Request for Bid
Rodney Baber Park Sewer Improvements Addendum # 2 to
RFB No. 192442.71.0402
May 19, 2016

The following information encompasses Addendum # 2 for the above referenced RFB. Bidders shall fully consider and acknowledge this Addendum in the preparation and submittal of its formal Bid. Failure to do so may result in the rejection of the Bid.

Section 1 – Updated Table 00370.3.1

Section 2 – Updated Technical Specifications, Drawings, and Maps

PLEASE NOTE: As documented in the Addendum 1 - Updated Selection Schedule (RFB Section 00170.16), the final date for questions is May 25, 2016.

SUBMIT ALL QUESTIONS BY E-MAIL TO:
Attn: Ginny Dorsey
DorseyV@bv.com
Cc: Justin Avent
justin_avent@gspnet.com
Cc: Brad Davis
DavisBJ@bv.com
(Reference:*SARP10 Program* ***Rodney Baber Park Sewer Improvements,*** *Bid No.* ***192442.71.0402***)

All other conditions and requirements remain unchanged

Section 1 – Updated Table 00370.3.1

Table 00370.3.1 - Unit Price Bid Form

Bidder should refer to Section 00270, Instructions to Bidders, when completing this Bid Form. Bidder shall

Bid Submitted by (Company Name)

00370.3 Bid Pricing Information

00370.3.1 Unit Pricing

Bidder proposes to complete the RFB Work based on firm, fixed, unit prices (US dollars), which prices multiplied by the final Work quantities would represent the full consideration to Bidder for its complete and satisfactory performance of the Work in compliance with all the terms and conditions of the RFB Documents. The Unit Prices in this Table include the cost of all the work which is required or implied by the RFB documents or which may be inferred therefrom, and which is customarily provided in furnishing a complete and finished work item of its kind. Further, any and all alterations, modifications, and adjustments to the work item, which is reasonably foreseeable or customarily encountered in providing and installing equipment, material, and services of the work item kind, will be performed without additional compensation.

In the event of a Purchaser-approved change in the scope of Work for which a unit price from this Table is not applicable, as determined by the Purchaser, the Subcontractor shall provide a new unit price for review and acceptance by the Purchaser. Subcontractor shall provide all information requested by the Purchaser to substantiate the value of the new unit price.

00370.3.1.1 Unit Prices

Item Number	Item Description	Unit of Measure	Estimated Quantity	Bidder Response: Unit Price	Bidder Response: Extension Price
Miscellaneous					
00001	Mobilization	LS	1	$ -	$ -
MACP					
00001-6.01	Post GPS Coordinates of Each Manhole Cover	EA	13	$ -	$ -
00001-6.03	Post MACP Level 2 Manhole Inspection	EA	13	$ -	$ -
PACP					
00003-6.01.12	Post Light Cleaning & Mainline CCTV Inspection for 12 inch Pipe	LF	1975	$ -	$ -
00003-6.01.24	Post Light Cleaning & Mainline CCTV Inspection for 24 inch Pipe	LF	505	$ -	$ -
Sewer Pipe Installation					
02530-02	Silt Fence	LF	5000	$ -	$ -
02530-04	24 inch Jack Application of Cast Fiber Poly Mortar Pipe	LF	475	$ -	$ -
02530-6.01	Site Preparation and Restoration	LS	1	$ -	$ -
02530-6.02	Undercut Backfill	Ton	800	$ -	$ -
02530-6.07.06.12.01	12 inch Ductile Iron Pipe, Class 50, 14-20 feet deep	LF	280	$ -	$ -
02530-6.07.15.12.01	12 inch Polyvinyl Chloride (PVC) Pipe, 6-10 feet deep	LF	880	$ -	$ -
02530-6.07.15.12.02	12 inch Polyvinyl Chloride (PVC) Pipe, 10-14 feet deep	LF	820	$ -	$ -
~~02530-6.07.16.24.01~~	~~24 inch Glass Fiber Reinforced Polymer Mortar Pipe, 22-26 feet deep~~	~~LF~~	~~210~~		
02530-6.07.16.24.02	24 inch Glass Fiber Reinforced Polymer Mortar Pipe, 26-30 feet deep	LF	30	$ -	$ -
~~02530-6.07.16.24.03~~	~~24 inch Glass Fiber Reinforced Polymer Mortar Pipe, 30-34 feet deep~~	~~LF~~	~~110~~		
02530-6.11.01	Service Connections	LF	250	$ -	$ -
02530-6.17.16.20	20 inch Casing with 12 inch Carrier Pipe	LF	40	$ -	$ -
Installation and Replacement of Manoles					
02531-6.01	Manhole Site Preparation and Restoration	LS	1	$ -	$ -
02531-03a	12 inch Core and Boot Existing Precast Manhole	EA	1	$ -	$ -
02531-03b	24 inch Core and Boot Existing Precast Manhole	EA	1		
02531-6.03.04	4 ft Diameter Precast Manhole Installation	VF	120	$ -	$ -
02531-6.03.06	6 ft Diameter Precast Manhole Installation	VF	35	$ -	$ -
~~03310-01~~	~~Reinforced Concrete Junction Box (Dog House Manhole)~~	~~EA~~	~~1~~		
~~02531-6.05~~	~~Traffic Control~~	~~EA~~	~~14~~		
02531-6.08	Vent Stack	EA	2	$ -	$ -
02531-6.09	Inside Drop Construction in Existing / New Manhole	VF	17	$ -	$ -
02531.6.09.01	NO. 7 Sewer Manhole Rim & Cover	EA	7	$ -	$ -
02531.6.09.02	Sewer Manhole Water Tight Rim & Cover	EA	2	$ -	$ -
02531.6.09.03	Sealed Manhole for Vent Stack	EA	2	$ -	$ -

Item Number	Item Description	Unit of Measure	Estimated Quantity	Unit Price	Extension Price
Pavement and Incidentals					
02920-5.01.01	Asphaltic Concrete Pavement Removal and Replacement	SY	5	$ -	$ -
02920-5.01.02	Concrete Pavement Removal and Replacement	SY	2	$ -	$ -
02950-5.01.05	Gravel Driveway and Gravel Area Removal and Replacement with Crushed Stone	Ton	10	$ -	$ -
~~02530-02~~	~~Silt Fence~~	~~LF~~	~~4500~~		
	100% Performance and Payment Bonds	Lot	1	$ -	$ -
			Total Estimated Unit Price Value		$ -

Section 2 – Updated Technical Specifications, Drawings, and Maps

SPECIAL CONDITIONS

l. SCOPE OF THE CONTRACT:

A. The work required under this Contract includes furnishing and paying for all necessary materials, labor, tools, equipment, and other items and construction improvements of the Rodney Baber Park Sewer Improvements, complete in every detail, ready for the Purchaser's beneficial use as specified herein and/or indicated on the contract drawings. The project shall consist of, but is not limited to, the following items:

1. Installation of approximately 2000 linear feet of new 12 inch diameter sanitary sewer ductile iron pipe (DIP) and polyvinyl chloride (PVC) pipe, approximately 480 linear feet of new 24 inch diameter sanitary sewer Glass Fiber Reinforced Polymer Mortar Pipe, new sanitary sewer manholes, and 12 foot diameter concrete junction box (doghouse manhole) over existing 84 inch gravity sewer line. Also included is the post construction assessment of all new pipes and manhole structures. The assessment includes manhole assessment as well as closed-circuit television (CCTV) or sonar inspection inspections for all pipe diameters. Other related work includes abandoning existing sanitary sewer pipes, bypass pumping, a new sewer tap and service line, restoring the disturbed area, and erosion control.

2. MODIFICATIONS AND ADDITIONS TO TECHNICAL SPECIFICATIONS:

A. In the event of conflict between the TECHNICAL SPECIFICATIONS, Construction Drawings, the General Provisions or Special Conditions contained herein, and/or product manufacturer's specifications the more stringent shall apply. However, all conflicts shall be brought to the attention of the INSPECTOR for approval.

B. The cost of all required material inspections and testing, including, but not limited to earthwork and concrete testing, shall be paid for by the CONTRACTOR.

C. Item No. 02530-02, Silt Fence

1. This item is not specified in the TECHNICAL SPECIFICATIONS.
2. Job Conditions
   - A. Excavation, trenching, backfilling, and grading operations to elevations as needed to meet the requirements shown on the Contract Documents, shall be done in such a manner as to cause the least amount of soil erosion and siltation.
   - B. Appropriate management practices and control structures shall be

in place prior to clearing of vegetation for necessary construction activities near streams, rivers, and lakes.

C. Provisions required to maintain uninterrupted surface water flow shall be maintained during the work. Storm water flow in existing gutters, surface drains, and swales shall not be interrupted.

D. The Engineer shall be notified of any unexpected subsurface or other unforeseen conditions. Work shall be discontinued until the Engineer provides notification to resume work.

3. Preparation

A. Erosion and sediment control shall be in accordance with the Tennessee Water Quality Control Act of 1977, as amended, and the Federal Act Pl 92-59.

B. The Tennessee Department of Conservation Publication, Tennessee Erosion & Sediment Control Handbook, latest revision, shall be used as a guide for construction of projects that require erosion and sediment controls to protect adjoining property and waters of the state.

4. Performance

A. Whenever possible, a buffer strip of vegetation cover shall be kept adjacent to grading operations.

B. Control measures shall be in place and functional before earth moving operations begin, and must be properly constructed and maintained during the construction period.

C. Staked and entrenched straw bales or silt fence shall be installed along the base of all sloped cuts and fills, on the down hill sides of stockpiled soil, and along stream banks.

D. All surface water flowing toward the construction area shall be diverted around the area as much as possible to reduce erosion potential by using beams, channels, and/or sediment traps as necessary.

E. Maintenance of erosion and sediment control methods shall be performed on a regular basis throughout the construction period and until a good vegetative cover is established over the entire disturbed area.

F. A vegetation buffer strip shall be maintained between any stream and pipe trenching. Excavated material from the trench shall not be placed between the trench and stream.

G. Trenches or pits shall be backfilled as soon as practicable to reduce erosion potential.

H. Erosion control measures shall be removed when they have served their useful purpose. The disturbed soil shall be fine graded, top soiled, and planted with permanent vegetation as soon as the construction sequence allows to prevent further potential erosion and sedimentation. Any seeded areas which are eroded shall be reworked as soon as possible.

5. Payment will be at the contract unit price for installation per Linear Foot (L.F.) Silt Fence, which shall include all material and labor necessary to complete the item as shown on the plans

D. Item No. 02531-03, Existing Manhole Core & Boot

1. Core-drill circular opening in manhole wall of diameter to fit the required boot size.
2. Kor-n seal flexible rubber boot (manufactured by National Pollution Control Systems, Inc. or as approved by the engineering department) shall be used for watertight connection.
3. Cut, shape and slope new invert channel in the existing concrete bench for smooth flow from new sanitary sewer connection.
4. Clean existing manhole of any dirt, concrete or debris which may accumulate during the construction process.
5. Payment will be at the contract unit price for installation of each Existing Manhole Core & Boot, which shall include all material and labor necessary to complete the item as shown on the plans.

E. Item No. 02530-04, 24-inch Jacking Application for Fiberglass Reinforced Pipe

1. This item is not specified in the TECHNICAL SPECIFICATIONS.
2. Reference: Section 02530 – Sewer Pipe Installation
3. Where 24-inch pipe jacking is indicated on the drawings, fiberglass reinforced poly mortar pipes shall be used.
4. Pipe shall be of stiffness class standard for jacking applications SN>72.
5. Jacking loads must be controlled within safe limits established by the manufacturer and applied in a manner to maintain the grade specified on the plans. Joint and pipe deflection shall meet or exceed manufacturer standards.
6. Pipe installed using the jacking application shall be jacked bell-trailing.
7. Jacking loads shall be minimized by overcutting the tunnel and lubricating the annular space.
8. Payment shall be at the contract unit price for installation per Linear Foot (L.F) of pipe.

CITY OF MEMPHIS – STANDARD CONSTRUCTION SPECIFICATIONS
SECTION 00001 - MANHOLE GPS &MACP INSPECTION

PART 1 – SCOPE

1.01 This Work will consist of locating sanitary sewer system facilities, gathering sub-meter grade GPS coordinates of manhole (including lamphole) covers, Manhole Assessment Certification Program (MACP) protocol Level 1 and Level 2 manhole inspections using the National Association of Sewer Service Companies (NASSCO) MACP Version 6.0.1 protocols, associated photographs, camera inspection of manholes and the associated pipe connections, and documentation of manholes not found, not on grade and/or not showing. Manholes to be located, documented and inspected are in both improved streets, arterial and primary roads, backyards and unimproved easements. Once new manhole coordinates are obtained, the updated source GIS map data shall be delivered to Program Manager(from hereon Program Manager shall be interpreted as "Program Manager or his designee") in order to reflect the actual sewer system network.

The Work covered by this section includes furnishing all labor, competent MACP certified technicians/crew leads, equipment, tools, accessories, and materials required to GPS, perform MACP Level 1 and Level 2 inspections, conduct camera inspections and document the specified manholes.

1.02 Sub-meter GPS coordinates, updated GIS map data, Levels 1 and 2 MACP data and records, and camera inspection photos of the manholes shall be delivered to the Program Manager on clearly labeled external hard drive(s) which will become property of the Program Manager. Inspection data for any one asset shall not be split between multiple drives. MACP data files shall be formatted to facilitate upload into a MACP Exchange Database or internet upload to an FTP site as approved by the Program Manager.

1.03 Selected Contractor(s) will be provided two Geo-databases; one will have supporting records (aerial photo overlays, outfall and block maps and as-builts, as available), and a maiden database which will include the asset ID for each manhole.

PART 2 - MATERIALS AND EQUIPMENT

2.01 MATERIALS

A. Submittals

1. Unless otherwise specified, all sample submittals shall be delivered to the Program Manager within two weeks of the NTP.

2. A Traffic Control Plan shall be submitted to the Program Manager, including the following items:

   a. Outline of permit acquisition procedure for lane closures.

   b. Methods for proper signing and barricades, which comply with local requirements and the City.

   c. Major streets (e.g. Shelby County Principal Arterial & Minor Arterial) requiring a City approved permit if taking a lane for mobile operations, secured through Traffic Control Plan submittal to the City and signed by a TN P.E. The City requires a two-week lead time for permit processing.

      i. The Contractor will be required to deliver a sample primary/arterial road Traffic Control Plan for review by the City.

ii. If the City determines that the nature of the work operation or the type of road in which the Contractor is working requires a permit, the Contractor will be required to modify the sample Traffic Control Plan to obtain a permit from the City.

d. For everywhere else where a permit is not required, the Contractor shall develop, provide, and implement a Traffic Control Plan for all mobile operations in accordance with standard MUTCD specifications.

e. The Contractor is also responsible for acquiring all necessary disposal and/or landfill site permits required to perform this work.

f. Railroad Rights of Way: The Contractor shall notify the Program Manager when work or access to manholes and sanitary sewers lie within the 25 feet railroad easement, as measured by 25 feet outside the nearest rail of the tracks. To access sewer facilities within the 25 feet of the railroad right of way, the Contractor shall contact 48 hours in advance the Program Manager, who will alert the City's Zone Construction Inspector to coordinate individual railroad direction and guidance.

3. Site Contractors emergency phone numbers.

4. Schedules of work on a weekly basis that will be delivered no later than 2:00 PM on Thursday for the week following, and daily AM email updates of approximate crew locations each day.

   a. Weekly schedule format shall contain the following elements:

      i. Map format.
      ii. Sufficient streets labeled and identified at a scale to provide clarity.
      iii. Nature and type of crew location by map area.

5. Permit required confined space entry plans in compliance with the Loss Control Manual.

6. GPS calibration standards, including frequency, are to be followed in the field; specify which available base stations will be used for the work.

7. Sample of sub-meter GPS coordinates delivered in electronic and pdf format.

8. Copies of NASSCO certifications for all field staff conducting MACP Levels 1 and 2 inspections.

9. Sample of MACP Level 1 and Level 2 documentation logs (with photo documentation comments and photos properly referenced) in MACP formats, in both electronic and pdf format.

10. Equipment list, including GPS and camera manufacturer and model equipment to be used.

11. Sample of the GPS coordinate delivery in an ESRI ArcPAD .axf file format.

12. Sample of the digital inspection data delivery in MS ACCESS database format.

2.02 EQUIPMENT

A. All equipment used for the gathering of GPS coordinates, collection of condition assessment information, and digital camera inspection of manholes shall be specifically designed and manufactured for the purpose intended under this Contract. The software and hardware for the electronic capture of the inspection defect observations must be consistent with NASSCO's MACP Level 1 and Level 2 requirements for the collection of data. ESRI ArcPad 10.1is required for GPS data collection and GIS map updates for manhole / lamphole facility locations. Export of the electronic inspection data to an MACP format Microsoft ACCESS database for analysis is required.

B. The Contractor shall submit an equipment list to the Program Manager for approval before the commencement of the Work and shall certify that back-up equipment is available and can be delivered to the worksite in 72 hours.

1. GPS Equipment

   a. Equipment shall be sub-meter grade, Trimble Pro Series Receivers with Floodlight technology capability, Top Con GRS-1 Series equipment or equal (to be approved by Program Manager prior to mobilization). GPS coordinates to be real-time or post-processed to achieve sub-meter accuracy. Equipment must have ESRI ArcPad 10.1 installed for use in data acquisition.

2. Camera

   a. All cameras used shall be digital format color cameras specifically designed or modified for use in sewer manhole inspection work. All cameras used during inspections shall have a minimum of 5 mega pixels .jpg format for sufficient clarity and detail in the photos, and photos of at least 2MB shall be submitted. The cameras shall be operable in 100 percent humidity conditions. The cameras shall be high-resolution cameras with wide viewing angle lenses and either automatic or remote focus and iris controls. Camera lighting shall be sufficient for use with digital color inspection cameras and for the manhole diameters and pipe connection diameters identified in the contract.

   b. The following photo sequence is specified: Photo 1- surface view photos taken of the manhole should include a whiteboard (or similar) with the manhole ID number identified on it. The photographer should be standing with the outlet pipe facing their 6 o'clock position. Photo 2 - the downhole photo of the manhole channel should be taken with the outlet pipe facing their 6 o'clock position. Additional photos as specified by MACP guidance.

   c. Inadequate lighting, image distortions, blurry or murky images, low resolution, dirty lens and/or other quality issues will be a cause for rejection. If unsatisfactory, Contractor shall perform work until deliverable is of acceptable quality. No payment will be made for unsatisfactory inspections or until product is accepted.

3. Data Logger and Software

a. MACP and camera inspections and logs created and captured electronically during the MACP inspection of the manhole through the use of commercially available electronic data loggers are required. Paper records for data collection in the field shall not be used. NASSCO MACP protocols shall be used for capturing and recording the observations.

b. The data logger equipment and software shall allow Program Manager direct access to the captured electronic data, and provide for export of the data in accordance with MACP formats and standards.

4. Retrieval of Stuck Equipment

a. The Contractor is responsible for hiring a licensed sub-contractor to retrieve any equipment that becomes lodged in the sewer system through the execution of the scope of work (fallen cameras, jet nozzles, inflatable plugs, sandbags etc.) at the Contractor's own cost. Such retrieval by an appropriately licensed sub-contractor shall be made within 72 hours to avoid interfering with the City of Memphis sewer system operations. Any and all impacts and related costs due to the Contractor's equipment in the line shall be the responsibility of the Contractor.

PART 3 – CONSTRUCTION REQUIREMENTS

3.01 INSPECTION

A. GPS Coordinates of Manhole Cover

1. Program Manager will provide Contractor with a digital copy of the original GIS source map indicating the sewer system network compiled from existing City records.

2. The Contractor shall capture and record sub-meter grade x, y and z coordinates of each manhole cover identified in the original GIS maiden data map provided with a unique asset identification (ID) number. Additional sanitary sewer lamp hole and manholes found in the field in the course of the inspection work that are not provided in current mapping nor identified with a current unique asset ID shall be documented and GPS coordinates shall be recorded. A provisional manhole asset ID number shall be used by the Contractor by adding a dash and a two-character number to the closest upstream manhole ID.

3. Record sub-meter GPS coordinates in NAD83 TN State Plane Coordinates horizontal, NAVD88 vertical in US Survey feet using properly-calibrated GPS equipment. If GPS coordinates cannot be obtained due to buildings, trees or cloud cover, Contractor shall note this on the inspection form and return at least one additional time at a different time of day or under different sky cover. If both attempts fail at securing the sub-meter coordinates, this is to be documented and reported in the submittal. Land surveying shall not be required where GPS is not available.

4. The Contractor shall be expected to use all reasonable means to locate the lampholes and manholes in the field. This includes walking the pipeline alignment, using measuring tapes or wheels from the last found manhole, using metal detectors, or other means. If manholes are not able to be found and documented or unknown manholes are found, record the reasons for not locating or not opening the manhole or the specifics of the new manhole found, and submit with supporting MACP documentation to the Program Manager daily.

