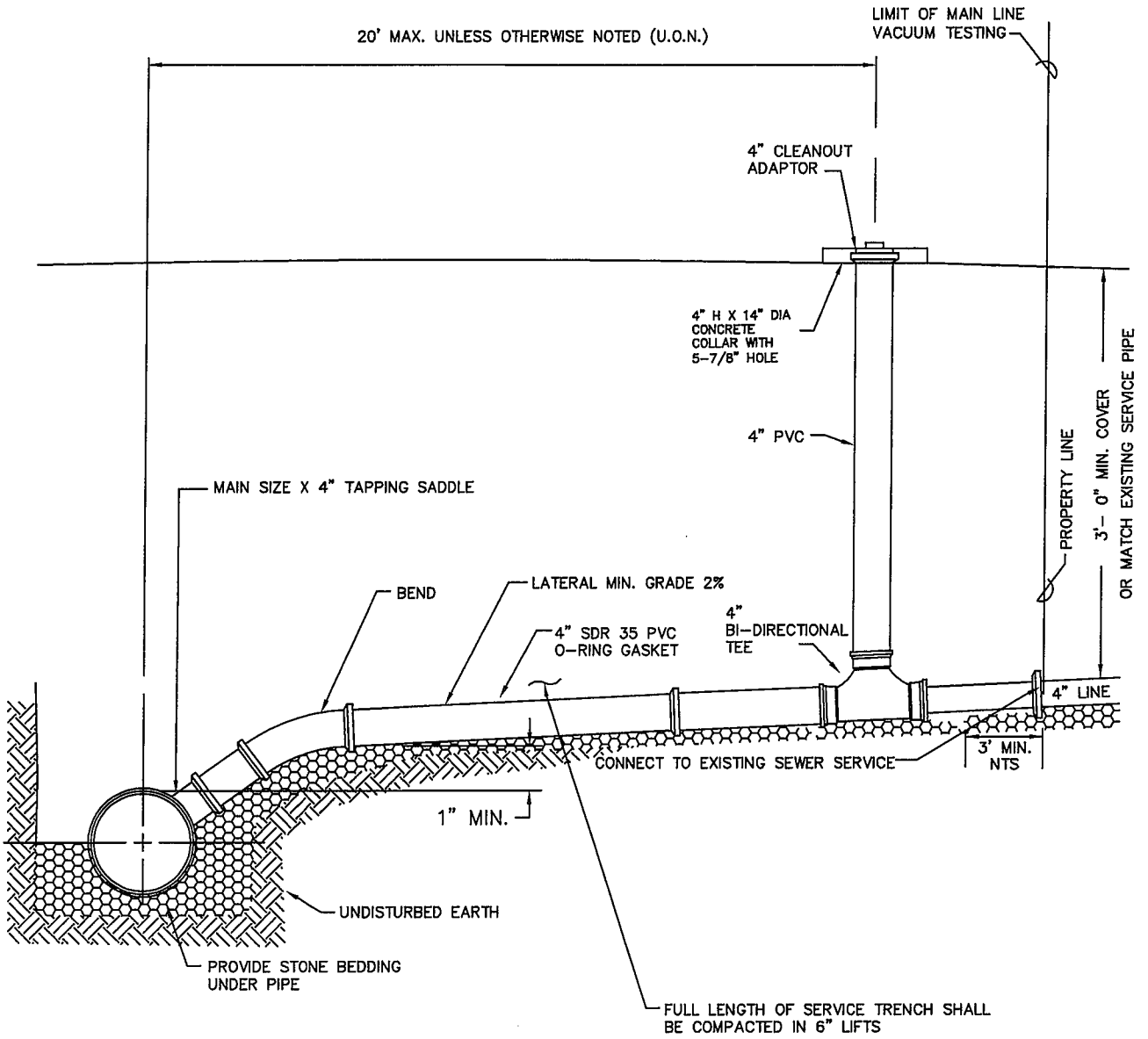
SANITARY SEWER SYSTEM
STANDARD DETAILS

REVISION NO: 1
DATE: MARCH 2013

STD-WW-10



SANITARY SEWER SERVICE REPLACEMENT

NOT TO SCALE

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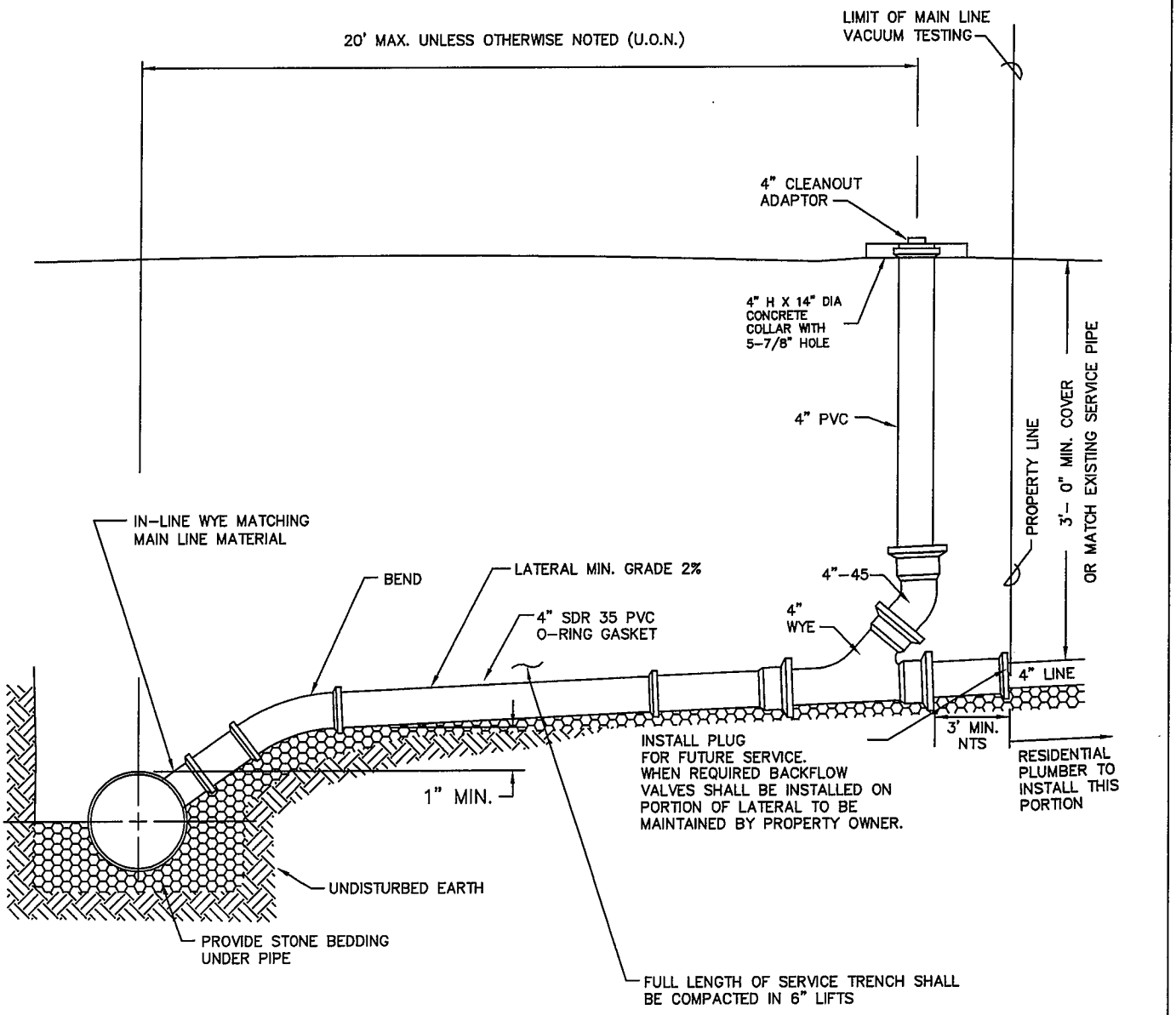
SANITARY SEWER SYSTEM
STANDARD DETAILS

REVISION NO: 1
DATE: MARCH 2013

STD-WW-11



NEW SANITARY SEWER SERVICE INSTALLATION

NOT TO SCALE

NOTE:

1. INTERMEDIATE CLEANOUTS SHALL BE INSTALLED EVERY 75 LINEAR FEET OF CUSTOMER'S SEWER SERVICE LATERAL AND AT ALL CHANGES IN DIRECTION.

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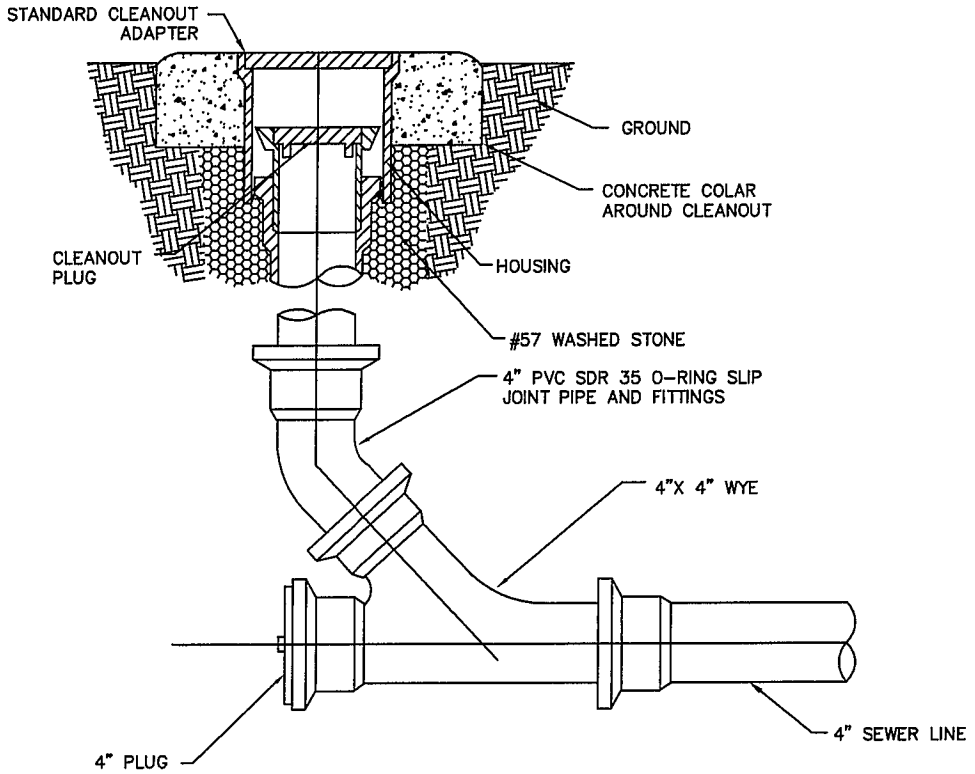
STANDARD DETAILS