5. Once GPS coordinates are obtained for known and newly discovered facilities, the original GIS map data shall be delivered to the Program Manager to reflect the actual sewer system network for the assigned inspection area.

6. The Contractor shall revisit predefined GPS control locations near project area at least one time per day per each GPS unit used as a quality control check on GPS accuracy. Contractor is to document these checks on a single log, which shall be kept on file for the duration of the project, and shall be released to Program Manager on a weekly basis.

B. MACP MH Inspection

1. The Contractor shall document and record each sanitary sewer manhole inspection in MACP Level 1 format for lampholes and Level 2 format for manholes with supporting completed MACP format database. The complete NASSCO MACP Levels 1 and Level 2 protocols must be utilized for the lamphole and manhole inspections respectively, and must be associated in the electronic database and pdf documentation with the unique asset ID provided.

2. The Contractor shall mark the direction of wastewater flow (one arrow per pipe)in and out of the manhole around the perimeter of the manhole cover on the street with discrete green arrows spray painted onto the road surface using a guide or template for the arrows. The arrows shall be a minimum of 12 inches and a maximum of 18 inches in length.

3. The Contractor shall follow the prescribed MACP Level 1 and Level 2 procedures and use the required nomenclature and formats to document the manhole interior and exterior conditions and defects.

4. Contractor shall be responsible for cleanup, repair, fines, property damage costs, and claims for any sewage backup, spillage or sanitary sewer overflow during or as a result of the field operations.

C. Camera Inspection of Manholes and Associated Pipe Connections

1. Digital camera inspection of manholes shall be completed in conjunction with Level 2 manhole inspections of defects and include each sewer pipe connection in the manhole. The photo record of the inspection shall document defects and leaks and shall include a photo record of the connecting pipes in each manhole. Abbreviations, naming conventions, and numbering conventions shall be documented in MACP formats. For photo image quality reference back to Section2.02.B.1.

2. File naming must be consistent. Additional instructions, naming conventions, file structures, etc. will be provided after contract award.

D. Meetings

1. The Program Team will arrange bi-weekly (every other week) meetings with the contractor to discuss data management and quality, and field issues.

PART 4 – DELIVERABLES

4.01 RECORDS

A. GPS Manhole Cover Coordinates

1. Contractor's Level 1 Lamphole and Level 2 Manhole GPS coordinate delivery to the Program Manager shall be in an ESRI ArcPAD .axf file format. The updated GIS source map data reflecting the actual sewer system network shall also be delivered. Inspection data is to be delivered to the Program Manager by the close of business on the Monday following a week after data acquisition. Subsequent data will not be accepted if GPS data is not obtained and delivered at the same time as inspection is conducted. The requested GPS control check file (MS EXCEL) shall also be delivered at this time.

B. Level 1 and Level 2 Inspection Documentation

1. Deliver complete MACP Level 1 for lampholes and Level 2 inspections for manholes in MACP electronic database and pdf electronic formats on an external hard drive. Delivery will be in MS ACCESS database format unless otherwise preapproved by the Program Manager. Inspection data is to be delivered to the Program Manager by the close of business on the Monday following a week after data acquisition.

C. Camera Inspection Documentation

1. Include specified camera photo documentation of defects, leaks and pipe connections in the MACP Image reference field as appropriate, for the Level 2 documentation. Inspection data is to be delivered to the Program Manager by the close of business on the Monday following a week after data acquisition.

D. Manhole Reports

1. Deliver a summary report in PDF format of each manhole inspected. The report will include all MACP Level 1 & Level 2 data collected for the manhole. The report shall include the surface view photo of the manhole with the outlet pipe facing 6 o'clock as well as a downhole photo of the channel with the outlet pipe at 6 o'clock. Any defects noted in the manhole shall also have an accompanying photo in the report.

E. Draft Report and Final Report

1. In addition to the electronic database and pdf format reports, three copies of the Draft Report will contain hard copies of each of the MACP inspections with camera manhole defect and pipe connection photographs. The MACP compliant database of the inspections in ACCESS format shall also be submitted to the Program Manager electronically on an external hard drive.

2. Draft Report shall be delivered to Program Manager within fifteen working days of the last or final inspection. The Program Manager will have a two workweek period to review and provide comments to the Contractor. The Contractor shall address all comments and submit the Final Report within one workweek from receipt of comments. At the Program 3. Manager's discretion, a meeting will be

held upon submittal of the Final Report to have the Contractor go over the processes used to address comments.

F. Quality

1. Rejection of deliverables will be submitted to the Contractor via the Program Team in a written communication discussing issues that must be addressed. The Contractor will be required to follow up with a response within three business days upon receipt of the written communication. Contractors will have seven (7) calendar days from the rejection notice date to make the necessary corrections and resubmit the data deliverable in its entirety.

PART 5 – MEASUREMENT

5.01 GPS COORDINATES OF MANHOLE COVER

A. The capture and associated documentation of sub-meter GPS x, y and z coordinates for each lamphole and manhole cover will be measured for payment per each lamphole and manhole located by GPS and its coordinates recorded in accordance with the specification, provided that documentation meets QA/QC standards.

5.02 MACP LEVEL 1 FOR LAMPHOLE INSPECTIONS

A. The inspection and recording of all lamphole observations in a MACP compliant fashion will be measured for payment per each lamphole inspected in accordance with the specification.

5.03 MACP LEVEL 2 FOR MANHOLE INSPECTIONS

A. The inspection and recording of all manhole observations in a MACP compliant fashion will be measured for payment per each manhole inspected in accordance with the specification.

PART 6 – PAYMENT

6.01 GPS COORDINATES OF MANHOLE COVER

A. The capture and associated documentation of sub-meter GPS x, y and z coordinates for each manhole cover shall be paid for at the unit price bid for each lamphole and manhole cover coordinates documented and recorded in accordance with the specification provided that QA/QC standards are met.

B. The unit price for each manhole cover GPS set of coordinates shall cover the entire cost of the GPS equipment and time necessary to gather the coordinates, including but not limited to calibrating the equipment; setup and access; traffic control; documenting results in prescribed MACP electronic formats, records and logs; power supply for equipment; interim and final reports; and all other appurtenant work.

C. No additional payment will be made for:
1. Location or re-inspection due to cars parked over manholes or other impediments to on grade and showing manhole covers.
2. Additional visit(s) to secure the proper GPS coordinates due to lack of adequate satellite coverage or reception.
3. Unapproved duplication of inspections: The contractor/subcontractor is responsible to ensure duplications do not occur.

6.02 MACP LEVEL 1 FOR LAMPHOLE INSPECTIONS

A. The inspection and recording of all lamphole observations in a MACP format shall be paid for at the unit price bid per each MACP Level 1inspection performed in accordance with the specification, provided that QA/QC standards are met.

B. The unit price for each MACP lamphole inspection shall cover the entire cost of the inspection and reporting, including but not limited to setup and access, documenting results in records and logs, power supply for equipment, interim and final reports and all other appurtenant work.

6.03 MACP LEVEL 2 FOR MANHOLE INSPECTIONS

A. The inspection and recording of all manhole observations in a MACP format shall be paid for at the unit price bid per each MACP Level 2inspection performed in accordance with the specification, provided that QA/QC standards are met.

B. The unit price for each MACP manhole inspection shall cover the entire cost of the inspection and reporting, including but not limited to setup and access, documenting results in records and logs, digital photos, power supply for equipment, interim and final reports, and all other appurtenant work.

6.04 PAYMENT WILL BE MADE UNDER:

Item No.	Pay Item	Pay Unit
00001-6.01	GPS COORDINATES OF MANHOLE COVER	EACH
00001-6.02	MACP LEVEL 1 LAMPHOLE INSPECTIONS	EACH
00001-6.03	MACP LEVEL 2 MANHOLE INSPECTIONS	EACH

END OF SECTION 00001

CITY OF MEMPHIS – STANDARD CONSTRUCTION SPECIFICATIONS
SECTION 00003 - CLOSED CIRCUIT TELEVISION INSPECTION OF SEWER MAINS&CONNECTIONS

PART 1 – SCOPE

1.01 This Work will consist of cleaning and Pipeline Assessment Certification Program (PACP) internal closed circuit television (CCTV) surveys to digitally inspect and record conditions of existing sanitary sewer mains and connections. Sewer pipes and connections to be inspected are located in both improved streets, arterial and primary roads, backyards and unimproved easements.

1.02 The Work covered by this section includes furnishing all labor, competent PACP certified technicians, equipment, tools, accessories, and materials required to clean and inspect the designated sanitary sewer lines.

1.03 PACP compliant inspections, logs, data, and photos shall be delivered to the Program Manager(from hereon Program Manager shall be interpreted as "Program Manager or his designee") on external hard drive(s) which will become property of the Program Manager. Data files shall be formatted to facilitate upload into a PACP compliant Exchange database or internet uploads formats to an FTP site approved by the Program Manager.

PART 2 – MATERIALS &EQUIPMENT

2.01 MATERIALS

A. Submittals

1. Unless otherwise specified all sample submittals shall be delivered to the Program Manager within two weeks of the NTP.

2. Traffic Control Plan shall be submitted to the Program Manager, including the following items:

   a. Outline of permit acquisition procedure for lane closures.

   b. Methods for proper signing and barricades, which comply with City of Memphis requirements.

   c. Major streets (e.g. Shelby County Principal Arterial & Minor Arterial) requiring a City approved permit if taking a lane for mobile operations, secured through Traffic Control Plan submittal to the City and signed by a TN P.E. The City requires two-week lead time for permit processing.

      i. The Contractor will be required to deliver a sample primary/arterial road Traffic Control Plan for review by the City.
      ii. If the City determines that the nature of the work operation or the type of road in which the Contractor is working requires a permit, the Contractor will be required to modify the sample Traffic Control Plan to obtain a permit from the City.

   d. For everywhere else where a permit is not required, the Contractor shall develop, provide, and implement a traffic control plan for all mobile operations in accordance with standard MUTCD specifications.

   e. The Contractor is also responsible for acquiring all necessary disposal and/or landfill site permits as required to perform this work.

f. Railroad Rights of Way: The Contractor shall notify the Program Manager when work or access to manholes and sanitary sewers lie within the 25 feet railroad easement as measured by 25 feet outside the nearest rail of the tracks. To access sewer facilities within the 25 feet of the railroad right of way the Contractor shall contact the Program Manager 48 hours in advance who will alert the City's Zone Construction Inspector to coordinate individual railroad direction and guidance.

3. Site Contractor emergency phone numbers.

4. Schedules of work on a weekly basis that will be delivered no later than 2:00 PM on Thursday for the week following with daily AM email updates of approximate crew locations each day.

   a. Weekly schedule format shall contain the following elements:

      i. Map format.
      ii. Sufficient streets labeled and identified at a scale to provide clarity.
      iii. Nature and type of crew location by map area.

5. Permit required confined space entry plans in compliance with the Loss Control Manual.

6. Copies of National Association of Sewer Service Companies (NASSCO) certification for all field staff conducting PACP inspections.

7. Sample of PACP compliant television survey log in MS Access format.

8. Sample of PACP compliant video inspection in MP-4 (Web optimized)format.

9. Cleaning and CCTV vehicle, equipment,andcleaning supplies list.

10. Disposal site(s) and appropriate landfill permits for appropriate disposal of all waste materials removed from the sewer during the light and heavy cleaning operations.

2.02 EQUIPMENT

A. General

1. All equipment used for PACP compliantCCTV sewer segment inspections of existing sanitary sewer mains andconnectionsshall be specifically designed and manufactured for the purpose intended under this Contract. The software and hardware for the electronic capture of the inspection defects and recorded observations must be Version 6.0.1NASSCOPACP compliant.

2. The Contractor shall submit an equipment list to the Program Manager for approval before the commencement of the Work and shall certify that back-up equipment is available and can be delivered to the worksite within 72 hours.

3. The Contractor shall provide equipment to perform inspections of sewer mains located in streets, street rights-of-way, backyards, easements and rights-of way that are off-road.

a. Including but not limited to portable CCTV equipment, vehicles capable of transporting TV equipment and accessing remote easements, and adequate cleaning equipment rights of way or easement applications.

B. PACP Compliant Software &Data Logger Requirements

1. Data logger

a. Internal inspection logs created and captured electronically during the television inspection through the use of commercially available electronic data loggers in the truck are required. NASSCO PACP protocols Version 6.0.1 shall be used for capturing and recording the observations. Audio commentary made during the inspection and captured on the digital video shall correspond with the PACP observations on the log.

b. The data logger equipment and software shall allow the Program Manager access directly to the captured electronic data and provide for a non-proprietary export of the data into MSACCESS databases in accordance with PACP standards for standalone database review.

2. Software must be compliant with the NASSCO PACP V.6.0.1 standards. Follow PACP protocol for recording of observations and defects for sewer mains.

a. All software shall be capable of providing complete survey reports in compliance with PACP, and the software shall be the V.6.0.1 of the PACP compliant software.

b. The Program Manager has no intent to specify which software the Contractor shall use, but requires the software and the submitted database to be fully compliant with PACP V.6.0.1 and capable of being exported to ACCESS databases. No payment will be rendered for improperly formatted data.

c. Software and data logger must be capable of capturing sewer main and sewer lateral observations by PACP descriptions, record travel footage along pipeline, and video time stamp the recorded observations to support hyper linking from the digital record to the event point or location within the digital inspection record. The same requirements apply to still photo images (if provided) which shall follow PACP guidelines and be hyperlinked to the inspection log.

C. Sewer Main CCTV

1. Sewer Main Digital Color Video Camera

a. All cameras used shall be digital format color CCTV units specifically designed and constructed for use in sewer pipe inspection work. The cameras shall be operable in 100 percent humidity conditions. The camera shall have a high-resolution, 360-degree pan and tilt or rotating head with a wide viewing angle lens and either automatic or remote focus and iris controls. Camera lighting shall be sufficient for use with digital color inspection cameras and for the manhole and pipe diameters identified in the contract.

i. Camera, Television Monitor, and Other Components shall be capable of producing a high resolution color digital inspection record.

ii. Video file to be in MP-4 (Web optimized) format

b. In all cases, the complete digital inspection system (camera, lens, lighting, cables, monitors, and recorders) shall be capable of providing a digital picture and digital video quality acceptable to the Program Manager. Inadequate lighting, image distortions, blurry or murky images, and dirty lenses will be a cause for rejection. No payment will be made for unsatisfactory inspections and the Contractor shall perform work until deliverable is of acceptable quality. Digital video cameras/digital recorders not specifically intended for use for internal television inspection of manholes and sewer lines shall not be permitted.

c. Pan and tilt type camera, capable of turning at right angles to pipe's axis over an entire pipe wall perimeter shall be used.

i. The camera lens shall be capable of self-righting itself after a lateral view or connection view with a return view down the pipe with a "home" capability for the lens.

d. Lighting shall be suitable to allow clear picture of entire inner pipe wall extending at least 10 feet in front, including black High Density Polyethylene (HDPE) pipe.

e. Document header and observations shall be in accordance with PACP V.6.0.1protocols.

f. Contractor shall have equipment capable of cleaning and assessing 12" and smaller diameter siphons.

D. Cleaning Equipment

1. Hydraulic sewer pipe cleaners or combination hydraulic/vacuum cleaners shall be specifically designed and constructed for such cleaning.

2. Mechanical sewer pipe cleaners shall be specifically designed and constructed for such cleaning.

3. The Contractor shall possess equipment capable of cleaning hydraulically or mechanically a minimum of 1,000 linear feet of pipe from one direction and have a minimum 1,000 linear feet of hose or cable on-site during the cleaning execution.

4. Hydraulic sewer pipe cleaners shall be specifically designed and constructed for such cleaning. The sewer cleaner shall have a minimum usable water capacity of 600 gallons and a pump capable of delivering at least 30 gallons per minute at 1,500 psi at the nozzle.

a. The hydraulic cleaning equipment shall have multiple hydraulic cleaner hose nozzles for a variety of sewer cleaning conditions, including grease, roots, debris and granular materials.

b. Vacuum equipment shall be capable of lifting debris removed from the segment from the downstream manhole.

5. Mechanical sewer pipe cleaners (cable machines with buckets, brushes, swabs, root cutters, and power rodders with similar capability) shall be capable of controlled forward and reverse travel through the sewers without inflicting damage to the existing pipe in removing rocks, grit and other heavy debris and roots.

PART 3 – CONSTRUCTION REQUIREMENTS

3.01 CCTV Inspection of Sewer Mains

A. Cleaning

1. Sewer pipe cleaners or combination hydraulic-vacuum cleaners must accompany CCTV units at all times. Ideally, sewers lines are to be cleaned and then followed immediately by CCTV inspection. All sewers must be cleaned in advance of CCTV during the same calendar day they are inspected.

2. Light Cleaning

a. Before CCTV work, the Contractor shall light clean the sewer line from manhole to manhole, from upstream to downstream direction unless an obstruction is encountered, one sewer section at a time and performed as efficiently as possible at the Contractor's discretion.

b. Materials shall not be passed from one sewer segment to another but must be trapped and removed from each sewer segment prior to CCTV inspection.

3. Heavy Cleaning

a. If a camera is inserted and additional debris or impediments to inspection are observed following the required light cleaning, heavy cleaning shallbe approvedby the Program Manager. Sections of pipe containing significant roots, large areas of debris, and/or several inches of depth of sands and gravels that will require the use ofadditional hydraulic nozzles, cable/bucket machine, power rodders and root cutters is considered heavy cleaning.

b. Heavy cleaning will be proposed by the Contractor and approved by the Program Manager. The Contractor must obtain prior approval for heavy cleaning in each sewer segment in order to receive payment for heavy cleaning.

4. Cleaning Execution

a. No roots, grease or debris from light or heavy cleaning shall be passed from sewer segment to sewer segment during the cleaning operation. All debris flushed from the sewer must be collected, captured, and removed from the sewer at the downstream manhole.

b. Roots shall be removed in the sections where root intrusion is a problem. Special precautions shall be exercised during the cleaning operation to assure complete removal of visible roots from the joint area and so as not to incur further damage to the pipe. Any visible roots that may impact rehabilitation efforts shall be removed. Fine roots are allowed if the Contractor made a heavy cleaning attempt to remove roots with proper root removal means. 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.

c. The Contractor is responsible for safe, responsible and legal handling and disposal of all material and debris removed from the sewers. The Contractor is responsible for all permits and landfill fees associated with the disposal of debris collected and removed from the sewer.

d. The Contractor shall provide a dated manifest of the volume or weight of the dewatered sewer cleaning loads taken and dumped at the permitted dump site selected by the Contractor. Each waste load manifest shall be associated with a list of corresponding sewer segments from where the waste originated.

e. Siphons shall be cleaned to remove 95% of the debris from the pipe.

B. Sewer Flow Levels During Inspection Operations

1. Maintain low sewer flowduring inspection by using sandbags or flow-through plugs or by inspecting during low flow times of day, evening, or early morning hours while camera is moving and recordingobservations in the sewer segment.Any items used to restrict flow shall be removed immediately after intended use.

a. Flow-through Plugs: If used, secure the plugs so as to remain in place during inspection. Use a fail-safe device at the downstream pipe connection to ensure the plug is not lost in the downstream sewer segment if it becomes dislodgedfrom the upstream pipe connection.

b. Conduct all cleaning and CCTV operations to prevent building backups and sewer overflows.

c. Contractor shall be responsible for cleanup, repair, fines, property damage costs, and claims for any sewage backup, spillage or sanitary sewer overflow during or as a result of the cleaning and inspection operations.

2. Allowable Depth of Flow For Inspection Operations

a. For effective inspection, all flow shall be minimized in the segment being inspected. However, the depth of flow at the upstream manhole of the interceptor section being worked shall be within the specified limits provided herein.

3. Maximum Allowable Depth of Flow for CCTV Inspection

a. 6 - 10 inch diameter Pipe - 20% of pipe diameter

b. 12 - 18 inch diameter Pipe - 25% of pipe diameter

c. 24-inch diameter and Larger Pipe - 30% of pipe diameter

d. Exceptions to these guidelines shall result in rejection, and non-payment, of the CCTV inspection unless approved in advance by the Program Manager.

C. Camera Operations

1. Using the pan/tilt feature, pan the interior of the manhole for record purposes in accordance with V.6.0.1 PACP protocols and begin and terminate the inspection in the starting and ending manholes.

    a. Capture the inside of manhole walls, manhole channel, and pipe connection to wall at both upstream and downstream manhole and lateral connections using the digital mainline sewer camera and the pan/tilt feature.

2. Place the camera at center of manhole and commence video before entering pipe.

    a. Start footage counter at manhole wall/pipe connection or at a short pre-measured distance down the pipe for the sewer segment inspection.

3. Connections: The digital camera shall be used to look at connections and up laterals from the connection in the main sewer pipe being inspected. The camera shall pause, pan, and record all connections. Conditions noted in these sidelines and laterals shall be noted on the inspection logs.

4. Mainline camera operations:

    a. Move through line at speed no greater than 30 feet per minute stopping for minimum 10 seconds to record lateral connections, mainline connections, defects, and features and points of interest.

    b. Do not float camera.

    c. Maintain technical quality, sharp focus, and distortion free picture with the camera lens centered in the pipe for the different diameters inspected.

        i. Eliminate steam in line for duration of inspection.
        ii. Utilize blower as needed to defog sewer line.

    d. Digitally record a complete sewer segment in its entirety with no breaks, “blink-outs,” or interruptions from manhole to manhole according to PACP V.6.0.1 formats.

    e. Pan, tilt, and rotate as necessary to best view and evaluate lateral connections, pipe defects, features, obstructions,and points of interest.

    f. Use power winches, powered rewinds, self-propelled tractors, or other devices that do not obstruct camera view or interfere with proper documentation of sewer conditions to move camera through sewer.

    i. Whenever non-remote powered and controlled winches are used, set up telephones or other suitable means of communication between manholes to insure good communication.

    g. Use hydraulic jet nozzle pressure and flow to remove standing water from depressions or sags in the sewer, if necessary, for complete inspection of the sag portion of the sewer segment.

h. Measurement for location of defects and service laterals:

   i. At ground level by means of Program Manager-approved footage counter or metering device.
   ii. Electronic display measurement meters: Accurate to PACP standards over length of section being televised.
   iii. Do not pull unnecessary length of slack camera cable if it impacts the footage counter.

i. Stop camera at service connections and inspect lateral with pan and tilt camera.

   i. Identify building connection in PACP compliant terms as active, capped, or abandoned.
   ii. If no wastewater flows are being discharged from building, consider steady, clear observed flow as infiltration/inflow.

j. Identification of defects

   i. If roots, sludge, or sediment material impedes inspection after the light cleaning, withdraw camera and perform heavy cleaning at the direction of the Program Manager.
   ii. Upon completion of heavy cleaning operation, resume internal inspection.
   iii. Furnish media confirmation for heavy cleaning (more than three passes with jet cleaner) to Program Manager.
   iv. If protruding tap impedes inspection trim protruding tap to 1/2 inch.

k. If obstructions are not passable and cannot be removed by sewer cleaning, withdraw CCTV equipment and perform a reverse inspection from opposite end of the sewer segment in accordance with PACP protocols.

   i. Contractor shall be responsible for costs associated for reverse set-ups when an obstruction is encountered that cannot be passed.
   ii. Contractor shall be responsible for all judgments and impacts as to whether an obstruction in the sewer main can be passed. Costs involved in extracting a stuck camera in the sewer main will be borne by the Contractor and at no additional cost to the Program Manager.
   iii. When additional obstructions are encountered after reversal of equipment and no means are available for passing a second obstruction in order to complete the sewer main inspection, remand the segment inspection to the Program Managerfor resolution. The portion of the main inspected will be paid for as prescribed.

l. Undocumented facilities

i. If undocumented manholes or sewer mains (facilitiesnot on the field updated GIS sewer maps) are encountered during the inspection, the Contractor needs to complete the documentation requirements per PACP requirements and capture on the video the following:

1. Approximate horizontal distance from the upstream or reference manhole.
2. Approximate depth of the undocumented manhole by turning the pan/tilt camera vertically and estimating the height of the cover from the invert.
3. A provisional manhole asset ID number shall be used by the Contractor by adding a dash and two-character number to the closest upstream manhole ID.

m. Retrieval of Stuck Equipment

i. The Contractor is responsible for hiring a licensed sub-contractor to retrieve any equipment/foreign objects that get stuck in the sewer system through the execution of the scope of work (fallen cameras, jet nozzles, inflatable plugs, sandbags etc.) at the Contractor's own cost. Such retrieval by an appropriately licensed sub-contractor shall be made within 72 hours to avoid interfering with the City of Memphis sewer system operations. Any and all impacts and related costs due to the Contractor's equipment in the line shall be the responsibility of the Contractor.Contractor shall follow SARP10 sewer point repair specifications outlined in "Section 02540 Sanitary Sewer Point Repairs" and "Section 02950 Removal and Replacement of Pavements and Incidentals" during retrieval of equipment. Also per "00585.2.2 Safety, Health, and Accident Prevention Program", Purchaser must approve sub-tier contractors prior to mobilization to the jobsite.

D. Quality Assurance

1. With each monthly invoice the Contractor shall provide a QA/QC memo documenting that 10% of the previous month's CCTV data has undergone a random, independent review by a PACP certified reviewer using NASSCO standards for Television Inspection of Main Sewer and PACP Quality control as the basis for the QA/QC procedures. The independent reviewer shall be a Tennessee P.E. or is a P.E. in another state and has a Tennessee P.E. license pending. Each line segment which has been randomly reviewed shall be identified in the QA/QC memo as well as any subsequent findings or recommendations. Internal independent QA/QC is acceptable, as long as the person is a Tennessee P.E. or is a P.E. in another state and has a Tennessee P.E. license pending. Failure to submit the QA/QC memo shall delay payment of the current month's invoice.

2. For all new Contractors and Operators who begin PACP coding, an initial review of CCTV data will consist of reviewing, at a minimum, 20 of the first 100 PACP inspection records submitted. Subsequent reviews will be based on the results of the initial reviews as explained below.

3. Auditing Procedures:

   a. Header information: As explained in the NASSCO PACP Quality Control Standards each audited inspection record is given an accuracy level for the header information and the detailed observation records. It is expected that the accuracy of the header record exceed 90% because the majority of the contents are based upon facts and not subject to operator judgment. To assess the accuracy level of the header, record the number of errors as compared to the total number of header fields using the following formula:
   100% - (error count/total header fields)*100% = Header Accuracy

   b. Detailed Observations: Determining the accuracy level for the detailed observation records is similar to the method for assessing the header record. The main difference being that a defect observation has multiple data entries that must also be counted towards the total number of entry fields. In the event that a defect is not coded all of the required entries for coding the missed defect are counted towards the total error count. The following formula is used to calculate the accuracy level of the detailed observation records:
   100% - (error count/total entries) * 100% = Detail Accuracy

   c. Review Scoring and Results

      i. Satisfactory Review, No changes required. Accuracy Level of 90% or above for both the Header Record and Observation Detail with no major errors or omissions found.

      ii. Unsatisfactory Review (below levels of acceptance) will not be accepted by the Program Manager and will not be considered payable items in the Contractor's Request for Payment.

E. Deliverable Documentation

1. Mainline Sewer

   a. SubmitV.6.0.1 PACP compliant records, logs, and electronic inspection data for sewer line inspection to Program Managerby the close of business on the Monday following a week after data acquisition.

   b. Monthly QA/QC memo submittal listing which segments have been randomly reviewed, as well as any subsequent findings or recommendations.

   c. Digital videos, data, and photos shall be delivered to the Program Manager on external hard drives which will become property of the Program Manager.

   d. Data files shall be formatted to facilitate upload into a PACP Exchange Database with the approval of the Program Manager.

   e. Inspections displaying poor digital video/audio qualitywill be rejected. Quality refers to, but is not limited to, grease or debris on lens, camera under water, image too dark or light, image washed-out, distorted image, out of focus images, lines improperly cleaned, and poor/no audio.

      i. Contractor will re-televise rejected inspections and resubmitinspections at no additional cost to the Program Manager.

2. Map changes/undocumented manholes:

    a. For map changes identifying undocumented manholes and network changes which were found as a result of field inspections or observations, a Map Edit Formshall also be prepared and supplied by the Contractor with a drawing or sketch and shall indicate special details, field measurement or distances, or locations about an observed undocumented manhole or a change to the sewer network. The Map Edit Form should also identify buried manholes and siphons that have been encountered.

    b. Contractor shall indicate all buried manholes identified in the field via CCTV using the provided Buried Manhole Form. Any additional manholes that have not been located or verified via CCTV but are impeding the completion of required CCTV work shouldbe designated as unable to locate (UTL) and be included on the form.

F. Easement or Turf Operation

1. The Contractor will restore the work area to its original condition as quickly as possible after the inspection is complete. The Contractor will not be allowed to postpone restoration of the site until the end of the project.

PART 4 –DELIVERABLES

4.01 RECORDS

A. Pipe Cleaning Record

1. The Contractor shall provide a dated manifest of the volume or weight of the dewatered sewer cleaning loads taken and dumped at the permitted dump site selected by the Contractor. Each waste load manifest shall be associated with a list of corresponding sewer segments from where the waste originated.

B. Digital Inspection Record

1. In the digital PACP V.6.0.1 compliant format, the Contractor shall provide the following information:

    a. Digital CCTV survey inspection which shall be recorded and shall be continuous as the inspection proceeds through the manholes and sewer pipes. Inspection videos should be delivered in anMP-4(Web optimized) format.

    b. Digital Recordings: The digital recording shall document the visual and audio record of the manhole and sewer pipe inspection and shall be the basis of measurement and payment. Digital recording playback shall be at the same speed that it was recorded. Original digital recordings for the Project shall be forwarded to the Program Manager on clearly labeled external hard drive(s)in PACP ACCESSformat with final report submittals and shall become the property of the Program Manager. Data for a single facility asset will not be split across multiple hard drives. Digital recordings shall be available to the Program Managerby the close of business on the Monday following a week after data acquisition. File naming must be consistent. Additional

instructions, naming conventions, file structures, etc. will be provided after contract award.

i. Picture Quality: The sewer inspection digital record shall be free of steam, fog, vapor, or other headspace distortion that degrades the quality of the picture from the intended purpose of evaluating the sewer for structural and watertight integrity. If necessary, the Contractor shall provide positive ventilation or other means through the sewer pipe to draw out steam, fog, and vapor that will degrade the recorded image of the pipe.

C. Inspection Documentation Logs

1. Observations made during television inspection shall be documented in an unmodified PACP compliant manner within an electronic inspection log form, supported by accompanying audio, digital photographs and MP-4(Web optimized) format recording written to an external hard drive and submitted to the Program Manager. Hard copies of completed inspection log photographs shall be furnished to the Program Managerwith invoicing.

D. Electronic & Hard Copy Records

1. Reports:

a. The Contractor shall prepare printed inspection log reports for each associated sewer pipes inspected during the actual field inspection activities. These field logs shall then be reviewed by the Contractor's technical staff, along with reviewing the associated digital video record, as a means of ensuring that no defects or entries are omitted or incorrect. Edited field logs shall then be used in the final project reports and submitted in pdf format.

2. Draft Report and Final Report:

a. The Draft Final Report will contain electronic and hard copies of each of the PACPCCTV log pipe segment inspection logs. Digital recordings of the inspections written to an external hard driveand the PACP compliant database of the inspections in ACCESS format shall also be submitted in electronic and pdf format.

b. Draft Report shall be delivered to the Program Manager within fifteen working days the last or final inspection. The Program Manager will have two workweeks to review and comment. Contractor shall address all comments provided and submit a Final Report within one workweek upon receipt of comments. At the Program Manager’s discretion a meeting will be held so the Contractor can explain the processes used to address the comments.

E. Meetings

1. The Program Team will arrange bi-weekly meetings (every other week) with the contractor to discuss data management and field issues.

F. Quality

1. Rejection of deliverables will be submitted to the Contractor via the Program Team in a written communicationdiscussing issues that must be addressed. The Contractor will be required to follow up with a response within three business days upon receipt of the written communication.Contractors will have seven (7) calendar days from the rejection notice date to make the necessary corrections and resubmit the data deliverable in its entirety.

PART 5 – MEASUREMENT

5.01 LIGHT CLEANING & CCTV INSPECTION

A. Light cleaning and mainline CCTV inspectionshall be measured by linear foot by each diameter of mainline sewer inspected and documented in accordance with the specification.

5.02 HEAVY CLEANING

A. Heavy cleaning shall be measured by linear foot of each diameter of heavy cleaning approved by the Program Managerand documented.

5.03 SIPHON CLEANING AND CCTV INSPECTION

A. Siphon cleaning and CCTV inspection shall be measured per linear foot of each diameter 12” and smaller of sewer inspected and documented in accordance with the specifications.

5.04 REMOTE TRIMMING OF PROTRUDING SERVICE LATERAL

A. Remote trimming of protruding service lateral that prevent a thorough inspection of the pipe will be measured per each.

PART 6 – PAYMENT

6.01 MAINLINE CCTV INSPECTION

A. Light cleaning and mainline CCTV inspectionshall be paid for at the unit price for each linear footof each diameter inspected and documented in accordance with the specification.

B. The unit price for Light Cleaning and Mainline CCTV inspection shall cover the entire cost of the required light cleaning and CCTV inspection and reporting in accordance with PACP V 6.0.1 format, including but not limited to labor, mobilization and access, CCTV equipment, recording media, traffic control, light cleaning of mainline sewer, documenting results in PACP records and logs, digital format recordings, photo equipment, power supply for equipment, interim and final reports and all other appurtenant work.

C. No additional payment will be made for:

1. Re-inspection due to rejected inspection and/or records for any reason.
2. Reversals.
3. Performing excavation and associated sewer point repair to retrieve a stuck CCTV camera or hydraulic cleaning hose/nozzle.

4. Incomplete electronic logs.
5. Unapproved duplication of inspections: The contractor/subcontractor is responsible to ensure duplications do not occur.

6.02 HEAVY CLEANING

A. Heavy Cleaning shall be paid for at the unit price for each linear foot of each diameter of heavy cleaned sewers at the direction of the Program Manager and in accordance with the specification.

B. The unit price for Heavy Cleaning shall include the entire cost including but not limited to labor, mobilization and access, traffic control, appropriate disposal of sewer debris removed from sewer at permitted site and all other appurtenant work. Payment includes non-hydraulic jet efforts such as porcupines, cutters, power rodding, clam buckets, and other mechanical means, traffic control, and re-cleaning with hydraulic jet, labor, materials, and equipment necessary to clean mainline sufficiently to allow video reviewers a clear picture of pipe conditions.

C. No additional payment will be made for:

1. Additional passes of heavy cleaning if the inspection observation reveals roots, grease or other debris remaining in the sewer after the heavy cleaning passes.

6.03 SIPHON CLEANING AND CCTV INSPECTION

A. Siphon cleaning and CCTV inspection shall be paid for at the unit price for each linear foot of each diameter 12” and smaller inspected and documented in accordance with the specification.

B. The unit price for Light Cleaning and Mainline CCTV inspection shall cover the entire cost of the required light cleaning and CCTV inspection and reporting in accordance with PACP V 6.0.1 format, including but not limited to labor, mobilization and access, CCTV equipment, recording media, traffic control, light cleaning of mainline sewer, documenting results in PACP records and logs, digital format recordings, photo equipment, power supply for equipment, interim and final reports and all other appurtenant work.

C. No additional payment will be made for:

1. Re-inspection due to rejected inspection and/or records for any reason.
2. Reversals.
3. Performing excavation and associated sewer point repair to retrieve a stuck CCTV camera or hydraulic cleaning hose/nozzle.
4. Incomplete electronic logs.
5. Unapproved duplication of inspections: The contractor/subcontractor is responsible to ensure duplications do not occur.

6.04 REMOTE TRIMMING OF PROTRUDING SERVICE LATERAL

A. Remote trimming of protruding service lateral that prevent a thorough inspection of the pipe will be measured per each.

6.05 PAYMENT WILL BE MADE UNDER:

Item No.	Pay Item	Pay Unit
00003-6.01	LIGHT CLEANING &MAINLINE CCTV INSPECTION FOR EACH DIAMETER	LF
00003-6.02	HEAVY CLEANING FOR EACH DIAMETER	LF
00003-6.03	SIPHON CLEANING AND CCTV INSPECTION FOR EACH DIAMETER	LF
00003-6.04	REMOTE TRIMMING OF PROTRUDING LATERAL	Each

END OF SECTION 00003

CITY OF MEMPHIS – STANDARD CONSTRUCTION SPECIFICATIONS
Modified by SARP10 Program
SECTION 01610 – BASIC PRODUCT REQUIREMENTS

PART 1 – GENERAL

1.01 All materials and permanently installed equipment (for example, traffic signalization equipment, sewer pumps, and other such items) furnished by the Subcontractor for the Work shall conform to the requirements of the Plans and Contract Documents, including the applicable City of Memphis Standard Construction Specifications and Design Standards.

1.02 Throughout the entire Project, all units of any one item of installed equipment shall be of the same manufacture and model unless otherwise approved by the Purchaser.

PART 2 – EQUIVALENT MATERIALS AND EQUIPMENT

2.01 The General Conditions allows for the substitution of equivalent materials and equipment, with the written approval of the Purchaser.

2.02 Reference to a particular product by manufacturer, trade name, or catalog number establishes the quality standards of materials and equipment required for the Work. It is not intended to exclude products equivalent in quality and similar in design. Whenever any article, material, or equipment is identified by using the name of a manufacturer or vendor, the term “or approved equal” if not inserted shall be implied.

2.03 If the Subcontractor proposes to furnish materials or supplies other than those specified, he shall furnish complete descriptive data, including performance capabilities, specifications, and other data as required in the Contract General Conditions. The provisions of this substitution of materials shall not relieve the Subcontractor of the responsibility of meeting the requirements of the Plans and Contract Documents. All materials must be approved by the Purchaser before any installation will be permitted.

PART 3 – LIST OF MAJOR EQUIPMENT AND MATERIALS

3.01 The Subcontractor shall submit to the Purchaser for approval, with due promptness after award of Contract but in no case later than at the preconstruction conference, a list of major equipment and materials which he proposes to provide. The list shall include in sufficient detail to identify the materials, the name of the manufacturer’s model number of all material that is identified on the Plans or in the Contract Documents, including catalog literature for standard equipment and detailed scale drawings of any nonstandard or special equipment and of any proposed deviation from the Plans. A signed statement shall accompany this list stating that materials and equipment are in exact accordance with Project specifications. No charge shall be made to the Purchaser for any materials or equipment purchased, labor performed, or delay to the Work prior to approval of materials by the Purchaser.

PART 4 – SOURCE OF SUPPLY

4.01 The source of supply for each material to be supplied by the Subcontractor shall be subject to approval by the Purchaser before delivery is started.

PART 5 – SAMPLES AND TESTING

5.01 Representative samples of materials included for incorporation in the Work shall be submitted to the Purchaser for his examination and/or testing when so specified or requested.

5.02 All testing of materials shall be made in accordance with the standard methods of testing of the ASTM, AASHTO, NEMA, ITE, or other applicable standard specifications.

PART 6 – PROPOSAL QUANTITIES

6.01 The quantities appearing in the Proposal Sheet(s) of the Proposal are approximate and are proposed and shown for the comparison of bids and award of a Contract. The Purchaser does not guarantee or assume any responsibility that the quantities indicated on the Plans or in the Proposal will hold true and accurate in the construction of the Project. The Subcontractor shall not plead deception or misunderstanding because of variation from these quantities. Unless otherwise provided in the Contract Documents, payment to the Subcontractor will be made only for the actual quantities of Work performed and accepted, and materials and equipment furnished and placed in accordance with the Contract. The Subcontractor is reminded of the limitation provided by Section 838 of the Charter of the City of Memphis which limits the total amount of the increase in the Contract Price, for any reason, to ten (10) percent of the original Contract award amount. There are no specific limitations on the amount by which the Contract Price and project quantities may be decreased.

PART 7 – MEASUREMENT

7.01 Measurement of Quantities

A. All Work completed under the Contract will be measured by the Purchaser according to United States standard measure.

B. The term “ton” will mean the short ton consisting of 2,000 pounds avoirdupois.

C. The determination of quantities for specific items will be made as set for the in the subsection titled “Measurement” under the applicable Sections of the Standard Construction and Material Specifications hereof, or of other Specifications provided for the Work.

D. Longitudinal and transverse measurements for surface area computations will be to the exact dimensions shown in the horizontal plane on the Plans or as ordered in writing by the Purchaser.

E. Structures will be measured according to the lines and exact dimensions shown on the Plans or as altered to fit field conditions by direction to the Purchaser.

F. In all cases where measurement of materials is based on certified weights, the Subcontractor shall furnish the Purchaser certified weigh bills showing the net weight of materials received in each shipment. In no instance will the Purchaser pay for materials in excess of the amounts represented by the certified weigh bills.

G. When certified scale weights are not used for measurement, all materials which are measured or proportioned by weight shall be weighed on accurate, approved scales, by competent, qualified personnel, at locations designated by the Purchaser.

H. Trucks used to haul material being paid for by weight shall be weighed empty at such times as the Purchaser directs, and each truck shall bear a plainly legible identification mark.

I. Measurements for payment will be made to the nearest fractional units specified below, unless otherwise specified herein or in the Contract Documents for the project.