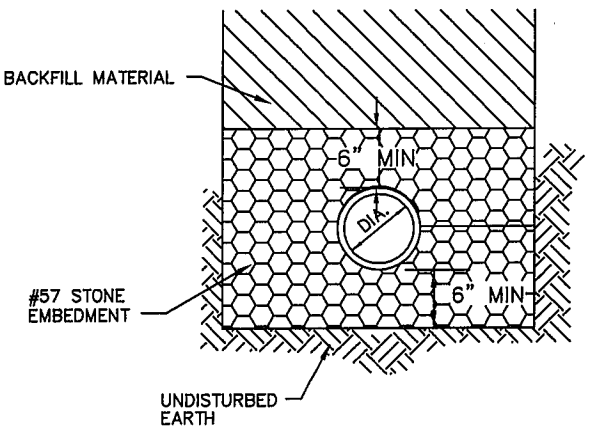
REVISION NO: 3
DATE: MARCH 2013

STD-WW-12



CLEANOUT DETAIL

NOT TO SCALE



TYPICAL SEWER SERVICE LINE TRENCHING DETAIL

NOT TO SCALE

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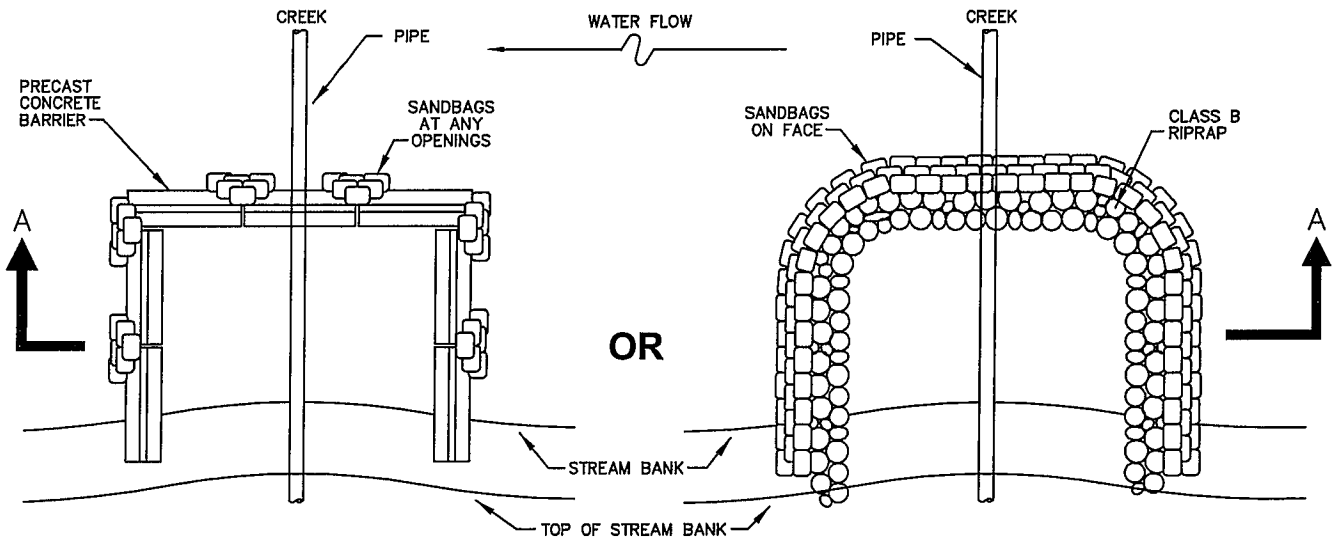
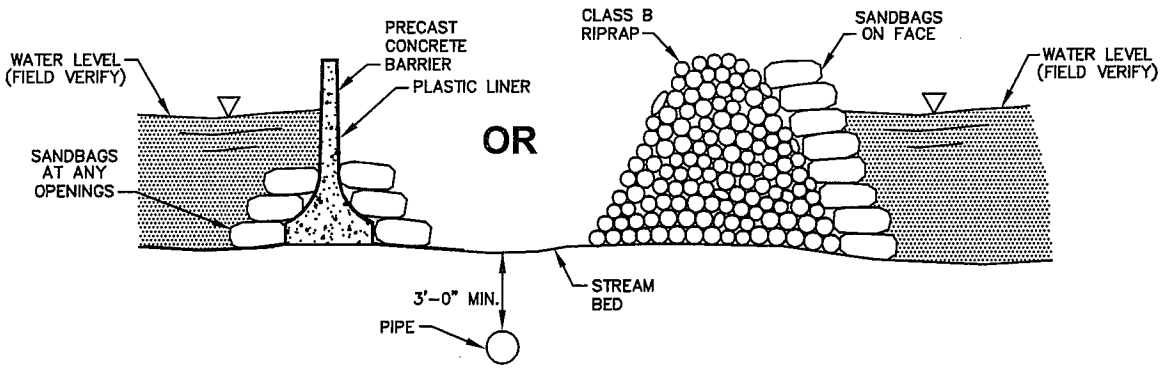
SANITARY SEWER SYSTEM
STANDARD DETAILS

REVISION NO: 1
DATE: MARCH 2013

STD-WW-13



PLAN



SECTION A-A

NOTES:

1. COFFER DAM WILL BE BUILT SO THAT APPROXIMATELY ONE-HALF (1/2) OF THE STREAM CHANNEL IS OPEN AT ALL TIMES.
2. MATERIAL FROM THE STREAM BED SHALL NOT BE USED FOR COFFER DAM.
3. NO EARTHEN MATERIAL SHALL BE USED FOR COFFER DAM OR PLACED IN STREAM FOR ANY REASON.
4. STREAM BED SHALL BE DISTURBED THE MINIMUM REQUIRED FOR CONSTRUCTION OF PIPE LINE AND WILL BE RESTORED TO ORIGINAL CONTOURS WHEN WORK IS COMPLETE.
5. ALTERNATIVE COFFER DAM MATERIAL IS ACCEPTABLE BUT SHALL BE APPROVED BY THE ENGINEER.

CREEK OR RIVER CROSSING

(LARGE CREEKS AND RIVERS)
NOT TO SCALE

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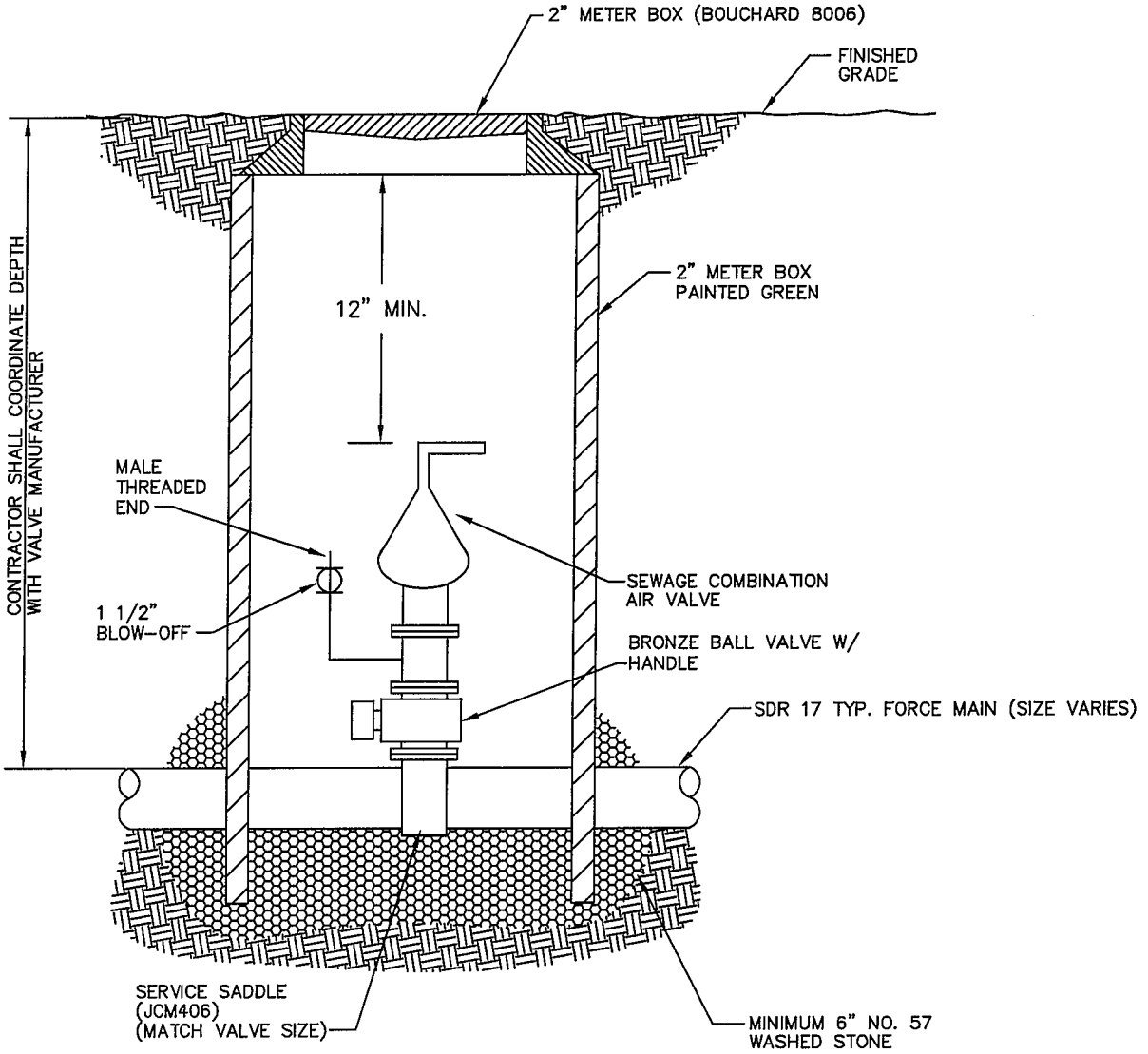
SANITARY SEWER SYSTEM
STANDARD DETAILS