Unit of Measurement	Nearest Unit
Linear Foot	0.1 LF
Square Foot	0.1 SF
Square Yard	0.1 SY

Ton	0.1 Ton
Cubic Yard	0.01CY
1,000 SF Unit	0.1 Unit

END OF SECTION 01610

SECTION 02530 SEWER PIPE INSTALLATION

PART 1 - SCOPE

1.01 This Work will consist of the construction of sanitary sewers, and service connections of the kinds and dimensions shown on the Plans, stipulated in the Contract Documents, or as directed by the Purchaser. The construction will be accomplished by these Specifications and in conformity with the lines, grades, and details shown on the Plans or established by the Purchaser. The Subcontractor will perform all work necessary to complete the Contract with the best modern practice. Without specifications that state the quality of any work, the Subcontractor is required to perform such items using first-quality construction. Unless otherwise provided, the Subcontractor will furnish all material, equipment, tools, labor and incidentals necessary to complete the Work.

PART 2 – MATERIALS AND EQUIPMENT

2.01 MATERIAL

A. Construction Material

1. All material furnished by the Subcontractor will be new, high quality and free from defects. Previously used material in acceptable condition may be used for bracing, forms, false work, and similar uses. Material not conforming to the requirements of the Specifications will be considered defective and will be removed immediately from the site.

B. Higher Strength Pipe

1. The Subcontractor may substitute a higher strength pipe of the same type as that specified subject to the approval of the Purchaser.

C. Qualifications of Manufacturers

1. Pipe for sanitary sewers will be the standard product of an established, reputable manufacturer made in a permanent plant. Suppliers for each material to be used by the Subcontractor will be subject to approval by the Purchaser. No material will be delivered until the manufacturer and product have been approved by the Purchaser. For any construction project, pipe and appurtenances for each pipe material shall be the product of a single manufacturer having a minimum of 10 years domestic experience producing the type of pipe supplied.

D. Material Inspection and Testing

1. Representative samples of material intended for incorporation in the work will be submitted for examination when so specified or requested. All material to be used in the work will be sampled, inspected, and tested by current ASTM specifications, or other standard specifications. The Subcontractor will furnish the Purchaser with three copies of certified reports from a reputable testing laboratory showing the results of the tests carried out on representative samples of material to be used on the Project. Each length of pipe delivered to the project will show the laboratory's stamp. The performance or cost of all testing is the responsibility of the Subcontractor.

2. The Subcontractor will notify the Purchaser before any deliveries of material and will make whatever provisions are necessary to aid the Purchaser in the inspection and culling of the material before installation.

E. Storage

1. The Subcontractor will provide and maintain storage facilities and exercise such measures to maintain the specified quality and fitness of material to be incorporated in the work. The interior and sealing surfaces of the pipe, fittings and adapters will be kept free from dirt and foreign matter. PVC pipe, fittings, and adapters stored outside and exposed to sunlight will be covered with an opaque material with proper ventilation.

F. Prestressed Concrete Cylinder Pipe

1. All prestressed concrete cylinder pipe shall conform to the requirements of AWWA C 301 and C 304 and will be designed for a variable depth of cover as shown on the profile; the maximum trench loading that can occur on an empty pipe after backfill is in place; and a live load equal to the AASHTO HS20 loading or the minimum live load as specified in AWWA C 301, whichever is greater. The interior surface of the pipe will be a smooth, cylindrical surface. Cement will meet all the requirements ASTM C 150, Type II. Steel cylinder shall be made of steel sheets not lighter than No. 16 gauge with a minimum yield strength of 33,000 psi, and conforming to the requirements of "Standard Specification for Hot-Rolled Carbon Steel Sheets and Strip Structural Quality", Grade 33, ASTM designation A 570. Steel used for the bell rings for pipe and fittings shall have a minimum yield strength of 30,000 psi and conform to the requirements of ASTM A 570. Steel plate and special shapes for spigot joint rings shall conform to the requirements of ASTM A 36 or the other ASTM specifications listed in AWWA C 301. High tensile prestressing wire shall be a minimum of No. 6 gauge and maximum class shall be Class III. The wire shall conform to the requirements of "Standard Specification for Steel Wire, Hard-Drawn for Prestressing Concrete Pipe", ASTM A 648. No lifting holes will be allowed. The pipe will be furnished complete with gaskets, grout bands and lubricant as required for proper installation.

2. The interior of all 36 inch and larger diameter pipe will be fully lined with a PVC liner as specified in Section 02530 Paragraph 2.01.DD. The liner will be installed by the pipe manufacturer prior to pipe delivery.

3. The liner will be welded at each joint after installation and testing of the pipe. Exceptions to the welding requirement may be granted at the direction of the Purchaser.

4. Fittings shall be composed of cut and welded steel plate with all welds inspected, and the completed cylinder shall be tested for tightness by the dye penetrant method. Fittings shall have wire reinforcement applied to the interior and exterior surfaces. Concrete and mortar linings shall be at least 3/8 inch thick and exterior mortar coating shall be 1 inch thick unless otherwise indicated. All materials and workmanship shall be as specified in AWWA C 301.

a. Curves of long radius may be formed by the use of pipe on which the spigot joint rings are placed on a bevel or by the use of bevel adapters. Special pipes shall be designed to provide the same strength as the adjacent pipe. Branch connection or openings, such as manholes and bypass pumping connections, shall be incorporated in straight pipe and shall be suitably reinforced. Special pipes shall be provided with joint rings corresponding to those on adjoining straight pipes. Special ends shall be provided on concrete pipe, where required to connect to pipe of other manufacturers and special structures.

G. Reinforced Concrete Pipe

1. All reinforced concrete pipe for gravity sewer applications will conform to the requirements of ASTM C 76 for circular pipe, Wall B for the specified diameter and strength class. If no class is specified, Class III pipe will be used. The interior surface of the pipe will be a smooth, cylindrical surface. Cement will meet all the requirements ASTM C 150, Type I. No lifting holes will be allowed. The pipe will be furnished complete with gaskets, grout bands and lubricant as required for proper installation. Pipe will be designed for a 0.01 inch crack D-Load. The ultimate D-Load will be at least 1.5 times the 0.01 inch D-Load.

2. The interior of all 36 inch and larger diameter pipe will be fully lined with a PVC liner as specified in Section 02530 Paragraph 2.01.DD. The liner will be installed by the pipe manufacturer prior to pipe delivery.

3. The liner will be welded at each joint after installation and testing of the pipe. Exceptions to the welding requirement may be granted at the direction of the Purchaser.

4. Joints in reinforced concrete pipe less than 30 inches in diameter will have compression gaskets or trapped O-ring gaskets. Pipes 30 inches in diameter or greater will have trapped O-ring gaskets meeting the requirements of ASTM C 443. When required, concrete pipe ends will be manufactured with steel bell and spigot end rings with a groove on the spigot for an O-ring rubber gasket. This joint will meet the joint requirements of ASTM C 443 and ASTM C 361. The shape, dimensions, and tolerances of the bell and spigot or tongue and groove ends of the pipe will meet the requirements of ASTM C 443. The ends of the rubber gasketed pipe will be accurately manufactured so that, when adjacent pipe sections are drawn together, the rubber gasket will be uniformly compressed around the periphery of the pipe to provide a watertight seal.

H. Ductile Iron Pipe and Fittings

1. Ductile iron pipe for gravity sewer and service connections will conform to ASTM A 746. Ductile iron pipe for force main applications will conform to ANSI A 21.51. The pipe thickness design will conform to ANSI A 21.50. If no thickness class is specified on the Plans or Contract Documents, Class 50 or approved equivalent will be used. All ductile iron pipe will be lined with either Protecto 401 Ceramic Epoxy, SewPer Coat Cement Mortar Lining, or Polyethylene. Linings will be applied according to manufacturer's recommendations. Fittings will conform to the requirements of ANSI A 21.10. Unless otherwise specified, joints will be push-on gasket type conforming to the requirements of ANSI A 21.11. Mechanical joints will conform to the requirements of ANSI A 21.11. Flanged joints will conform to the requirements of ANSI A 21.15. Flexible joint ductile iron pipe for river crossing applications will conform to ASTM A 536 and will be Grade 70-50-05. Steel retainer rings will conform to ASTM A 148 for Grade 90-60.

I. Deleted.

J. Polyvinyl Chloride (PVC) Gravity Pipe and Fittings (8-15 inch Diameter)

1. All PVC gravity pipe and fittings 8-15 inches in diameter shall be solid wall PVC; no profile wall PVC pipe is allowed for pipes 15 inches or less in diameter. PVC solid wall pipe and fittings for gravity sewer applications will conform to the requirements of ASTM D 3034. The standard dimension ratio (SDR) will be SDR 26 (Type PSM). PVC resin will conform to ASTM D 1784 cell class 12454C. A different cell class will be allowed only if the material meets the requirements of a superior cell class than 12454C. Fittings for PVC gravity sewer pipe will be fabricated from PVC meeting the respective ASTM PVC pipe standard for molded or extruded PVC. The wall thicknesses of the waterway and bell of fittings will be no less than the respective minimum thicknesses for the equivalent pipe. All fittings will be compatible with the pipe to which they are attached.

2. All PVC gravity pipe joints will be gasketed bell and spigot push-on type conforming to ASTM D 3212, unless directed otherwise in these Specifications. Gaskets will be part of a complete pipe section and purchased as such. Lubricant will be as recommended by the pipe manufacturer.

3. Solvent welded PVC saddle wye's may only be used on existing PVC and truss gravity sewer mains. Collar joints for fittings will be either Type SC (solvent cement) or Type OR (flexible gasketed compression joint) and will conform to the requirements of ASTM D 2680.

K. Polyvinyl Chloride (PVC) Profile Pipe and Fittings (18-36 inch Diameter)

1. All 18-36 inch diameter PVC sewer pipe and fittings shall be designed and manufactured in accordance with ASTM F 679, F 794, F 949, or F 1803. All PVC sewer pipe and fittings shall be manufactured from PVC resin with a cell classification of either 12454C or 12364C as defined in specification ASTM D 1784. The pipe shall be furnished complete with gaskets, fittings, lubricant, etc. as required for proper installation and completion of the line. The minimum pipe stiffness at 5% deflection shall be 46 psi when tested in accordance with ASTM D 2412 and as specified in ASTM F 679, F 794, F 949, or F 1803, as applicable. Samples of the type of pipe to be used shall be tested in accordance with ASTM D 2412. Impact tests shall be conducted in accordance with ASTM D 2444 and shall comply with ASTM F 679, F 794, F 949, or F 1803. Tests may be conducted by the manufacturer in the presence of the Purchaser. The City and Purchaser shall have the right to make unannounced visits to the pipe manufacturer's facility to inspect the manufacturing process.

2. All joints shall be the bell and spigot type and conform to ASTM D 3212. Gaskets shall meet ASTM F 477. All bells shall be formed integrally with the pipe and shall contain a factory installed elastomeric gasket which is positively retained. No solvent cement joints will be permitted in field construction.

3. The pipe manufacturer shall furnish to the Purchaser a notarized certificate(s) of inspection stating that each piece of pipe used on this project was made and tested in accordance with these specifications.

4. All pipeline material shall be generically the same throughout the project with the permissible exception of utilizing different material for piping used for tie-ins of smaller lines, or as noted on the plans or as approved by the Purchaser.

L. Glass Fiber Reinforced Polymer Mortar Pipe and Fittings up to 72 inch Diameter

1. Pipe shall meet the requirements of ASTM D 3262 - Standard Specification for Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe. The pipe shall be manufactured to form a dense, non-porous, corrosion-resistant, composite pipe that is resistant to corrosion from hydrogen sulfide and other corrosive materials normally found in sewerage systems, all without the use of special HDPE or PVC liners.

2. Minimum acceptable nominal length for joints of pipe shall be 20 feet except where field conditions require otherwise.

3. Design: The design of the pipe shall comply with all requirements of the latest revision of ASTM D - 3262 for non-pressure (gravity) flow conditions. The pipe shall also be designed for a variable depth of cover as shown on the profile; the maximum trench loading that can occur on an empty pipe after backfill is in place; and a live load equal to the AASHTO HS20 loading or the minimum live load as specified in the latest revision of ASTM D - 3262, whichever gives the greater live load.

4. Resin Systems: These shall be only polyester resin systems with a proven history of satisfactory performance in sewage applications. Historical data shall have been acquired from a composite material of similar construction and composition.

5. Glass Reinforcements: Reinforcing glass fibers used in the manufacture of the pipe shall be of the highest quality commercial grade E-glass filaments with binder and sizing compatible with impregnating resins.

6. Interior Lining: All interior surfaces of the pipe shall be lined with a fiberglass reinforced polyester lining as a part of the manufacturing process.

7. Joints: The pipe shall be field connected with fiberglass sleeve couplings that utilize full face elastomeric sealing gaskets of EPDM rubber compound, providing a zero leakage joint. The coupling shall be factory assembled to one end of the pipe. Each joint shall be pressure tested after installation.

8. Tests and Examinations: Tests, in-process and final examinations shall be performed by the manufacturer, or an independent testing laboratory approved by the Purchaser, in accordance with the latest revision of ASTM D 3262, in order to assure conformance. All instruments, gauges, and other testing and measuring equipment shall be of the proper range, type and accuracy to verify conformance and test equipment shall be checked at least annually against calibrated and certified test gauges and instruments. The Purchaser shall have access to all records of tests and inspections related to the manufacture of the pipe, and, without notice to the manufacturer, shall also have the right to witness the manufacture of the pipe and any tests being performed by the manufacturer or his suppliers relative to products, materials, or the pipe being produced. Copies of records of tests and inspections shall be submitted if requested by the Purchaser.

a. Pipes: These shall be manufactured and tested in accordance with ASTM D 3262.
b. Joints: Coupling joints shall meet the requirements of ASTM D 4161 and/or produce a zero leakage joint.
c. Stiffness: Minimum pipe stiffness when tested in accordance with ASTM D 2412 shall be 46 psi.

9. Fittings and Special Pipe: Fittings shall be contact molded or manufactured from mitered sections of pipe joined by glass-fiber-reinforced overlays, all capable of withstanding all operating conditions when installed.

10. Curves of long radius shall be formed by the use of bevel end pipe or by the use of bevel adapters. Deflection of pipe joints to form the long radius curves will not be accepted. Special pipes shall be designed to provide the same strength as the adjacent pipe. Branch connections or openings, such as manholes and bypass pumping connections, shall be incorporated in straight pipe and shall be suitably reinforced. Special pipes shall be provided with joints corresponding to those on adjoining straight pipes. Special ends shall be provided on pipe, where required, to connect to pipe of other manufacturers and special structures.

11. Unloading Handling and Storage: All pipe shall be inspected at time of delivery, and damaged pieces rejected and removed from the site of the work. Unloading shall be done by mechanical equipment designed to properly handle the pipe, and dropping from delivery vehicles will not be permitted. Pipe shall be stored in an orderly manner to protect the pipe from injury, and from damage by freezing, all in accordance with the manufacturer's written instructions.

M. High Density Polyethylene (HDPE) Pipe and Fittings

1. High Density Polyethylene Pipe (HDPE) may be used in construction of inverted siphons. No HDPE will be allowed in any other gravity sewer application. All HDPE shall be manufactured from virgin, extra high molecular weight, high density PE3408 or PE3608 polyethylene pipe grade resin to a minimum cell classification of PE345434C as determined by ASTM D3350. No post consumer recycled polyethylene materials shall be allowed. The minimum material classification shall conform to III C 5 P34 as determined by ASTM D1248.

2. All HDPE pipe and fittings shall conform to ASTM F714 and ASTM D3261, respectively, and have a Standard Dimension Ratio (SDR) of 17, maximum.

3. Successive joints of HDPE pipe shall be joined by heat fusion at a fusion pressure of 75 psi and temperature of 400° F. All such connections shall be performed in strict accordance with the manufacturer's instructions.

N. Polyvinyl Chloride (PVC) Pressure Pipe and Fittings

1. PVC pipe and couplings for force main applications will conform to the requirements of ASTM D 2241 and AWWA C 900 Standard for Polyvinyl Chloride (PVC) Pressure pipe 4 inches through 12 inches for Water. The minimum pressure class will be Class 100 or as specified and outside diameter base (IPS or CI) will be as specified in the Plans or Contract Documents.

2. Joints for pipe and couplings will be solid ring elastomeric gasket type. Gaskets must withstand internal pressures of not less than the minimum sustained pressure and burst pressure requirements specified for the pipe with which they are designed to be used. No solvent cement joints will be allowed. Joints will conform to the requirements of AWWA C 900 and/or ASTM D 2241.

O. High Density Polyethylene (HDPE) Pressure Pipe and Fittings

1. High Density Polyethylene Pipe (HDPE) shall be manufactured from virgin, extra high molecular weight, high density PE3408 polyethylene pipe grade resin to a minimum cell classification of PE345434C as determined by ASTM D3350. No post consumer recycled polyethylene materials shall be allowed. The minimum material classification shall conform to III C 5 P34 as determined by ASTM D1248.

2. All HDPE pipe and fittings shall conform to ASTM F714 and ASTM D3261, respectively, and have a Standard Dimension Ratio (SDR) of 17, maximum.

3. Successive joints of HDPE pipe shall be joined by heat fusion at a fusion pressure of 75 psi and temperature of 400° F. All such connections shall be performed in strict accordance with the manufacturer's instructions.

P. Air/Vacuum Valves, Automatic Air Release Valves and Combination Valves

1. The Air/Vacuum Valves shall be single body, double orifice and shall automatically exhaust air from the force main while being initially filled with fluid. After the air has been exhausted from the line, the valve shall close tightly. The valve shall remain closed as long as the sewer line is under positive pressure. Should the force main pressure fall below atmospheric pressure, the valve shall reopen to allow air to enter the pipe thereby preventing a negative pipe pressure. The valve shall be designed to prevent clogging due to solids in the fluid. Each of these valves shall be designed to separate the liquid from the sealing mechanism. The Air/Vacuum Valves shall be as manufactured by A.R.I. or approved equal.

2. The Combination Air Valve shall consist of a combination of an air and vacuum large orifice and an automatic small orifice in a single body. The valve must be designed to operate with liquids carrying solid particles. The valve shall discharge air during the filling or charging of the system and admit air to the system while being emptied of liquid and discharge accumulated air from the system while it's under pressure and operating. Each of these valves shall be designed to separate the liquid from the sealing mechanism. The valve shall have a working pressure range up to 150 psi or as specified on the plans. Combination Valves shall be A.R.I. or approved equal.

3. The manufacturer shall certify venting capacity and provide three copies of installation and maintenance manuals for each type of Combination Air Valve and Air/Vacuum Valve supplied.

4. The Manufacturer shall guarantee all items specified to be free from defects in design, materials and workmanship for one year from the date of acceptance. During the guarantee period, the Manufacturer shall furnish and install replacement parts for any defective component at no additional cost.

Q. Check Valves, Gate Valves and Ball Valves

1. All check valves shall have external arms so that the valve may be opened and closed by hand. Check valves shall be controlled closing swing check valves and shall be Golden-Anderson Series 250, or Valve and Primer Series 6000, or as approved. Each check valve shall have a cast iron body, stainless steel plates, stainless steel springs, stainless steel hinge pins and stops, Teflon spring and hinge bearings and standard trim for IBBM construction. All wetted components shall be 316 stainless steel. Each check valve shall have Buna N seals.

2. All check valves shall be class 125 vertical or horizontal swing type with iron body and flanged ends.

3. Knife gate valves will be manufactured by Red Valve Company, Inc, Pittsburgh, PA; and shall be their Standard Flexgate, or approved equal. Knife gate valves must conform to AWWA C-504 requirements. The shaft shall be constructed of Type 304 stainless steel. The knife gate shall be Type 316 stainless steel. The valve seat shall be a resilient, mechanically retained, field replaceable, polytetraflouroethylene elastomer. The upper and lower bearings shall be self lubricating Teflon. The valve shall be equipped with a handwheel.

4. Wedge gate valves will be resilient wedge gate valves as manufactured by Mueller Co., or approved equal. Wedge gate valves must conform to AWWA C 509 or AWWA C 515 and will be either series 2360 or series 2361.

5. All ball valves for 2 inch and 3 inch diameter fittings shall be full port, brass ball valves, shall be rated to 125 psi minimum, and shall meet the requirements of NSF/ANSI 61/8. Ball valves will have threaded connections and blowout proof stems. Ball valves will be Series FBV-3C as manufactured by Watts, or as approved.

6. Valve manufacturer shall furnish certification that each valve has been subjected to a hydrostatic water pressure twice the pressure class and that each valve is free of defects. The valve manufacturer shall guarantee all items specified to be free from defects in design, materials and workmanship for one year from the date of acceptance. The manufacturer shall, during the guarantee period, furnish and install replacement parts for any defective component at no additional cost.

R. Steel Casing Pipe

1. Casing pipe will conform to ASTM A 139. Minimum yield strength will be 35,000 psi. Wall thickness will meet the requirements of the latest revision of the American Railway Engineering Association Manual of Recommended Practice unless otherwise specified. Wall thickness will be:

Nominal Thickness Inches	Nominal Diameter Inches
0.188	Less than 14
0.219	14 and 16
0.250	18
0.281	20
0.312	22
0.344	24
0.375	26
0.406	28 and 30
0.438	32
0.469	34 and 36
0.500	38, 40, and 42

2. When casing is installed without a protective coating and is not cathodically protected, the wall thickness shown above will be increased to the nearest standard size that is a minimum of 0.063 inches greater than the thickness shown. This requirement does not apply to casing diameters less than 12 3/4 inches.

S. Lubricants for Prefabricated Pipe Gaskets

1. The lubricant used in jointing pipes fitted with flexible, rubber gaskets will be as recommended by the pipe manufacturer. Lubricants will be suitable for use at temperatures from 5° to 120° F(-15°C to 50°C). Containers will be labeled with the intended, compatible pipe material and the manufacturer's name.

T. Primers and Adhesives

1. All primers and solvents used with ABS Composite Sewer pipe will conform to ASTM D 2235 and will be applied as recommended by the manufacturer. For bonding PVC to PVC, solvent cement will conform to ASTM D 2564. For bonding PVC to ABS, solvent cement will conform to ASTM D 3138. Adhesives used to fasten flexible rubber or rubber gaskets will conform to the requirements of the gasket manufacturer.

U. Adapters and Couplings

1. At the direction of the Purchaser, a connection of sanitary sewer pipes, 6 inches through 16 inches, of dissimilar material, different sizes or for the repair of sanitary sewer pipes of similar material may be made by means of an approved compression or mechanical connector or adapter. The gaskets for compression connectors or adapters will be manufactured of an approved preformed elastomeric material conforming to applicable sections of ASTM Standards C 143, C 425, C 564, and D 3212. Mechanical couplings or adapters will have tightening clamps or devices made of 300 series stainless steel with a stainless steel shear ring and stainless steel hardware, as specified in ASTM A 167. If a stainless steel shear band is not used a concrete collar is required. Each connector and adapter will bear the manufacturer's name and required markings. Installation will be by the manufacturer's recommendations.

2. At the direction of the Purchaser, a connection of sanitary sewer pipes (18 inches in diameter and larger) of dissimilar material, different sizes or for the repair of sanitary sewer pipes of similar material may be made in accordance with Specification Section 02530 Paragraph 3.09.C. Mechanical connectors meeting the above requirements may be used at the direction of the Purchaser.

V. Portland Cement Concrete

1. Portland Cement Concrete will be of the class and dimensions shown on the Plans, or as directed by the Purchaser. The classes of concrete are called Class A and Class C. Class A concrete is intended principally for concrete structures designed for high strength. Class C concrete is low strength concrete, intended principally for foundation stabilization, pipe cradles and encasement and other general purpose uses. All portland cement, coarse aggregate, fine aggregate, water, air entraining agents and chemical admixtures, their proportioning, mixing, delivery, minimum strength, sampling and testing will be as specified in Specification Section 03050.

W. Crushed Limestone

1. Crushed limestone will be size No. 67 Coarse Aggregate meeting the requirements of the Tennessee DOT Standard Specifications for Road and Bridge Construction and the following gradation:

Total Percent by Dry Weight,
Passing Each Sieve (U.S. Standard)

Size No.	1"	3/4"	3/8"	No. 4	No. 8
67	100	90-100	20-55	0-10	0-5

X. Sand

1. Sand for pipe bedding will consist of natural sand, all of which passes a 3/8 inch sieve and not more than 10 percent passes a No. 200 sieve.

Y. Mortar

1. Mortar will be composed of one part portland cement, two parts masonry sand, hydrated lime not to exceed 10 percent of the cement used, and 4 parts water. All ingredients will be proportioned by measurements and not by estimating. All portland cement, sand, and water will be as specified in Specification Section 03050. All hydrated lime will be as specified by ASTM C 6.

2. The mortar will be hand mixed or machine mixed. In the preparation of hand mixed mortar, the sand, cement and hydrated lime will be thoroughly mixed in a clean, tight, mortar box until the mixture is of uniform color, after which water will be added. Machine mixed mortar will be prepared in an approved mixer and will be mixed not less than 1½ minutes. Mortar will be used within 30 minutes after mixing.

Z. Bracing Lumber

1. Lumber for tunnel bracing will be a minimum of 3 inches thick and made of bridge oak. All timbers will be of good quality, straight grained, and free from weakening knots and other defects. Bracing will be placed to form a structurally sound timber tunnel. The timber tunnel lining will remain in place after laying the pipe and backfilling.

AA. Pit Run Gravel

1. Pit run gravel will consist of one of the three gradations shown in the table below.

	Total Percent by Dry Weight, Passing Each Sieve (U.S. Standard)						
Size No.	2½"	2"	1½"	1"	3/8"	No.40	Clay *
1	100	95-100			35-65	10-30	1-12
2		100	95-100		40-65	10-30	1-12
3			100	90-100	45-65	10-35	2-12

*Clay content will be determined by the Hydrometer Test-AASHTO T 88. Clay content up to 15 percent may be used with the approval of the Purchaser.

2. That portion passing the No. 40 sieve will be known as the binder. The binder aggregate will consist of hard durable particles of limestone or sound siliceous material. Shale aggregate or pipe clay binder will not be acceptable. The percent of silt will not exceed the percent of clay by more than 25 percent. If the binder material is insufficient to bond the aggregate a satisfactory binding material may be incorporated, as approved by the Purchaser, so that the resultant mixture will comply with these Specifications. The mixing will be done uniformly, and blending of material on stockpiles or in the pits by bulldozers, clamshells, draglines, or similar equipment will not be permitted.

BB. Brick

1. All brick will conform to ASTM C 55 for Grade A. Unless otherwise approved by the Purchaser, bricks will conform to the following dimensions:

	Depth (in)	Width (in)	Length (in)
Standard Size	2 1/4	3 3/4	8
Allowable Variation	+ 1/4	+ 1/4	+ ½

2. All brick will be new and whole, of uniform standard size and with straight and parallel edges and square corners. Bricks will be tough and strong and free from harmful cracks and flaws. Brick will be culled after delivery if required and all culls will be removed from the work site.

3. The Subcontractor may be required to furnish the Purchaser with at least five bricks of the character and make he proposes to use, at least one week before any bricks are delivered for use. All brick will be of the same quality as the accepted samples.

CC. Non-Shrinking Grout

1. Grout will be mixed in small quantities as needed and will not be retempered or used after it has begun to set. Unless otherwise specified, the grout will consist of one part portland cement, two parts masonry sand by volume, a nonshrinking, nonmetallic admixture and sufficient water to form a grout of proper consistency. When nonshrinking or nonshrinking fast setting grout is specified it will be formulated by the incorporation of an admixture, or a premixed grout may be used.

2. The formulation, admixture or the premixed grout used will be subject to the approval of the Purchaser and will be mixed and used according to the recommendations of the manufacturer. These special grouts will be classified as follows:

Type I - Nonshrinking Grout
Type II - Nonshrinking, Fast Setting Grout

Portland cement, masonry sand, and water will conform to the requirements of Specification Section 03050.

DD. Polyvinyl Chloride (PVC) Protective Lining for Concrete Pipe and Structures

1. Liner shall be Ameron T-Lock as manufactured by Ameron Protective Coatings Division, Brea, California or approved equivalent.

2. The material used in the liner and in all joint, corner, and welding strips shall be a combination of polyvinyl chloride resin, pigments, and plasticizers, specially compounded to remain flexible. Material color shall be white.

3. Polyvinyl chloride resin shall constitute not less than 99 percent, by weight, of the resin used in the formulation. Copolymer resins will not be permitted.

4. Tensile specimens shall be prepared and tested in accordance with ASTM D412 using die B. Weight change specimens shall be 1-inch by 3-inch samples of the sheet thickness. Specimens may be taken from sheet and strip at any time prior to final acceptance of the work.

5. Liner plate locking extensions embedded in concrete shall withstand a test pull of at least 100 pounds per linear inch applied perpendicularly to the concrete surface for a period of one minute, without rupture of the locking extensions or withdrawal from embedment. This test shall be made at a temperature of 70-80°F inclusive.

6. All plastic liner plate sheets, including locking extensions, all joint, corner and welding strips shall be free of cracks, cleavages or other defects adversely affecting the protective characteristics of the material. The Purchaser may authorize the repair of such defects by approved methods.

7. The lining shall have good impact resistance, shall be flexible and shall have an elongation sufficient to bridge up to 1/4-inch settling cracks, which may occur in the pipe or in the joint after installation, without damage to the lining.

8. The lining shall be repairable at any time during the life of the structure.

9. Liner shall be a minimum of 0.065 inches in thickness. Locking extensions (T-shaped) of the same material as that of the liner shall be integrally extruded with the sheet. Locking extensions shall be approximately 2.5 inches apart and shall be at least 0.375 inches high.

10. Sheets shall have transverse strap channels cut in the locking extensions so that the strap can be placed into and perpendicular to the locking extensions.

11. These channels shall be not less than 3/4 inch wide and not more than 1 1/4 inch wide and shall be cut so that a maximum 3/16 inch of the base of the locking extension remains in the base of the strap channel. Strap channels shall be provided at intervals of not less than 15 inches and no more than 20 inches center-to-center. The strap channels will not be cut through the final two locking extensions on each edge of the sheet.

12. Transverse flaps shall be provided at the ends of sheets for pipe. Locking extensions shall be removed from flaps so that a maximum of 1/64 inch of the base of the locking extension is left on the sheet.

13. Weld strips shall be approximately 1 inch wide with a minimum width of 7/8 inch. The edges of weld strips shall be beveled in the manufacturing process. Thickness of weld strip shall be a nominal 1/8 inch.

14. All sheets used shall be shop tested for pinholes using an electrical spark tester set at 20,000 volts minimum. Any holes shall be repaired and retested.

EE. Reserved

FF. Reserved

GG. Reserved

2.02 EQUIPMENT

A. The Subcontractor will furnish and maintain in good condition all equipment and facilities as required for the proper execution and inspection of the Work. All equipment and facilities will be on site and approved by the Purchaser before work will be permitted to begin.

PART 3 - CONSTRUCTION REQUIREMENTS

3.01 SITE PREPARATION AND RESTORATION

A. Rights-of-Way and Easements

1. Rights-of-way and/or easements as shown on the Plans and/or rights-of-way/easement plats are provided by the City to the Subcontractor for construction of sanitary sewer facilities. The Subcontractor will confine his construction activities to these areas. The Subcontractor will be responsible for obtaining written agreements for use of private property outside City acquired rights-of-way/easements for such purposes as storage of material and equipment and access to the construction site. The Subcontractor will immediately provide a copy of all such written agreements to the City and Purchaser upon obtaining the same.

B. Clearing of Rights-of-Way and Easements

1. The Subcontractor will confine his clearing of rights-of-way and easements to the least area necessary for construction of facilities shown on the Plans. The Subcontractor will protect as many trees and shrubs within the area as possible. Where necessary for construction the Subcontractor will clear all live and dead vegetation and growth, pole stubs, logs, and other objectionable material. Cleared material will be removed to within 3 inches of existing ground. This work will be done well before excavation operations but only after erosion controls have been placed.

C. Location of Existing Obstructions

1. Locations of obstructions shown on the Plans are approximate and are not intended as an accurate location of such obstructions. Obstructions not shown on the Plans but encountered by the Subcontractor will be removed and replaced in their original state or protected by the Subcontractor at no additional cost to the Purchaser.

D. Removal of Obstructions

1. The Subcontractor will demolish and remove all structures and structure foundations, abandoned vehicles, appliances, and rubbish within the right-of-way/easement limits necessary for the performance of the work.

E. Protection of Obstructions Outside Easement Limits

1. The Subcontractor will protect and avoid damage to all trees, shrubs, plants, fences, structures, and all other objects outside the right-of-way/easement limits shown on the Plans and/or Plats due to construction operations. All damage will be repaired or restored at the Subcontractor's expense. Particular attention will be paid to avoid damage to trees, shrubs, bushes, and private property located next to rights-of-way/easements. No trees, plants, or other objects may be removed outside such limits without written permission of the property owner.

F. Special Protection of Obstructions Inside Easement Limits

1. Wherever the underground installation of sanitary sewer facilities will go through surface improvements previously made by the City, other governmental bodies, or property owners, the Subcontractor will be responsible for their protection and preservation. This responsibility includes the removal and storage of such improvements to allow replacement and restoration as close as possible to the undisturbed condition.

G. Disposal of Debris

1. All trees, brush, logs, snags, leaves, sawdust, bark, and refuse will be collected and disposed of according to the City Code of Ordinances at the expense of the Subcontractor. There will be no separate pay item for disposal of debris. Debris will be removed from the site when practical and will not be left until the completion of the contract. Burning of debris is not allowed. When material is to be disposed of outside the easement, the Subcontractor will first obtain written permission from the property owner on whose property the disposal is to be made and will file a copy with the Purchaser. Unless otherwise provided in the Contract Documents, the Subcontractor will arrange for disposing of such material outside the right-of-way/easement. No debris will be deposited in wetlands.

H. Replacement of Fences

1. Any fences disturbed inside the right-of-way/easement limits will be replaced or restored to their original or better condition. Any fences removed will be replaced in their original location. Fences in such poor condition that they cannot be taken down and rebuilt with the same material will be replaced with new fence material similar in original quality, size, construction, and appearance to the removed fence. Exceptions to this requirement will be allowed if written releases are obtained from the property owners by the Subcontractor and submitted to the Purchaser.

I. Restoration of Turfed Areas

1. All areas will be restored as nearly as practicable to their original condition. Finished lawn areas where soil has been deposited will be cleared to the level of the existing sod and then raked and watered. Areas where sod has been damaged, destroyed, or ruts have been filled will be resodded After final restoration of the settled trench surfaces, trench areas and areas regraded as part of the construction will be resodded, unless otherwise shown on the Plans or directed by the Purchaser. New sod shall consist of live, dense, well rooted growth of Bermuda grass, free from Johnson grass, nutgrass, and other obnoxious grasses or weeds, well suited for

the intended purpose and for the soil in which it is to be planted. All sod shall be cleanly cut in strips having a reasonably uniform thickness. Subcontractor shall water sodded areas as frequently as required for a period of at least two weeks and shall apply fertilizer as necessary. Sod must be living at the time of final acceptance of the project.

3.02 EXCAVATION

A. All excavation performed under this Section including trench excavation, structure excavation, and channel excavation, but excluding undercut excavation, will be considered unclassified excavation despite the nature of the material and objects excavated and will not be measured or paid for separately except as specifically noted. Pavement removal and replacement will be accomplished as specified in Specification Section 02950.

B. Trench Excavation

1. All trenches will be open cut unless otherwise shown on the Plans. Tunneling, boring, or jacking may be allowed by written permission of the Purchaser.

2. Trenches may be excavated by machinery to a depth that will not disturb the finished subgrade. The remaining material will be hand excavated so that the pipe is bedded on a firm, undisturbed subgrade.

3. No more than 300 feet of trench will be opened ahead of the completed sanitary sewer, nor will more than 100 feet be left unfilled except by written permission from the Purchaser. In special cases the Purchaser may limit the distance to which the trench may be opened by notifying the Subcontractor in writing.

4. The width of trenches below a level 1 foot above the outside top of pipe will be at least 6 inches but not more than 12 inches on each side of the outside of the pipe for all sizes up to and including 16 inches in diameter. A maximum trench width dimension for these pipe sizes will be 36 inches. For 18 inch diameter pipes, the width of trenches below a level 1 foot above the outside top of pipes will be at least 6 inches on each side of the pipe, with a maximum trench width of 42 inches. For pipe sizes more than 18 inches, the width of trenches below a level 1 foot above the outside top of the pipe will be at least 12 inches but no more than 15 inches on each side of the outside of the pipe. If the trench width at or below 1 foot above the top of pipe exceeds the width specified, provisions will be made at the Subcontractor's expense to compensate for the additional load upon the pipe.

5. The sides of the trench will be as nearly vertical as possible. The bottom of the trench will be carefully graded, formed, and aligned according to SARP10 Trench Cross Section Showing Terminology Figure and to the satisfaction of the Purchaser before sanitary sewers are laid.

C. Other Excavation

1. Undercut Excavation:
Undercut excavation will consist of removing and disposing of unsatisfactory material below the grade established on the Plans for sanitary sewers, structures, and manholes. No undercut excavation will be done without prior authorization of the Purchaser. The limits of undercut excavation will be determined by the Purchaser who will be present during the undercut operations.

2. Undercut areas will be backfilled with No. 67 limestone or other aggregate approved by the Purchaser to the grade established on the Plans to produce a suitable Foundation. The backfill will be placed in 6 inch maximum lifts and compacted to 95 percent of maximum density at plus or minus 2 percent of optimum moisture content as determined by Laboratory Standard Proctor

Test (ASTM D 698) or a minimum relative density of 0.75.

3. Unauthorized Excavation Below Subgrade or Outside Limits:
Any unauthorized excavation and subsequent removal and backfilling beyond the lines and grades shown on the plans will be at the Subcontractor's expense. The excess space between the undisturbed bottom and sides of the excavation and subgrade limits shown on the Plans will be backfilled according to Specification Section 02530 Paragraph 3.02.C.2.

D. Change in Location and Grade

1. If the Purchaser orders in writing that the location or grade of a proposed sanitary sewer facility be changed from that shown on the Plans, the following provisions will apply. If the change is made before excavation work has begun and the item being constructed is covered in the Proposal Sheet(s) by pay items with appropriate depth classifications, the appropriate pay item will apply. If the facility being constructed is not covered in the Proposal Sheet(s) and if the average excavation per linear foot at the changed location or grade is within 10 percent of the original Plan quantity, there will be no change in the unit price for this work. If the average excavation per linear foot at the changed location varies more than 10 percent above or below original Plan quantities, a Change Order will be prepared to cover the new work. For purposes of comparing changed quantities with Plan quantities, a 1 foot long strip will be calculated from natural ground line to invert along both the revised and original locations. These calculations will then be multiplied by the proper lengths to determine the total cost.

2. If the change is made after excavation has already begun on the original Plan location, the procedures described above will apply to payment for work along the changed location. If abandonment of an existing excavation is required due to a change by the Purchaser, a Change Order will be prepared covering the backfilling and restoration of the abandoned excavation. Backfilling and restoration of the abandoned excavation will be accomplished according to the appropriate section of these Specifications.

3. Filling a portion of existing excavation to meet changed grades will be accomplished according to Specification Section 02530 Paragraph 3.11.

4. If a change in a location and/or grade is authorized in writing by the Purchaser at the written request of the Subcontractor, the Subcontractor will not receive any additional compensation for the changed work. Backfilling and restoration of abandoned excavation work will be accomplished totally at the Subcontractor's expense. If changes requested by the Subcontractor result in reduced lengths and/or depth of excavation, the revised quantities using Proposal unit prices or Change Orders as appropriate will be used to develop payment.

E. Disposition of Excavated Material

1. Excavated material suitable for backfill will be stored no closer than 2 feet from the edge of the excavation. Excavated material will not obstruct crosswalks, sidewalks, driveways, street intersections, nor interfere unreasonably with travel on streets. Gutters or other surface drainage facilities will not be obstructed. The Subcontractor must provide access to fire hydrants, mail boxes, sewer and conduit manholes and similar utility or municipal service facility as required. Excavated material intended for backfill will be stored in a way that minimizes loss of excavated material due to erosion. The Subcontractor shall comply with all applicable OSHA regulations and City of Memphis Storm Water Ordinances. 2. Unless otherwise directed, all excavated material that will not be used for backfilling or restoration will be removed from the site and disposed of by the Subcontractor. If the Subcontractor proposes to store or place such excess excavated material upon any private property, written consent of the property owner or owners must be obtained by the Subcontractor in advance. A certified copy will be given to the Purchaser. No surplus or excess material will be deposited in any stream channel nor anywhere that would change preconstruction surface drainage.

F. Control of Water

1. The Subcontractor will keep all excavations free of water. If the trench subgrade consists of good soil in good condition at the time of excavation, it will be the Subcontractor's responsibility to maintain it in suitable condition. Dams, flumes, channels, sumps, or other work and equipment necessary to keep the excavation clear of water will be provided by the Subcontractor. Dewatering of trenches, will be incidental to trench excavation. The Subcontractor will avoid producing mud in the trench bottom by his operations. If necessary or so ordered by the Purchaser, the Subcontractor will remove any soil that becomes unacceptable and replace it with limestone or other approved aggregate at his own expense to maintain a firm, dry base.