REVISION NO: 1
DATE: MARCH 2013

STD-WW-14



NOTES:
1. COMBINATION AIR VALVE TO BE INSTALLED AT ACTUAL HIGH POINT OF LINE. CONTRACTOR SHALL COORDINATE LOCATION WITH INSPECTOR.
2. VALVE SIZE AS SHOWN ON DRAWINGS OR DETAILED IN THE SPECIFICATIONS.
3. ALL PIPING FOR COMBINATION AIR VALVE SHALL BE BRASS OR STAINLESS STEEL.
4. CONTRACTOR SHALL ADJUST THE DEPTH OF THE FORCE MAIN AT ALL HIGH POINTS TO ACCOMODATE THE INSTALLATION OF THE COMBINATION AIR VALVE.

SEWAGE FORCE MAIN COMBINATION AIR VALVE

NOT TO SCALE

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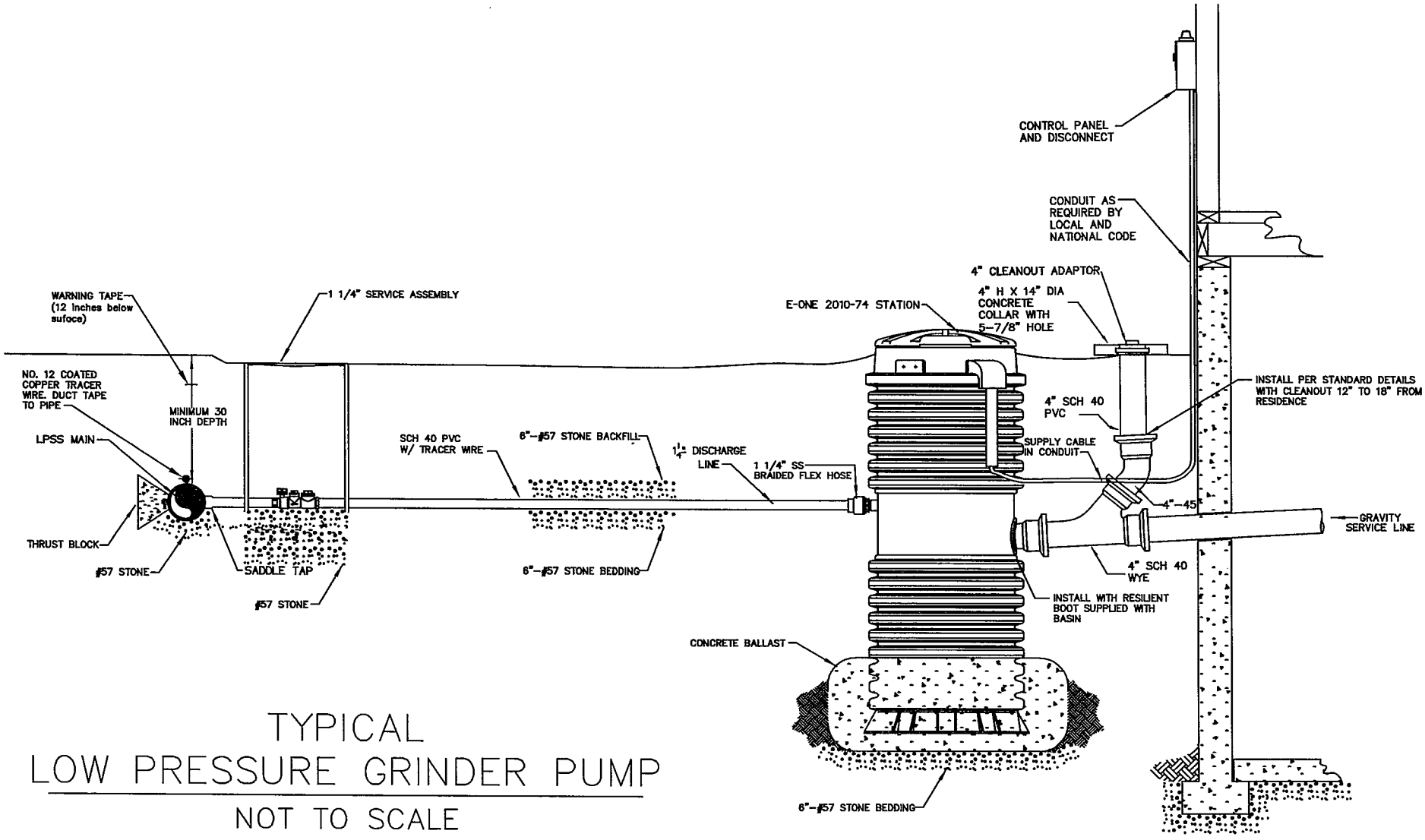
SANITARY SEWER SYSTEM
STANDARD DETAILS

REVISION NO: 2
DATE: MARCH 2013

STD-WW-15



TYPICAL
LOW PRESSURE GRINDER PUMP

NOT TO SCALE

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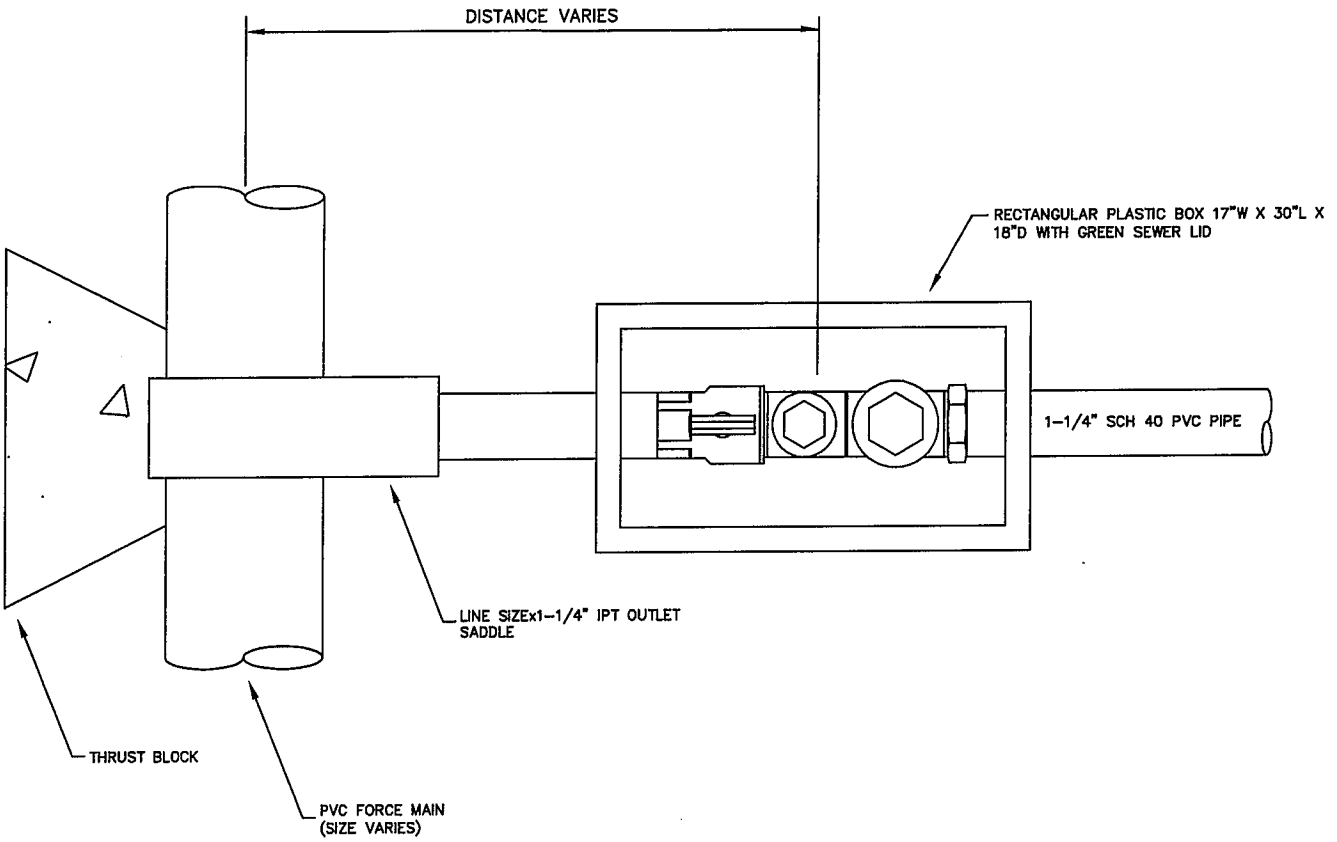
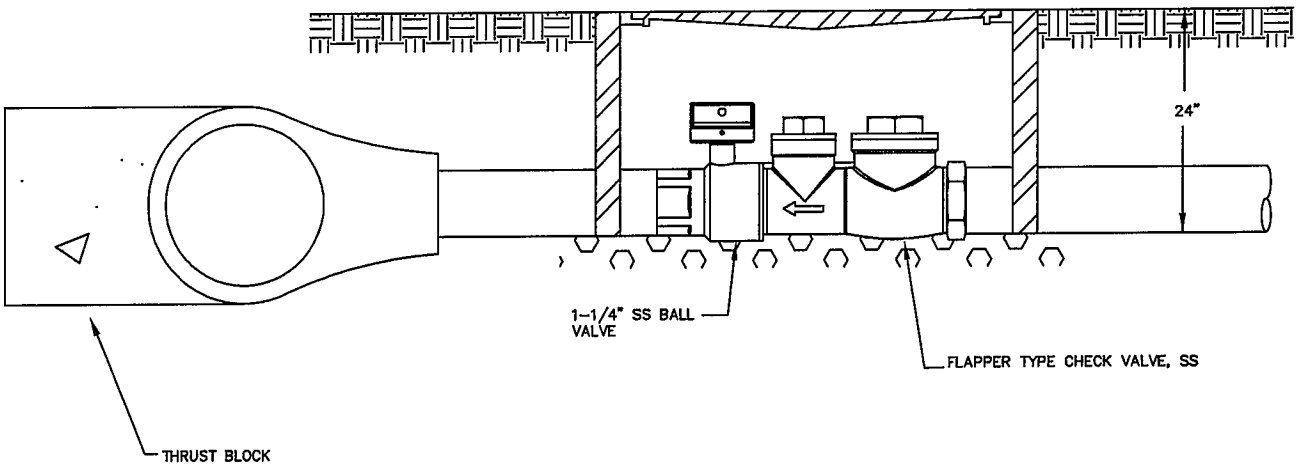
SANITARY SEWER SYSTEM
STANDARD DETAILS