2. Pipe embedment, laying, jointing, and the placing of concrete or masonry will be done in a water free trench or excavation. Trenches will be kept clear of water until pipe joints, concrete and masonry have set and are resistant to water damage. The water will be disposed of in a manner acceptable to the Purchaser.

3. All gutters, pipes, drains, conduits, culverts, catch basins, storm water inlets, ditches, creeks, and other storm water facilities will be kept in operation, or their flows will be satisfactorily diverted and provided for during construction. Any facilities disturbed during construction will be restored to the satisfaction of the Purchaser.

G. Excavation Around Obstructions

1. The Subcontractor will perform all excavation by hand where excavation by machinery would endanger trees, structures, or utilities that otherwise might be saved by hand excavation.

2. The Subcontractor will cautiously excavate test holes to find the limits of underground obstructions anticipated within the excavation. When a water pipe, gas pipe, other sanitary sewer, storm drain, or similar utility comes within the limits of the trench, such facilities will be properly supported.

H. Excavation for Manholes and Special Structures

1. The Subcontractor will be responsible for performing the Work according to the lines and elevations shown on the Plans or as directed by the Purchaser. The Subcontractor will excavate as required for all structures with foundations carried to firm, undisturbed earth at the elevation of the underside of the structure.

2. The outside dimensions of excavations for manholes and special structure will be at least 12 inches greater than the outside of the masonry or concrete work to permit backfilling around the structure.

3. Where structures are to be built in street rights-of-way or paved areas, the excavation will not exceed 2 feet from the outside of the masonry or concrete work. If the excavation exceeds this limit, the Subcontractor will be required to backfill the entire space around the structure with pit run gravel compacted as specified in Specification Section 02530 Paragraph 3.11.B.

I. Special Protection

1. Treacherous Ground:
When running sand, quicksand, or other treacherous ground is encountered, the work will be carried on with the utmost urgency and will continue day and night should the Purchaser so direct.

2. Sheeting and Shoring:
The Subcontractor will furnish, place, and maintain sheeting and shoring as required to support the sides of any excavation to prevent earth movement that could endanger the workers or public and to prevent damage to the excavation, adjacent utilities or property. The Subcontractor will place this sheeting and shoring without the Purchaser's instructions.

3. Sheeting will extend below structure invert a sufficient depth to assure adequate support. In the installation of sheeting, the use of vibratory type pile drivers (as opposed to impact type) will be limited to sheeting driven no greater than 5 feet below the invert. The sheeted trench width, as measured between those faces of the sheeting in contact with the earth trench wall, will not exceed the maximum width of a trench per Specification Section 02530 Paragraph 3.02.B. Walers and struts will be designed and installed to present no obstructions to proper placement of the pipe, pipe embedment, cradle or encasement, and they will not interfere with the satisfactory installation of the pipe.

4. Sheeting, bracing, and shoring will be withdrawn and removed as the backfilling is being done, except where the Purchaser permits the material to be left in place. The Subcontractor will cut off sheeting left in place at least 2 feet below the surface and will remove the cut off material from the excavation.

5. All sheeting, bracing, and shoring which is not left in place under this provision will be removed in a way that will not endanger the completed work or other structures, utilities, storm drains, sewers, or property. The Subcontractor will be careful to prevent the opening of voids during the extraction process.

6. If sheeting and shoring are not specifically required on the Plans or in the Specifications, steel drag shields or trench boxes may be used subject to the authorization of the Purchaser. Voids left by the advancement of the shield will be carefully backfilled and compacted following trench backfill requirements.

7. Excess Width of Trench:
If the Subcontractor is permitted to use equipment that results in wider trenches than specified, approved methods will be used around the pipe to resist the additional load caused by the extra width. The dimensions of the cradle or other methods will be specified by the Purchaser. The Subcontractor is responsible for meeting all applicable OSHA requirements. No extra compensation will be allowed for the additional material or work. Excess width trenches for semi-rigid and flexible pipe will be backfilled and compacted according to ASTM D 2321, and no concrete cradle will be used.

8. Blasting:
Blasting will be undertaken only after the Subcontractor has received written authorization from the Purchaser. With respect to the use of explosives in blasting, the Subcontractor will obtain all necessary permits and comply with all laws, rules, and regulations of the federal, state, City, and the insurer governing the keeping, storage, use, manufacture, sale, handling, transportation, or other disposition of explosives. The Subcontractor will obtain additional insurance covering the use of explosives with limits and coverage as specified by the Purchaser. All operations involving the handling, storage, and use of explosives will be conducted with every precaution under the supervision of a properly licensed individual. The Subcontractor will take special precautions for the proper use of explosives to prevent harm to human life and damage to surface structures, utilities, storm drains, sewers, or other subsurface structures. The Subcontractor will advise the Purchaser in advance when charges are to be detonated. Blasts will not be fired until all persons in the vicinity have had ample notice and have reached positions of safety.

9. Sanitary sewer construction will be carefully protected from all blasts, and all excavations requiring blasting will be fully completed at least 30 feet ahead of the laying of the pipe. The mouth of the pipe will always be covered with a board or other plug carefully fitted to the pipe to prevent earth or other substances from entering.

10. After a blast is fired, the Subcontractor will thoroughly scale the excavation. All loose, shattered rock or other loose material that may be dangerous to the workers, pipe, or structure will be removed and the excavation made safe before proceeding with the work. The fact that the removal of loose, shattered rock or other loose material may enlarge the excavation beyond the required width will not relieve the Subcontractor from making such removal and filling the extra space. The Subcontractor will not be entitled to extra compensation therefore.

11. Underpinning:
When excavations require underpinning of existing structures, the Subcontractor will submit shop drawings of underpinning details to the Purchaser for review before commencement of excavation below the foundation of the structure. Review of underpinning details by the Purchaser will not relieve the Subcontractor of his responsibility for protection of the structure and its contents.

J. Existing Utilities

1. Location:
The Plans show the readily available record of location of existing structures and facilities both above and below the ground, but the Purchaser assumes no responsibility for the accuracy or completeness of this information. Utility service connections are not shown on the Plans, but can be expected in built-up areas, and if relocating them is necessary, it will be the Subcontractor's responsibility to arrange for the relocation with the owner or owners of the utilities.

2. Protection
The Subcontractor will protect any storm drain, sewer, or utility within the limits of the construction. The Subcontractor will proceed with caution and will use every means to establish the exact location of underground structures and facilities before excavating in the vicinity. The Purchaser will not be responsible for the cost of protection or repair or replacement of any structure, pipe line, conduit, service connection, or similar facility broken or damaged by the Subcontractor's operations. All water and gas pipes and other conduits near or crossing the excavation will be properly supported and protected by the Subcontractor.

3. If the construction requires the removal and replacement of any overhead wires or poles, underground pipes, conduits, structures or other facilities, the Subcontractor will arrange for such work with the Owner or Owners of the facilities. No additional payment will be made by the Purchaser for this work.

4. Service Connections:
Sewer and utility services between mains and buildings will be maintained and adjusted as necessary by the Subcontractor to provide as nearly a continuous operation as can be expected. This will be accomplished in any way that the Subcontractor chooses, provided the individual service is not interrupted for more than two consecutive hours. The occupants will be notified by the Subcontractor at least six hours before such service interruptions. When a break occurs, the Subcontractor will notify the affected occupant(s) of the probable length of time that the service will be interrupted.

5. If existing underground facilities or utilities require removal and replacement for the performance of this work, all replacements will be made with new material conforming to the requirements of these Specifications. If not specified, the material will be as approved by the Owner.

6. The removal and replacement of water services to adapt to new construction will be the Subcontractor's responsibility within the limits where the new service line grade blends smoothly with the existing service line grade.

7. The removal and replacement of sewer house connections to adapt to new construction will be the Subcontractor's responsibility from the sewer main to a point where the new grade and existing grade can be matched.

8. The Subcontractor will be responsible for any damage to the sewer house connection because of his operations. The Purchaser does not guarantee the number, size, condition, nor length of adjustment necessary to bring a service to a new grade.

3.03 SEWER PIPE INSTALLATION

A. General

1. Sewer pipe and pipe embedment will be constructed as shown on the Plans. It will be the Subcontractor's responsibility to find all underground utilities before construction to insure there are no conflicts with the proposed line and grade. The Subcontractor's surveyor shall verify the base information on the City's plans prior to commencement of construction. Any discrepancies in the plans shall be reported to the Purchaser immediately. If approved by the Purchaser, minor changes in the alignment or grade will be permitted to avoid underground facilities, if straight alignment can be maintained between manholes. If minor changes in line or grade cannot avoid a conflict with the existing utility, the Subcontractor will arrange with the owner of said utility to have it adjusted as required to accommodate the proposed sewer at no additional expense to the Purchaser.

B. Modifications of Existing Sanitary Sewer Facilities

1. Maintenance of Flow:
Where existing sewer lines are being modified, the Subcontractor will arrange his work so that sewage flow will be maintained during the construction period with no discharge of sewage into the open trench, and no back up of sewage in the existing line. The Subcontractor will provide necessary bypass pumping capacity to carry flow downstream of the section to be modified.

2. Abandonment of Sewer Pipe:
Sewer pipe called for in the Specifications or Plans to be abandoned will be sealed at each end for a minimum distance of 18 inches, or one-half the diameter of the pipe, whichever is greater. Unless otherwise specified, the pipe will be sealed with a brick bulkhead and/or acceptable cement grout to form a solid watertight plug completely bonded to the pipe. Any sewer manholes to be abandoned will be abandoned per Specification Section 02531 Paragraph 3.03.B.

3. The Subcontractor will be allowed to remove pipe to be abandoned if wanted. If the Subcontractor elects the removal method, all associated costs will be included in the cost for other Pay items.

4. Connection to Existing Manholes:
The Subcontractor will cut suitable openings into existing manholes or remove existing pipe to accommodate the sewer pipe at the proper elevation, location, and direction, as indicated on the Plans. Care will be used to avoid unnecessary damage to the existing manhole.

5. All loose material will be removed from the cut surfaces that will be completely coated with nonshrinking grout before setting the pipe. Before inserting the pipe, a sufficient thickness of grout will be placed at the bottom and sides of the opening for proper bedding of the pipe. For semi-rigid and flexible pipe installations a water stop as approved by the pipe supplier will be installed on the pipe according to the manufacturer's recommendations. After setting, all spaces

around the pipe will be solidly filled with nonshrinking grout and neatly pointed up on the inside to present a smooth joint, flush with the inner wall surface. Any necessary revisions on the existing manhole invert will be made to provide a smooth, plastered surface for properly channeled sewage flow from the new connection. Plaster on the exterior of brick manholes will be repaired with nonshrinking grout. Particular care will be given to insure that the earth sub-base and bedding next to the manhole will provide firm solid support to the pipe.

6. Removal of Sewer Pipe:
Existing pipes and manholes to be removed and their locations will be shown on the Plans. Existing sewer pipe and manholes that must be removed to excavate for the proposed sewer will be included in the cost of the proposed sewer pipe and no additional compensation will be made to the Subcontractor. The City reserves the right to retain or reject salvage of any material encountered. All remaining material becomes the property of the Subcontractor who will be responsible for properly disposing of the same.

3.04 PIPE EMBEDMENT

A. Pipe embedment will be defined as that material supporting, surrounding and extending to 6 inches above the top of the pipe. Pipe Embedment for sewer pipe will conform to the requirements given below for Class A, B.1, B.2, or C, whichever is shown on the Plans. If the class of pipe embedment is not shown, a minimum of Class B.1 (for concrete and ductile iron pipe) or B.2 (for fiberglass reinforced polymer mortar pipe, PVC, and HDPE pipe) will be provided as specified below. At the direction of the Purchaser or as shown on the plans, sewer pipe and Class B.1 or B.2 will be encapsulated in geotextile fabric meeting the following requirements:

Physical Property	Test Method	Acceptable Test Result
Tensile Strength, wet, lbs	ASTM D-1682	200 (min)
Elongation, wet, %	ASTM D-1682	40 (min)
Coefficient of Water Permeability, cm/sec	Constant Head	0.03 (min)
Puncture Strength, lbs.	ASTM D-751	100 (min)
Pore Size - EOS U.S. Standard Sieve	Corps of Engineers CW-02215	40 (max)

B. Class A - Concrete Cradle

1. Class A pipe embedment for sewer pipe will consist of a continuous concrete cradle constructed in conformity with the details shown on the plans or as directed by the Purchaser. Class A pipe embedment will only be used for rigid pipe.

C. Class B.1-Crushed Limestone

1. Class B.1 pipe embedment will be number 67 crushed limestone. Pipe 4 inches to 24 inches in diameter will be bedded on 4 inches of bedding material. Pipe 27 inches to 48 inches in diameter will be bedded on 6 inches of bedding material. Pipe embedment for pipes larger than 48 inches in diameter will be by design based on anticipated soil conditions. After pipe installation, crushed limestone will then be tamped under the haunches continuing in layers not more than 6 inches in loose thickness around the pipe to the spring line. The remainder of the installation will be as outlined in Specification Section 02530 Paragraph 3.11. Unless otherwise instructed, concrete and ductile iron pipe will be bedded in Class B.1 pipe embedment.

D. Class B.2-Crushed Limestone

1. Class B.2 pipe embedment will be number 67 crushed limestone. Pipe 4 inches to 24 inchesin diameter will be bedded on 4 inches of number 67 crushed limestone Pipe 27 inches to 48 inches in diameter will be bedded on 6 inches of bedding material. Pipe embedment for pipes larger than 48 inches in diameter will be by design based on anticipated soil conditions. After pipe installation, crushed limestone will then be tamped under the haunches and continued in layers not more than 6 inches in loose thickness around and above the pipe to a level 6 inches above the outside top of the pipe. The remainder of the installation will be as outlined in Specification 02530 Paragraph 3.11. Class B.2 pipe embedment will be used for all flexible pipe including fiberglass reinforced polymer mortar pipe, PVC and HDPE.

E. Class C-Sand

1. Class C pipe embedment will only be used when specified by the Purchaser or construction plans. The remaining depth of the trench will then be backfilled and compacted as specified in Specification Section 02530 Paragraph 3.11.

3.05 PIPE LAYING

A. Inspection Before Laying

1. All pipe will be inspected on delivery. Pipe that does not conform to the requirements of these Specifications or is not suitable for use will be rejected and immediately removed from the work site.

B. Preparation of Pipe Ends

1. All surfaces of the pipe to be joined will be clean and dry. All necessary lubricants, primer, adhesives, and similar material will be used as recommended by the pipe or joint manufacturer's specifications.

C. Care During Hoisting, Placing, And Shoving Home

1. Equipment used to handle, lay, and join pipe will be equipped and used as to prevent damage to the pipe. All pipe and fittings will be carefully handled and lowered into the trench. Damaged pipe or jointing material will not be installed.

D. Direction of Work

1. The laying of pipe will be commenced at the lowest point. The bell or grooved end will be laid upgrade. All pipe will be laid with ends abutting and true to line and grade. They will be carefully centered so that when laid they will form a sewer with a uniform invert.

E. Uniform Pipe Bearing

1. Special care will be taken to insure that the pipe is solidly and uniformly bedded, cradled, or encased according to the Plans. For pipe with a bell that is larger than the barrel of the pipe the bedding material will be removed to a depth that will provide continuous support for the bell and barrel. No pipe will be brought into position for joining until the preceding length has been bedded, joined, and secured in place. Where a concrete cradle is required, the pipe will be supported at no more than two places with masonry supports of minimum size sufficient to provide the required clearance and to prevent displacement during placing of concrete.

F. Alignment and Grade

1. Each piece of pipe will be checked for vertical and horizontal alignment immediately after being laid. All adjustments to alignment and grade must be made by scraping away or filling in

under the barrel of the pipe and not by wedging or blocking up any portion of the pipe or striking the pipe to drive it down. Curved alignments will not be allowed except as directed by the Purchaser.

G. Backfilling to Secure Pipe

When the joint is made, sufficient backfill material will be simultaneously placed along each side of the pipe to prevent moving the pipe off line and grade. Particular care will be used to prevent disturbance or damage to the pipe and the joints during backfilling.

H. Flotation and Water in the Trench

1. The Subcontractor will take all necessary precautions to prevent flotation of the pipe in the trench. Water will not be allowed to rise in the trench. The Subcontractor will use well points, sump pumps, or another approved method of dewatering as required to lower the water table below the bottom of the excavation while minimizing the migration of fines from the surrounding area. The Subcontractor will make a request to the Purchaser and receive approval prior to the use of special dewatering equipment other than well points or sump pumps. Dewatering operations are considered incidental to the work and no additional compensation will be made to the Subcontractor.

I. Open Ends

1. Whenever pipe laying is stopped for any significant length of time, such as at the end of a workday, the unfinished end will be protected from damage and a temporary tight fitting plug or bulkhead will be placed in the exposed ends of the pipe to keep soil or other debris from entering the pipe.

J. Concrete Cradle Section next to Manhole

1. The pipe will be supported from the manhole wall to the limits of the manhole excavation in a normal sewer trench with a concrete cradle, structurally continuous with the manhole base slab or footing. Cost for this work is incidental to the cost of the pipe installation.

K. Cutting Pipe

1. Cutting will be in a neat workmanlike manner at right angles to the pipe axis without damage to the pipe. Observe specifications regarding joint locations. Smooth the cut end by power grinding or filing to remove burrs and sharp edges. Repair lining of the pipe as required.

L. Wyes and Special Fittings

1. Wyes, stubs, reducers, fittings, or other special pipes will be installed as shown on the Plans or where ordered by the Purchaser. The fittings and special pipes will be made of a compatible material, type, and class and/or strength designation as the pipe and installed as required by the Plans and Specifications. The cost for providing and installing the above items is incidental to the cost of the pipes.

M. Valves

1. Valves and appurtenant fittings will be installed as shown on the Plans or where directed by the Purchaser.

2. Check valves and gate valves will be installed on either flanged or mechanical joint ductile iron pipe.

3. Air release, vacuum relief and combination air valves larger than 3 inches in diameter will be installed on either flanged or mechanical joint ductile iron pipe. A gate valve conforming to section 2.01.Q shall be installed to isolate these air valves from the force main.

4. Air release, vacuum relief and combination air valves 3 inches in diameter and smaller will be installed on a ductile iron tap 'T' fitting. A ball valve conforming to section 2.01.Q shall be installed on a 6" threaded nipple between the 'T' and the air valve.

3.06 PIPE JOINTS

A. General

1. Pipe will be jointed immediately following the laying of each section. No pipe section will be left overnight which has not been completely jointed to the preceding pipe section in conformance with these Specifications.

2. The following provisions will apply to insure tight and sound joints:

a. The joint will be placed with special care to avoid breaking joints and to leave gasket, if required, in proper position.

b. All pipe 12 inches in diameter or larger will have dead weight held by crane while being lined up and pushed home.

c. Pipe will be pushed home with a constant and even force and not jarred home by the momentum of a moving force that will place an impact load on pipe.

d. Cement and lubricant will be used as recommended by the manufacturer and designated by the Purchaser.

B. Compression Joints

1. The two ends to be joined will be thoroughly cleaned and a compression gasket compatible with the type of pipe to be joined will be at the position recommended by the pipe manufacturer.

2. Lubricant recommended by the gasket manufacturer will be liberally applied to the gasket and both ends immediately before pipe ends are joined. The upstream pipe will be positioned such that the spigot may enter the bell squarely. The pipe being laid will be pushed home and the gasket position checked with a feeler gauge before installation of the next section. Flat, unconfined gaskets on concrete pipe will be cemented to the spigot at the position recommended by the pipe manufacturer.

C. Mechanical Joints

1. The two ends to be joined will be thoroughly cleaned with a wire brush and the plain end, socket end, and gasket will be brushed with soapy water. The end will be centered in the socket and adequate anchorage will be provided to hold the pipe in position until the joint can be completed. When deflecting pipe from a straight line is necessary, the deflection will be made after joint assembly and before tightening bolts. Pipe deflection will not exceed that specified by ANSI C 600.

2. When tightening bolts, it is essential that the gland be brought up toward the pipe flange evenly, maintaining approximately the same distance between the gland and the face of the

flange at all points around the socket. All bolts will be torqued to the required range recommended by the pipe manufacturer. Over stressing of bolts will be avoided. Gauge lines on the spigot end will be checked following assembly to ensure proper positioning of bell and spigot has been accomplished.

3. Any joints not properly positioned will be disassembled, cleaned, and reassembled as previously indicated.

D. Flanged Joints

1. The two ends to be joined will be thoroughly cleaned with a wire brush. Bolt holes on each pipe flange to be joined will be aligned and bolts inserted. Bolts will be torqued evenly by alternating tightening of bolts opposite one another until all bolts are torqued to the recommended pressure.