REVISION NO: 2
DATE: MARCH 2013

STD-LP-01





1 1/4" SERVICE ASSEMBLY

NOT TO SCALE

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STANDARD DETAILS

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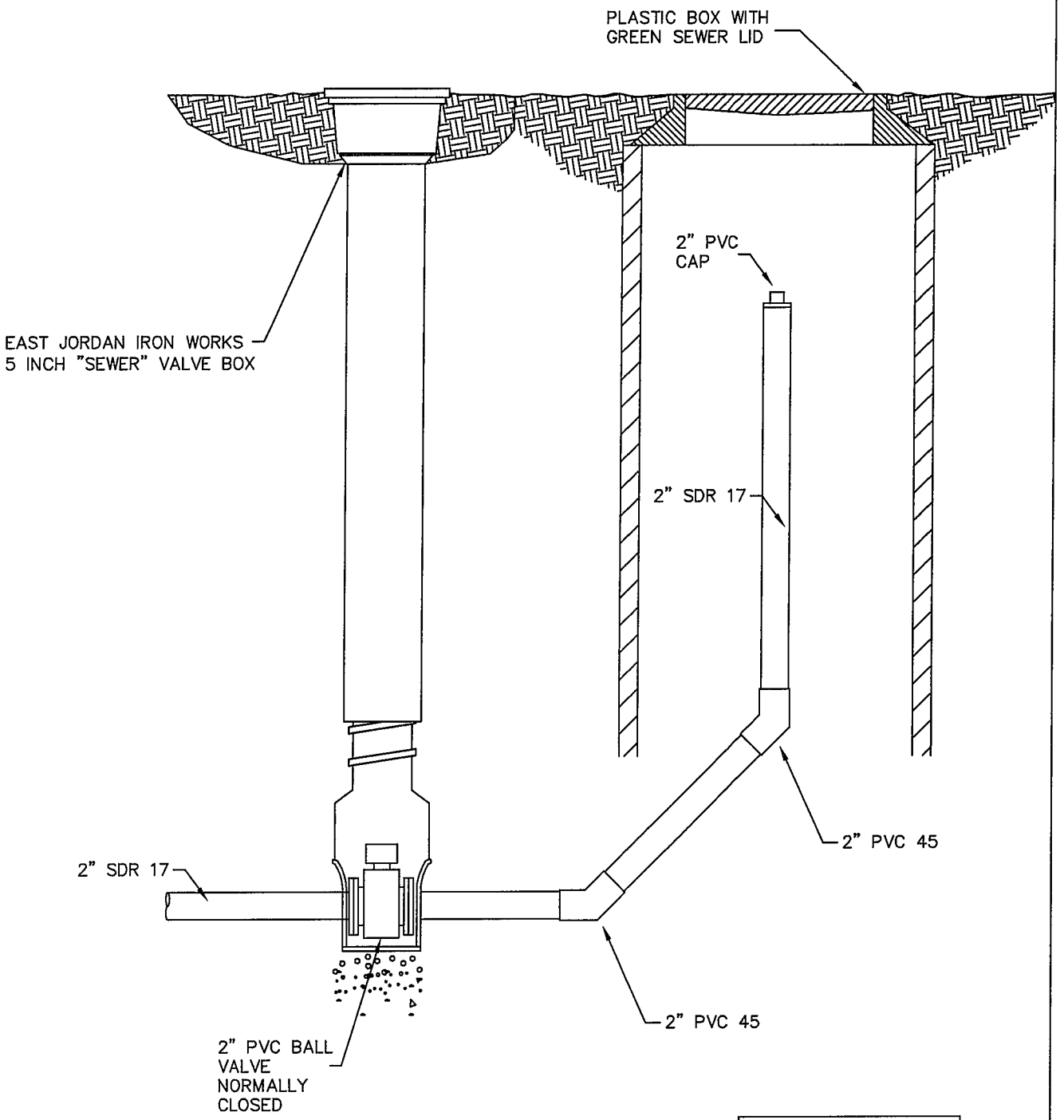
DATE: MARCH 2013

STD-LP-02



2" PVC LINES

FLUSHING STATION

NOT TO SCALE

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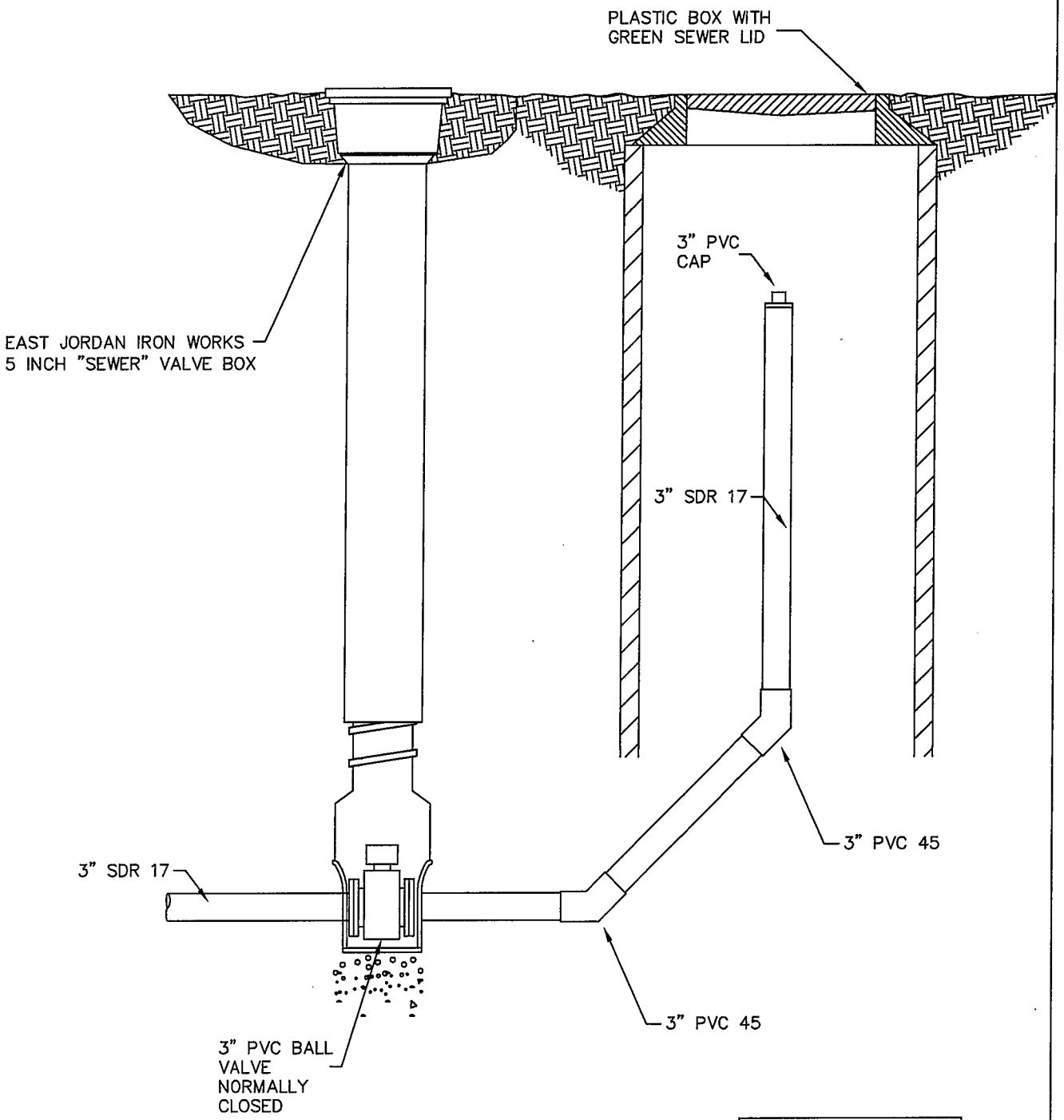
STANDARD DETAILS