E. Solvent Cement Joints

1. The two ends to be joined will be thoroughly cleaned and primer liberally applied to the outside of the spigot within the joint insertion limits and inside the bell in conformance with the manufacturer's recommendations. Cement will be applied immediately to the same surfaces as the primer and the pipe joined within one minute. A sufficient quantity of cement will be applied to form a bead of excess cement around the full circumference of the joint when the spigot is fully inserted. The spigot end will be inserted to the insertion stop mark and rotated one-fourth turn. Avoid disturbing the joint until cement has had ample time to set.

F. Restrained Joints

1. Restrained push-on joints are to be used as specified on the plans or by the Purchaser. These special joints will be installed as specified by the manufacturer. The length of the pipe to be restrained will be determined by the Purchaser based on pipe size, internal pressure, depth of cover, and soil characteristics around the pipe.

3.07 PIPE CAPS AND PLUGS

A. Wyes, stubs, or other fittings installed in the pipe for future connections will be closed at the open end. For pipes 21 inches in diameter or smaller, an approved cap or plug will be installed in the bell or socket using the same type joint or jointing material as required for the sewer. For pipes larger than 21 inches in diameter, temporary approved masonry bulkheads of the thickness required by the Plans and Specifications to close the open end may be substituted for stoppers. Care in backfilling will be used so that such closure and its seal will not be disturbed. This stopper will be jointed so that it may be removed later without injury to the pipe itself. Work and material is incidental to the cost of the pipe installation.

3.08 SERVICE CONNECTIONS

A. All service connections for pipe diameters up to and including 12 inches will be 6 inch diameter in-line wye connections unless indicated otherwise on the Plans. Service connections on pipes larger than 12 inches in diameter will not be allowed. Saddles will not be used on new construction. Although the general location of connections may be shown on the drawings, the actual location will be determined by the Subcontractor, subject to approval by the Purchaser. Connections for undeveloped property will generally be at the center of the lot. Connection locations for developed property will be coordinated with the property owner. The quantities shown on the proposal sheet are only approximate and are subject to change. The depth of connections at the property line will be determined by the Purchaser. Building connections will be laid on no less than a 1 percent grade for 6 inch diameter connections unless otherwise directed by the Purchaser. Each building connection

will be accurately recorded by station offset and depth on the as-built drawings and will be furnished to the Purchaser. Unless authorized by the Purchaser in writing, or shown on the drawings, building connections will not be tied into new or existing manholes. When service connections are tied into manholes at an elevation greater than 2 feet above the manhole invert, the service will be constructed as a drop construction as specified in Specification Section 02531 Paragraph 3.08.

B. Service connections will be laid in open trenches except where tunneling may be necessary under existing curbs, sidewalks, or pavements. In all such instances, a shaft must be excavated at the end of the connection for inspection purposes and measurement of length and depth. All service connections will extend to the right-of-way or easement limits. The service connection will be installed in conformance to the City of Memphis Standard No. SST-16.

C. Cleanouts for service laterals shall be a 2-way cleanout as manufactured by Plastic Trends (G 1006), or approved equal, and extend 3' above finished grade to mark sewer service connections until building connection is made. Any sanitary sewer services which are over 12 feet in depth shall require water line and/or mechanical joint quality pipe. Contractor shall install tracer wire along the service line, terminating at the cleanout location.

3.09 PIPE ENCASEMENT, COLLARS, AND THRUST BLOCKS

A. General

1. Concrete will be Class "C" Concrete as specified in Specification Section 03050. All concrete will be placed, cured, and protected according to the applicable paragraphs of Specification Sections 03050 and 03310. Pipe alignment will be inspected immediately following concrete placement and any misalignment caused by the placement of concrete will be corrected before the initial set. Concrete will be protected against water until completely cured.

B. Pipe Encasement

1. Concrete encasement for pipes is to be used at the locations shown on the Plans or as directed by the Purchaser. Concrete will be Class C and will be reinforced as required. All pipe requiring encasement will be blocked at each joint using masonry supports of a minimum size sufficient to provide the required clearance and to prevent displacement during placing of concrete. Concrete will be placed on either side of the pipe in approximately equal amounts to prevent movement of the pipe. Concrete encasement is to be rectangular in section with a thickness of ½ the pipe diameter between the outside edge of pipe and the outside of encasement at the closest point unless shown otherwise on the Plans. The absolute minimum thickness for concrete encasement shall be 6 inches regardless of pipe size.

C. Pipe Collars

1. Concrete pipe collars are to be used to join pipe ends that cannot be joined with prefabricated joints. Concrete will be Class C and will be reinforced when shown on the Plans. Concrete pipe collars will be constructed at the locations and to the dimensions shown on the Plans or as directed by the Purchaser. Pipes being joined will be blocked and supported laterally to prevent movement during placing or curing of concrete. Rubber water stops will be placed on each pipe before pouring the concrete collar. Fernco or equal mechanical coupling will be used for pipe connectors 16 inches and smaller.

D. Thrust Blocks

1. Concrete thrust blocks are to be used to resist internal thrust pressures at bends and fittings in force mains at the locations shown on the Plans or as directed by the Purchaser. Concrete will be Class C and will be reinforced when shown on the Plans. Thrust blocks will conform to the dimensions shown on the Plans or City of Memphis Standard SST-12. Load distribution type thrust blocks will be poured continuously from the force main to the undisturbed trench face. Backfill will not be placed as backing material for load distribution type thrust blocks.

2. All concrete will be poured in a way that leaves the pipe joint accessible for caulking or

tightening of bolts. Care will be taken to permit the concrete to cure long enough to develop sufficient strength before the concrete is required to withstand the thrust. The area of the concrete bearing on the main or the restraining mass must be large enough to prevent over stressing the concrete.

3. If a concrete mass is used, a form may be necessary to contain the mass to provide access to joints or to insure the required bearing area. Generally, some form work is required for the mass of concrete necessary for blocking on mains sized 12 inches and larger. In poor soil, forming the concrete mass to construct the necessary bearing surface will be necessary. Instead of this construction, a restrained joint may be used.

4. Thrust blocks will be included in the linear foot price for the force main.

3.10 INVERTED SIPHONS

A. Each siphon will include inlet, outlet, and any intermediate manholes where shown on the Plans with all foundations, pipes, and pipe encasement and other appurtenances. Pipe to be included in the cost of the siphon is to be all pipe, fittings and specials between the center of the inlet manhole and the center of the outlet manhole.

B. The Subcontractor will construct cofferdams, temporary bulkheads, perform all pumping and other work necessary to protect the siphon during construction. The Subcontractor will be required to maintain a dry trench during construction, and will never be permitted to lay pipe or place concrete with water in the trench. Trenches will be kept free from water until the material in the joints and masonry has sufficiently hardened.

C. Unless otherwise specified, inverted siphon pipe will be lined ductile iron Class 50 pipe and fittings as specified in Specification Section 02530 Paragraph 2.01.H fabricated for push-on type joints or HDPE conforming to Specification Section 02530 Paragraph 2.01.M. The siphon pipes will be encased in concrete at the locations and to the dimensions shown on the Plans or Design Standards. The excavation, pipe embedment, laying, jointing, pipe encasement, and backfill operations will conform to the applicable sections of this Specification.

D. When shown on the Plans, flexible joint ductile iron pipe will be used instead of push-on joint pipe as shown on Design Standards. Flexible joint pipe will be laid such that the maximum joint deflection as specified by the pipe manufacturer for each joint is not exceeded.

E. The inlet, outlet, and any intermediate manholes will be constructed according to the requirements of Specification Section 02531.

F. The inlet and outlet manhole inverts will be carefully shaped to conform to the inlet and outlet pipes and cause the least possible resistance to flow. The inlet manhole will have an invert weir constructed to contain low flows to a single siphon pipe. The invert weir will be level across the top and constructed to the elevation shown on the Plans. The outlet manhole invert will be formed to reduce backflow into the inactive siphon pipes.

3.11 BACKFILLING

A. General

1. After sanitary sewer facilities have been bedded and installed according to these Specifications and upon permission of the Purchaser, the backfill may be placed. Backfilling operations will continue following as closely behind pipe installation as practical. All backfill will be placed in uniform horizontal layers. Pushing backfill material down a ramp into excavated areas will not be permitted. No trash will be allowed to accumulate in the space to be backfilled.

Particular care will be taken to avoid allowing wood to be included in the backfill, other than sheeting and shoring that has been approved to be left in place.

2. The Subcontractor will be responsible for the condition of the trenches and filled areas during the contract and warranty period. The Subcontractor will maintain frequent inspection of the same. Anytime during the 12-month warranty period the trenches or filled areas settle and sunken places appear, the Subcontractor will be required to refill these sunken places when they are discovered with suitable material and will replace all damaged curb, gutter, and sidewalk. All soft or dangerous trenches will be marked, barricaded and caution lighted for the protection of the public.

3. Property with an existing dwelling located on it or lots within a developed subdivision or planned development are considered improved property.

B. Street Right-of-Way and Improved Property

1. Backfill Material:

a. Backfill for manhole and pipe trench excavations through pavements in street or highway right-of-way or where the Purchaser orders, will be made with pit run gravel or other acceptable material as approved by the Purchaser. The backfill will be from the top of the pipe embedment material or manhole foundation to the subgrade elevation of the pavement. Pea gravel or similar granular material approximately uniform in size and without bonding properties will not be used.

2. Backfill for manhole and pipe trench excavations beyond pavements in street or highway right-of-way or outside public right-of-way will be made with select earth from the top level of the pipe embedment material or foundation to the subgrade elevation in paved area, or within 1 inch of the surface in areas to be sodded, or to the surface in all other areas.

3. Select material will be free from debris, organic matter, perishable compressible material and will contain no stones or lumps larger than 6 inches. Rocks and lumps smaller than 6 inches will not exceed an amount that will interfere with the consolidating properties of the fill material. Care will be taken that stones and lumps are kept separated and well distributed, and that all voids are completely filled with fine material. No rocks or lumps will come in direct contact with the pipe. The upper 3 feet of backfill in sodded or planted areas will be free of rocks or lumps larger than 1 inch in diameter.

4. Placement and Compaction:

a. Sanitary Sewer Trenches:
Backfill material will be placed by hand in 6 inch loose layers and tamped to a point 2 feet above the outside top of the pipe. Backfill will be compacted with suitable mechanical tamping equipment with special care being taken not to damage the pipe or joints. Use of compaction equipment directly above semi-rigid and flexible pipe should be avoided until sufficient backfill has been placed to ensure that the equipment will not damage the pipe. A minimum of 36 inches of compacted backfill above the top of semi-rigid and flexible pipe will be in place before wheel loading and a minimum of 48 inches of compacted backfill before use of pneumatic tampers. From these elevations to the subgrade elevation of the pavement, bottom of the sod, or to the original ground surface, suitable backfill will be mechanically placed in 9 inch, maximum, loose layers. All backfill material will be compacted to 95 percent of maximum density at plus or minus 2 percent of optimum moisture content as determined by Laboratory Standard Proctor Test (ASTM D 698).

b. Manholes and Special Structures:

When the masonry or concrete work has set sufficiently to withstand compaction, and the Purchaser authorizes, backfill material will be placed in 6 inch loose layers and compacted with heavy tampers or pneumatic tampers to 95 percent of maximum density at plus or minus 2 percent of optimum moisture content as determined by Laboratory Standard Proctor Test (ASTM D 698). Suitable backfill will be placed in this manner from the foundation of the structure to the subgrade elevation of the pavement, the bottom of the sod or to the original ground surface.

C. Open Areas and Unimproved Property

1. Backfill Material:

Backfill of excavations on unimproved property will be made with select material from the top level of pipe embedment material or foundation to the surface. Non-granular select material to be used for backfill will be free from debris, organic matter and perishable compressible material, and will contain no stones or lumps or rock fragments larger than 6 inches. Rocks or lumps smaller than 6 inches in diameter will not exceed an amount that will interfere with the consolidating properties of the fill material. No rocks or lumps will come in direct contact with the pipe. Stones and lumps will be kept separated and well distributed, and all voids will be completely filled with fine material.

2. Placement of Backfill:

Backfill procedures specified in Specification Section 02530 Paragraph 3.11.B will apply from the trench bottom to a point 2 feet above the outside of the pipe. From this point to slightly above the surrounding surface elevation, suitable backfill may be placed by bulldozer or other mechanical means.

D. Sanitary Sewer Facilities Placed on Fill

1. All sanitary sewer pipe laid on fill will be ductile iron pipe. Fill material placed in areas over which sanitary sewer facilities will be constructed will be select, job-excavated earth from the original ground to the subgrade elevation of the facility.

2. The fill material will be placed in 6 inch loose layers and compacted to 95 percent of maximum density at plus or minus 2 percent of optimum moisture content as determined by Laboratory Standard Proctor Test (ASTM D 698) up to a point at least 2 feet above the outside top of the pipe or to the foundation of manholes or special structures. If compaction standards for the sanitary sewer exceed that of the adjoining fill, the width of compaction for a sanitary sewer will be not less than the outside diameter of pipe plus 10 feet. If compaction standards for the sanitary manhole or special structure exceed that of adjoining fill, the limits of compaction for the structure will be not less than 5 feet outside the structure base slab.

E. Removal of Excess Material

1. After the trench or excavation has been properly backfilled, all excess dirt will be removed from the streets, roadways and improved private property so pavements or turfed areas may be replaced and properties cleaned.
2. In open areas and unimproved property, the excess material may be used to fill low spots on property next to the right-of-way/easement. Before spreading excess soil, the Subcontractor will obtain written permission from the property owner for the spreading of excess soil, and a copy of the written permission will be submitted to the Purchaser. Such spreading or filling will not obstruct surface drainage and be to the satisfaction of the property owner. Excess material will be disposed of by the Subcontractor.

3.12 TUNNELING, BORING, AND JACKING

A. General

1. Sewer pipe will be constructed by tunneling, boring, or jacking only at those locations shown on the plans or directed by the Purchaser. Carrier pipe for these applications will be of the type specified in the Plans and Specifications. Grade and alignment will be maintained through all liner pipes. The Subcontractor will submit shop drawings detailing the method, equipment and material to be used for tunneling, boring and jacking operations to the Purchaser for review and approval. The approval by the Purchaser of any drawings or plans will not in any way be deemed to release the Subcontractor from full responsibility for complete and accurate performance of the Work according to the Contract Drawings and Specifications.

2. When tunneling, boring, or jacking is required under railroads, highways, streets, or other facilities, construction will not interfere with the operation of the railroad, street, highway, or other facility and will not weaken or damage any embankment or structure. No water shall be introduced into any tunneling, boring or jacking excavation that lies within City, State or Rail Road right-of-way. A boring that uses a bentonite slurry may be allowed at the discretion of the Purchaser and the owner of the right-of-way.

3. The Subcontractor will be responsible for protection of utilities and sewers against damage by his work. If any utility above or near the tunnel is endangered or has been damaged because of the construction operations, the utility owner will be notified immediately and will be given access to the area to carry out all necessary repairs to such utilities. If any sewers are damaged, it will be the responsibility of the Subcontractor to make the necessary repairs. If any public or private property is endangered or has been damaged due to tunneling, boring, or jacking operations, it will be repaired at the Subcontractor's expense. All cost and expense to the Subcontractor of carrying out the above requirements will be considered included in his bid prices for the completed sewer installation.

4. Access pits will be of sufficient size to provide ample working space for the jacking or boring equipment, reaction blocks, bracing, liner plates, spoil removal, and 2 sections of pipe. Provisions will be made for the erection of guide rails in the bottom of the pit where applicable. If drainage is to be discharged from the jacking pit, a collection sump will be provided. Wherever end trenches are cut in the sides of the embankment or beyond it, such work will be sheeted securely and braced satisfactorily to prevent earth caving.

5. The Subcontractor will furnish and operate all necessary pumping equipment of ample capacity and arrange to keep tunnels and shafts free of water during construction and to dispose of water satisfactorily. During placement of concrete, drainage and pumping will be arranged so concrete is placed in dry conditions. No water will flow over the concrete until it has set and will not be damaged.

B. Tunneling

1. The Subcontractor will carry out the work of tunneling so there will be no cave-in or heaving of earth or other material into the tunnel excavation. If there should be any fall or movement of earth into the tunnel, the Subcontractor will proceed with the work with all necessary precautions to insure the safety of life and of sewers, utilities and public and private property above and near the tunnel.

2. The Subcontractor will furnish, place, and maintain all sheeting, bracing, lining or casing required to support the tunnel until the pipe and its pipe embedment, jointing, encasement, and backfilling have been completed. All liners will remain in place.

3. Care will be used in trimming the surfaces of the excavated section and in placing the liners or sheeting and bracing so that the required minimum clearance between the outside of the pipe and the final position of the liners, sheeting and bracing in the tunnel will be attained without any deviation in sewer alignment. Sheeting or lining must be placed and held tightly against the trimmed earth surface of the excavated section so that there will be no voids between the earth and the lining or sheeting.

4. No part of the lining, bracing, or flanges of steel liner plates will project closer to the outside of the pipe or pipe bells than the clearance limits shown on the Plans, or a minimum of two inches, if not shown on the Plans.5. If timber is used for lining and bracing instead of steel liner plates, invert struts will be placed at the required intervals but in such manner that the pipe and its pipe embedment will be supported entirely by the original earth floor of the tunnel and not on timber lining or bracing. All timbers, when placed for the support of the roof and sides of the tunnel, will be properly fitted and wedged in place. Timber sets in tunnels will be abutting. All voids behind timbers will be filled with blocking or other suitable material.

6. Timbering will be designed and placed to allow the filling of voids. All excavated material not required for backfilling abandoned shafts will be removed from the site and disposed of by the Subcontractor at his expense.

7. Shafts will be constructed at the location shown on the Plans. Temporary construction shafts will be of adequate size and properly constructed and equipped to meet all safety requirements. All shafts will be barricaded, lighted, fenced, and properly guarded from the beginning of the excavation until the completion of the construction requiring the shaft.

8. Provision will be made at all shafts so that plumb lines suspended on the centerline of the sewer at each end of the shaft will hang freely from the surface.

9. A ladder meeting OSHA requirements will be provided in each shaft and will be kept in safe, good repair, clean and clear of debris.

10. Cavities between the surfaces of excavation and the tunnel liner plates or sheeting will be completely filled with a uniform sand cement grout consisting of 1 part portland cement and 7 parts sand and the minimum amount of water necessary for proper placement. Grout will be placed under pressure through grout holes in the steel liner plates or sheeting. The grout holes will be located and the grout placed in such sequence to insure the complete filling of all cavities and to transfer the load from the undisturbed material to the tunnel lining or sheeting uniformly.

11. After the tunnel section is excavated, lined, and braced, the pipe will be placed on and supported by steel rails or other approved supports. The supporting system will assure line and grade and will allow space below the pipe for concrete grout. Care will be used to avoid damage to the pipe and the liner plates.

12. The space between the pipe and the tunnel will be completely grouted with a mixture of sand and portland cement, mixed in the proportions of 1 part cement to 7 parts sand by volume and a minimum amount of water necessary for proper placement whether placed under pressure or by hand.

13. Temporary shafts will be completely abandoned. Unless otherwise specified in the Plans or Contract Documents all sheeting, bracing, and similar items may be removed unless the Subcontractor requests and receives authorization from the Purchaser to leave it in place. No payment will be made for items left in place at the Subcontractor's option. If the Plans or the Purchaser requires leaving the sheeting, bracing, and similar items in place, measurement will be made as provided in Specification Section 02530.5 and payment will be made as provided in

Specification Section 02530.6.

C. Boring

1. When required by the Plans, sewers will be installed in bored holes. The holes will be bored from the downstream end, unless site conditions dictate otherwise and the Purchaser approves.

2. The boring machine to be used will be in good condition and capable of drilling the bore hole within the required limits of accuracy. A smooth liner of sufficient strength will be forced into the bored hole to give a tight fit against the earth sides of the bore hole and still provide a uniform clearance of at least two inches around the pipe flange to permit pressure grouting. The liner pipe will be carefully inspected to insure that the carrier pipe can be properly placed.

3. All carrier pipe shall be mechanical joint or restrained joint pipe. Manholes at the ends of a section of bored pipe will not be constructed until the bored section is completed.

4. The following procedures will be used for carrier pipe 18 inches and larger in diameter. The assembled pipe will be placed in the bored hole with approved, non-metallic, casing spacers attached. Casing spacers will be attached in accordance with the manufacturer's recommendations and with a casing spacer installed within 6 inches of each end of the bore. The assembled pipe will be placed in the bored hole only by such method that will keep the joints in compression. Any method that disjoints the pipe while being placed will not be permitted.

5. The ends of the bore shall be sealed with an approved, flexible end seal. The end seals shall be attached in accordance with the manufacturer's recommendations using stainless steel hardware.

6. When unforeseen obstructions or conditions require abandonment of a partially completed bore hole, and the starting of a new hole, the Subcontractor will grout the abandoned bore hole solid. The Subcontractor will receive no compensation for any expenses incurred by any unsuccessful attempt.