REVISION NO: 3
DATE: MARCH 2013

STD-LP-03



3"+ PVC LINES

FLUSHING STATION

NOT TO SCALE

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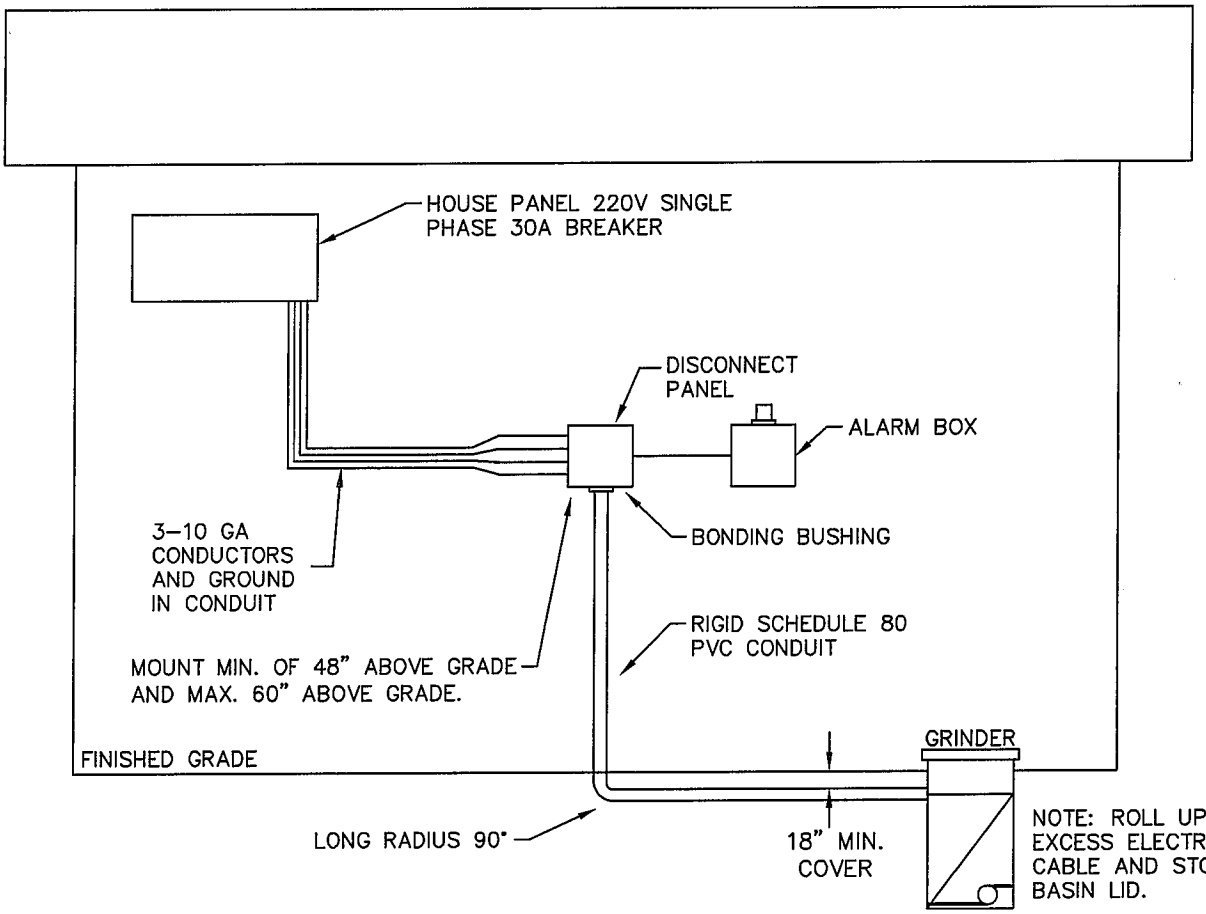
STANDARD DETAILS

REVISION NO: 3
DATE: MARCH 2013

STD-LP-04



NOTE: VERIFY MOTOR AMPERAGE AND ALL NAMEPLATE REQUIREMENTS PRIOR TO INSTALLATION. ALL CONNECTIONS SHALL BE IN ACCORDANCE WITH LOCAL CODES AND NEC.

ELECTRICAL INSTALLATION FOR SIMPLEX GRINDER PUMPS

NOT TO SCALE

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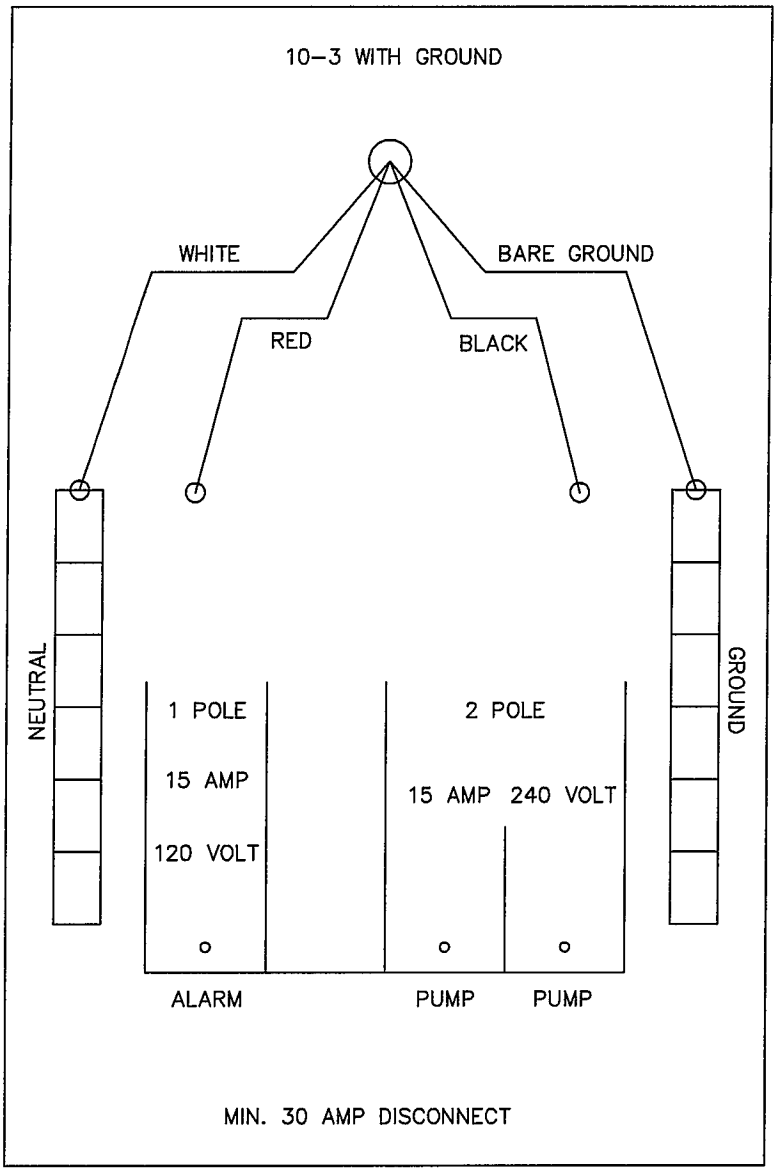
SANITARY SEWER SYSTEM
STANDARD DETAILS

REVISION NO: 2
DATE: MARCH 2013

STD–LP–05



30 AMP DISCONNECT PANEL

NOT TO SCALE

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STANDARD DETAILS

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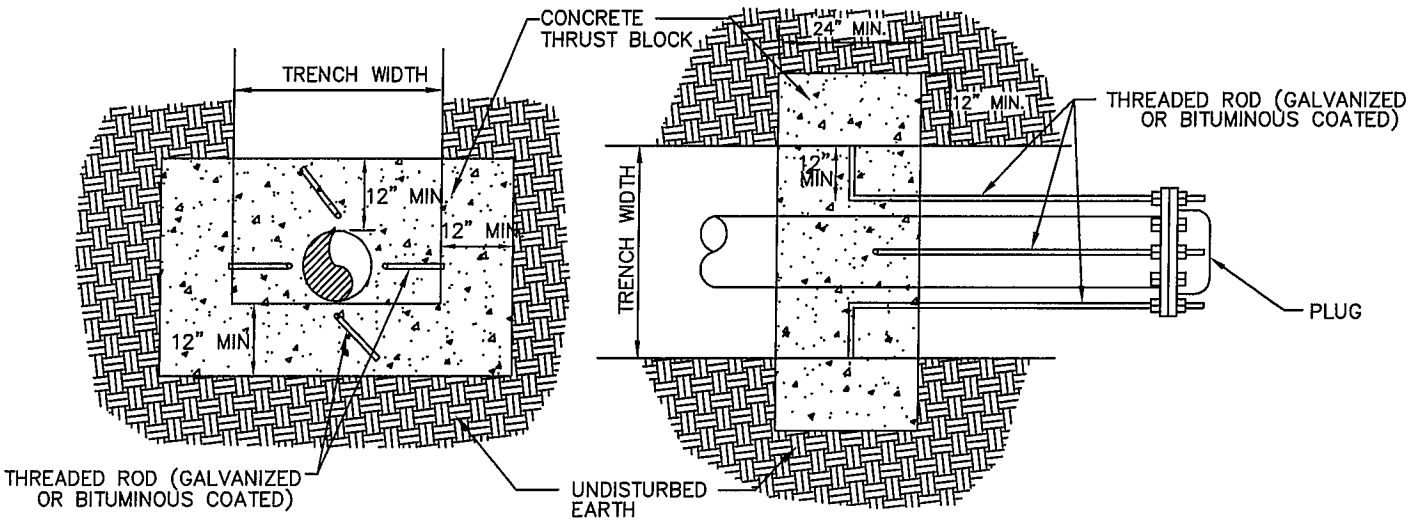
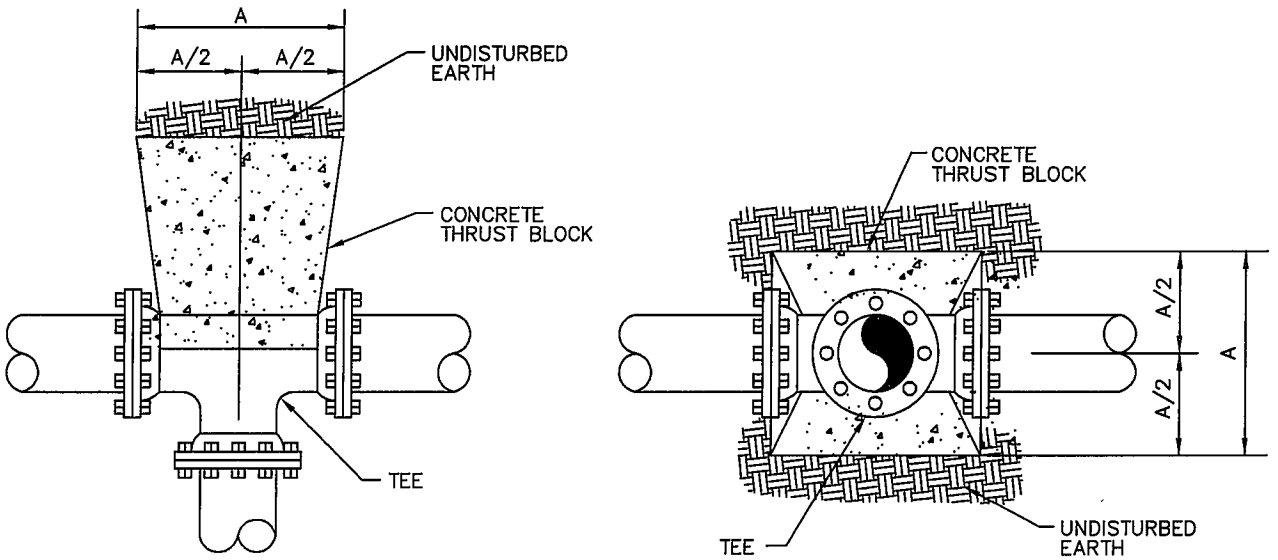
DATE: MARCH 2013

STD–LP–06





NOTES:

1. FITTING JOINTS SHALL NOT BE POURED IN CONCRETE OR HAVE CONCRETE SPILLED ON THE BOLTS OR NUTS. THE FITTING SHALL BE WRAPPED IN A LAYER OF POLYETHYLENE PLASTIC PRIOR TO POURING THE THRUST BLOCK.
2. ROD AND EYE BOLT DIAMETER SHALL BE A MINIMUM OF 3/4" AND SHALL MATCH THE SIZE OF THE BOLT PROVIDED WITH THE FITTING.
3. CONTRACTOR SHALL REPLACE FITTING BOLTS WITH THREADED ROD FOR 1/2 OF THE BOLTS SUPPLIED WITH EACH FITTING. RODS SHALL BE EQUALLY SPACED.

SIZE	TEE	PLUG
2-6	16	14
8	22	18
10	28	22
12	32	28
14	38	32
16	42	36
18	48	40
20	52	44
24	64	54
30	78	66
36	94	80
42	108	92
48	124	104

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