D. Jacking

1. The Subcontractor will furnish for the Purchaser's review, a plan showing his proposed method of jacking, including the design for the jacking head, jacking support or back stop, arrangement and position of jacks, pipe guides, and similar items in the assembled position. The review of this plan by the Purchaser will not relieve the Subcontractor from his responsibility to obtain the specified results.

2. Heavy duty jacks suitable for forcing the pipe through the embankment will be provided by the Subcontractor. In operating jacks even pressure will be applied to all jacks used. A suitable jacking head and bracing between jacks and jacking head will be provided so that pressure will be applied to the pipe uniformly around the circumference of the pipe. A suitable jacking frame or backstop capable of resisting the jacking forces will be provided. The pipe to be jacked will be set on guides, properly braced together to support the section of the pipe and to direct it in the proper line and grade. The whole jacking assembly will be placed to line up with the direction and grade of the pipe. The Subcontractor may use a cutting edge of steel plate around the head end of the pipe extending a short distance beyond the end of the pipe with the inside angles or lugs to keep the cutting edge from slipping back onto pipe.

3. The pipe will be jacked from the downstream end. Manholes at the ends of a section of jacked pipe will not be constructed until jacked section is completed.

4. Any pipe damaged in jacking operations will be removed and replaced by the Subcontractor

at his own expense. Embankment material will be excavated just ahead of the pipe and material removed through the pipe, and the pipe forced through the embankment with jacks, into the space thus provided.

5. The excavation for the underside of the pipe, for at least one-third of the circumference of the pipe, will conform to the contour and grade of the pipe. A clearance of not more than 2 inches may be provided for the upper half of the pipe. This clearance is to be tapered off to zero at the point where the excavation conforms to the contour of the pipe.

6. The distance that the excavation will extend beyond the end of the pipe depends on the character of the material, but it will not exceed 2 feet in any case. This distance will be decreased if the character of the material being excavated makes it desirable to keep the advance excavation closer to the end of the pipe.

7. A cushion material will be placed in the joints between each pipe section adequate to distribute the jacking forces around the entire periphery of the pipe uniformly.

8. When jacking of pipe is begun, the operation will be carried on without interruption, as much as practicable, to prevent the pipe from becoming firmly set in the embankment.

9. The pits or trenches excavated to allow jacking operations will be backfilled immediately after the jacking of the pipe has been completed according to Specification Section 02530 Paragraph 3.11.

E. Sewer Pipe in Jacked Liner

1. When required by the Plans or Contract Documents, a sewer pipe will be installed by jacking a pipe as a liner and inserting a carrier pipe of required size, type, and class. When using jacking for liners, the steel liner will be welded steel, 35,000 psi yield strength, and of the diameter and wall thickness required on the Plans and Specifications. The Subcontractor will provide, at his own expense, thicker walled lines if necessary to withstand the forces of jacking. In any case, the Subcontractor will retain full responsibility for the adequacy of this jacking operation, equipment and material.

F. Reserved.

3.13 DELETED

3.14 FINAL GRADING

A. Final grading around sanitary sewer facilities will conform to the elevation of adjacent undisturbed ground or as shown on the Plans. Sufficient grading will be done to provide adequate drainage.

3.15 CLEANING

A. All necessary precautions will be taken to prevent the entrance of mud, sand, or other obstructing material into the pipelines. As the work progresses, the interior of the sewer will be cleaned of all dirt, jointing material and extraneous material. On small pipe where cleaning after laying may be difficult, a squeegee will be kept in the pipeline and pulled forward past each joint immediately after its completion. Before final inspection the Subcontractor will remove all debris and foreign material.

PART 4 - FINAL TESTING AND ACCEPTANCE

4.01 VISUAL INSPECTION

A. All work will be subject to visual inspection for faults or defects and any such deviation or omission will be corrected at once. All tests will be made by the Subcontractor who will provide necessary equipment for testing and lamping the system in the presence of and under the supervision and instructions of the Purchaser. Lamp tests will be observed first hand by the Purchaser. Each section of sewer line will show a full circle of light when lamped between manholes. All defects located will be corrected before conducting leakage tests.

4.02 LEAKAGE TESTS

A. Leakage tests will be performed on the full length of all sewer lines and manholes in the presence of the Purchaser before acceptance. The cost of all testing will be included in the unit price for the item being tested.

B. Exfiltration Leakage Test

1. This section will only apply to pipe larger than 24 inches and smaller than 48 inches in diameter. All pipe over 48 inches in diameter will have individual joint testing according to Specification Section 02530 Paragraph 4.02.E. The method of testing used by the Subcontractor will be subject to approval by the Purchaser. The Subcontractor will provide all required testing apparatus. The method adopted must exert a minimum internal water pressure of four feet. This hydrostatic head will be measured from the inside top of the pipe at the high end of the section being tested. The height of the water level at the beginning of the test must be high enough so that the 4-foot head will be standing at the end of the test. The maximum hydrostatic head is limited to 15 feet. The exfiltration test will be maintained for at least two hours on each reach between manholes as necessary to find all leaks. The trench and backfill are intended to be free of excess water.

2. In areas where groundwater is known to exist, a one-half inch diameter capped pipe nipple approximately 10 inches long will be installed through the manhole wall on top of the lowest sewer line entering the manhole. This will be done at the time the sewer line is installed. Immediately before the performance of the leakage test, the groundwater level will be determined by removing pipe cap, blowing air through pipe nipples into the ground to clear it, and then connecting a clear plastic tube to the nipple. The tube will be held vertically and a measurement of height in feet of water will be taken after the water stops rising in this plastic tube. The height in feet will be divided by 2.3 to establish the pounds of pressure that will be added to all readings. In the event there is water present in the trench or backfill at the time of the test, the required head producing the pressure inside the pipe must be raised to offset the counteracting pressure outside of the pipe. The test will not be considered satisfactory until an acceptable method of measurement shows that the exfiltration rate does not exceed 0 gallons per inch of internal diameter per mile of pipe per day for each reach tested.

3. An initial test must be arranged by the Subcontractor so that the first reach of each size laid by each crew at the beginning of the work day can be tested before the backfill has been completed, but the pipe will be backfilled to a point 2 feet above the outside top of the pipe. This test reach is intended to extend only to the next proposed manhole location. However, if conditions justify, the length of the test reach may be reduced but never will this reach be less than 100 feet. No further pipe laying will be permitted by this crew until the above described test has been satisfied. All remaining pipe will be subject to the exfiltration test after manholes have been constructed and backfill placed. Manholes are to be included in this test and will be considered as sections of pipe equal to the diameter of the manhole.

4. If anytime the exfiltration observed and measured by the Purchaser exceeds 0 gallons per inch of internal diameter per mile of sewer per day, the Subcontractor will find the point(s) of leakage and will make necessary repairs and then retest the same reach. The Subcontractor will submit his plans for repair to the Purchaser for his review.

5. Water used for testing will be removed from the test reach following acceptance and will be disposed of properly. Water used for testing will not be discharged in such a manner to damage other construction or public or private property. The cost of providing the test water will be borne by the Subcontractor.

C. Air Leakage Test for 6-24 inch Diameter Pipe

1. Upon completion of construction, or earlier if the Purchaser deems advisable, the Subcontractor will provide the necessary equipment and labor to perform low pressure air tests according to ASTM F1417. This test will be performed in the presence of the Purchaser and will be for all types of gravity sewer pipe. This test will also include service lines from manholes.

2. The pressure test gauge will meet the following minimum specifications:

Size (diameter)	4 ½ inches
Pressure Range	0-15 PSI
Figure Intervals	1 PSI Increments
Minor Subdivisions	0.05 PSI
Pressure Tube	Bourdon Tube or diaphragm
Accuracy	Plus or minus 0.25% of Maximum scale reading
Dial	White coated aluminum with black lettering, 270° arc and mirror edges
Pipe Connection	Low male ½ inch NPT

3. Calibration data will be supplied with all pressure test gauges. Certification of pressure test gauges will be required from the gauge manufacturer. This certification and calibration data will be available to the Purchaser whenever air tests are done.

4. Air leakage tests will be performed on each reach of sewer pipe between manholes after completion of the installation of pipe and appurtenances and the backfill of sewer trenches. The test time will be determined from the following table. If air tests fail to meet the following requirements, repeat tests as necessary after all leaks and defects have been repaired. Before acceptance, the same sewer reach will pass the low pressure air test.

Time Required for a 1.0 psig Pressure Drop for Size and Length of Pipe Indicated [1]

Pipe Diameter (in.)	Minimum Time (min:sec)	Test Time for Length of Sewer Tested (min)
6	5:40	.854 X L(ft)/60
8	7:34	1.52 X L(ft)/60
10	9:26	2.374 X L(ft)/60
12	11:20	3.418 X L(ft)/60
15	14:10	5.342 X L(ft)/60
18	17:00	7.692 X L(ft)/60
21	19:50	10.47 X L(ft)/60
24	22:40	13.674 X L(ft)/60

1. Establish the test time for the sewer length from the formula or the minimum time, whichever is greater.

D. Infiltration Test

1. Infiltration tests may be required for the complete line or any portion of it. Failure of any part of the line to pass an infiltration test will be sufficient reason to require additional work by the Subcontractor to reduce the infiltration in such portions of the line tested. The passing of an infiltration test will in no way relieve the Subcontractor of any responsibility to repair visible leaks found during the visual inspection.

2. Maximum allowable infiltration will be 0 gallons per mile per inch of diameter of sewer per 24-hour day at a time. The joints will be tight, and visible leakage in the joints of leakage greater than that specified above will be repaired at the Subcontractor's expense by any means necessary.

E. Joint Acceptance Testing

1. Individual joints will be tested for pipe diameters of 48 inches and greater. Testing will be performed according to ASTM C 1103.

4.03 DEFLECTION TEST - SEMIRIGID AND FLEXIBLE PIPE

A. All polyvinyl chloride (PVC) pipe and glass fiber reinforced polymer mortar pipe will be tested for deflection. All testing will take place after backfill has been in place at least 30 days. All lines will be thoroughly cleaned before testing to assure accuracy.

B. Tests will be run using a rigid ball or nine arm mandrel having a diameter of 95% of the inside diameter of the pipe for PVC and 96% of the inside diameter of the pipe for glass fiber reinforced polymer mortar pipe. The mandrel will be pulled freely by hand through the pipe from manhole to manhole. No pipe deflection will exceed 5% for PVC and 4% for glass fiber reinforced polymer mortar pipe. Any section failing the test will be repaired by re-bedding or pipe replacement and retested to the satisfaction of the Purchaser.

C. The cost of this service will be included in the unit price bid for the pipe.

4.04 SEWAGE FORCE MAINS

A. The Subcontractor will perform hydrostatic pressure and leakage tests concurrently conforming to AWWA C 600, AWWA C 605, or ASTM D 2774 procedures as applicable and as modified herein. Tests will apply to all sewage force mains after backfilling.

B. Force mains will be tested separately in segments between sectionalizing valves, between a sectionalizing valve and a test plug, or between test plugs. Select test segments such that adjustable seated valves are isolated for individual checking. The Subcontractor will furnish and install test plugs at no additional cost, including all anchors, braces and other devices to withstand hydrostatic pressure on plugs. The Subcontractor will be responsible for any damage to public or private property caused by failure of plugs. Limit water fill rates of line to available venting capacity.

C. Hydrostatic Pressure Test
Conduct tests at 1.5 times maximum operating pressure determined by following

$$P_{pt} = 0.650 (OP-GE), \text{ in which}$$

P_{pt} = test pressure in psi at gauge elevation
OP = operating pressure in feet as indicated for highest elevation of the hydraulic gradient on each section of the line
GE = elevation in feet at center line of gauge

D. Hydrostatic Leakage Test

Conduct tests conforming to AWWA C 600, AWWA C 605, or ASTM D 2774 procedures, as applicable, at maximum operating pressure determined by following formula:

P_{lt} = 0.433 (OP-GE), in which

P_{lt} = test pressure in psi at gauge elevation
OP = operating pressure in feet as indicated for highest elevation of the hydraulic gradient on each section of the line
GE = elevation in feet at center line of gauge

E. Satisfactorily complete previously defined pressure tests before determining the amount of leakage. Maximum allowable leakage will be determined by the following formula:

$$L = ND\frac{\sqrt{p}}{7400}$$

L = Allowable leakage in gallons/hour
N = Number of joints in length of pipeline tested
D = Nominal diameter of the pipe, in inches
P = Average test pressure during leakage test, in pounds per square inch, gauge

4.05 FINAL ACCEPTANCE

A. When all work required by the Contract has been completed, the Subcontractor shall submit to the Purchaser written certification from a registered land surveyor that the centerline of each structure is within 2.0 feet of the centerline of the sewer easement or the location designated on the plans. After receiving the surveyor's certification from the Subcontractor, the Purchaser will make a final inspection of the Work, including any tests for operation. After completion of this inspection the Purchaser will, if all things are satisfactory to him, issue to the Subcontractor a Certificate of Completion certifying that the Work required by the Contract has been completed according to the Contract Drawings and Specifications. However, the Certificate will not operate to release the Subcontractor or his sureties from any guarantees under the Contract or the Performance Bond. Upon receipt of the Certificate of Completion the Subcontractor will clean the premises and see that they are in an orderly condition.

PART 5 - MEASUREMENT

5.01 SITE PREPARATION AND RESTORATION

A. The area to be considered for measurement will be the limit of the construction area unless otherwise directed by the Purchaser.

B. When the Proposal Sheet(s) do(es) not contain an item for Site Preparation and Restoration, this work will be required within the construction limits and will not be paid for directly but will be considered as a subsidiary obligation of the Subcontractor under other contract items.

5.02 UNDERCUT BACKFILL

A. Undercut backfill will be measured by the ton of limestone in place.

5.03 TRAFFIC CONTROL

A. Traffic control will be paid per each sewer pipe installation.

5.04 PAVEMENT BACKFILL

A. Pit run gravel or other acceptable material used for backfill under pavements or other areas directed by the Purchaser will be measured by the cubic yard in the following manner. Cubic yards of Pavement Backfill equals the linear feet of sewer pipe installed directly below pavement as measured along the centerline of the pipe multiplied by the trench payline width in feet multiplied by the depth of pavement backfill material in feet divided by 27. The trench payline width is defined as the outside diameter of the sewer pipe plus 2 feet. The depth of pavement backfill is defined as the distance from 6 inches above the top of the sewer pipe to the subgrade elevation of the pavement.

5.05 SERVICE CONNECTION REMOVAL AND REPLACEMENT

A. Service connection removal and replacement for construction of sewer facilities will be measured per each, complete in place. Service Connections damaged by the Subcontractor that do not require removal and replacement for construction of sewer facilities will not be measured for payment.

5.06 EXCAVATION

A. All work for excavation, blasting, drainage of trenches and dewatering, backfilling of excavation, compaction, grading, protection of existing utilities, disposal of excess material, and all other similar items included in this section of the Specifications but not covered by a Pay Item herein will be considered obligations of the Subcontractor under other Pay Items of the Contract.

5.07 SEWER PIPE

A. Sewer pipe length will be measured per linear foot along the centerline of the pipe from center of manhole to center of manhole. When there are special structures, sewer pipe will be measured from inside face to inside face for the various sizes, types, classes or wall thicknesses. No measurement of pipe depth will be made unless changed field conditions result in a change in the Plans by the Purchaser.

B. Sewer pipe length measurement will include the length of wyes as measured along the primary axis for all sizes of sewer pipe.

5.08 PIPE WYES

A. Pipe wyes on sewer lines will not be measured for payment, but are incidental to the cost of furnishing and installing sewer pipe.

5.09 SEWAGE FORCE MAIN

A. Sewage force main length will be measured per linear foot along the centerline of the pipe from the point of measurement at the pumping station or valve box shown on the Plans to the end of the force main at its discharge location. Shut-off and relief valves, valve boxes, and thrust blocks are incidental to the construction of the force main and/or pump station and will not be measured for payment.

5.10 DUCTILE IRON PIPE FITTINGS

A. Ductile iron pipe fittings will not be measured for payment, but are incidental to the cost of furnishing and installing ductile iron sewer pipe or inverted siphons.

5.11 SERVICE CONNECTIONS

A. Building connections between sewer main and right-of-way or easement line will be measured per linear foot to the nearest whole foot, along the centerline of the pipe from the outside face of the wye to the end of the reducer, for the various sizes and types constructed.

B. Building connections between a manhole and the right-of-way or easement line will be measured per linear foot horizontally from the inside face of the manhole to the end of the reducer. Drop service connections will be measured per vertical foot from the flow line of the service connection in the manhole wall to the end of the building connection inside the manhole to the nearest whole foot, along the centerline of the pipe for the various sizes constructed. No measurement of building connection depth will be made. Building connection length will include the length of fitting, reducers, and specials as measured along their centerline.

5.12 Reserved.

5.13 PLAIN CONCRETE FOR GENERAL USE

A. Concrete for general use including but not limited to pipe bedding, encasement and collars at the locations shown on the Plans or directed by the Purchaser will be measured per cubic yard, complete in place for each class used.

5.14 REINFORCED CONCRETE

A. Reinforced concrete including but not limited to pipe encasement and collars at the locations shown on the Plans or directed by the Purchaser will be measured per cubic yard, complete in place.

5.15 INVERTED SIPHON

A. Inverted siphons constructed according to Plans and Specifications will be measured per lump sum, for each siphon complete in place.

5.16 SEWER IN EARTH TUNNEL

A. Sewers constructed in earth tunnels will be measured by the centerline length for tunnels with liner plate or without liner plate.

B. Measurements will be from the face of the pit to the face of the pit.

5.17 SEWER IN BORED HOLE

A. Sewers constructed in a bored hole will be measured by the centerline length for bored holes with or without liner pipe.

B. If Subcontractor has requested and has obtained approval to use a bored hole instead of the construction required by the Plans, no measurement of sewers in bored holes will be made.

C. Reserved.

5.18 JACKED SEWER

A. Jacked sewers will be measured by the centerline length from the face of the pit to the face of the pit. If the Subcontractor has requested and has obtained approval to jack a sewer instead of the construction required by the Plans, no measurement of jacked sewers will be made.

5.19 SEWER IN JACKED LINER

A. Sewers in jacked liner will be measured by the centerline length from the face of the pit to the face of the pit. If the Subcontractor has requested and has obtained approval to construct a sewer in a jacked liner instead of the construction required by the Plans, no measurement of sewers in jacked liner will be made.

5.20 DELETED

5.21 ABANDONMENT OF EXISTING PIPE

A. Abandonment of existing pipe will be considered as a subsidiary obligation of the Subcontractor under other Pay Items of the Contract.

5.22 REMOVAL OF EXISTING PIPE

A. Removal of existing pipe will be measured per linear foot, to the nearest whole foot, along the centerline of the pipe to be removed regardless of size, type, or depth. No measurement of existing pipe removal within the limits of excavation for new sewers will be made.

PART 6 - PAYMENT

6.01 SITE PREPARATION AND RESTORATION

A. Payment will be made for Site Preparation and Restoration at the contract lump sum price, which will be full compensation for removal of trees, shrubs, plants, brush, rubbish, fences, manmade obstructions including but not limited to structures, abandoned cars and appliances, building foundations, and all other obstructions as may be directed by the Purchaser; the disposal of debris, removing of obstructions, and the restoration of fences, turfed areas, and all other items will be as specified in the Plans and Contract Documents or as directed by the Purchaser.

6.02 UNDERCUT BACKFILL

A. Accepted quantities of undercut backfill will be paid for at the contract unit price per ton of limestone furnished and placed, which will be full compensation for undercut excavation, special protection, protection of existing utilities, and backfilling to bottom of facility subgrade elevations, complete in place.

6.03 TRAFFIC CONTROL Traffic Control will be paid per each sewer pipe installation including all appurtenances required to comply with MUTCD Standards. .

6.04 PAVEMENT BACKFILL

A. Accepted quantities of pit run gravel or other acceptable material used for backfill under pavements or other areas designated by the Purchaser will be paid for at the contract unit price per ton furnished and placed, which will be full compensation for furnishing, placing and compacting the selected material.

6.05 BUILDING (HOUSE) CONNECTION REMOVAL AND REPLACEMENT

A. Accepted quantities of building connections removed and replaced will be paid for at the contract unit price per each for various types of building connections, which will be full compensation for excavation, removal of old service line and appurtenances, furnishing and construction of new service lines, connections to existing service line and appurtenances to remain, and backfilling, complete in place.

B. All pipeline material will be generically the same throughout the project except solid wall PVC pipe service connected to truss pipe mainlines.

6.06 OMITTED

6.07 SEWER PIPE

A. The accepted quantities of all sewer pipe will be paid for at the contract unit price per linear foot furnished and laid for the various sizes, types, classes, or wall thicknesses of pipe, which will be full compensation for material and material testing, excavation, special protection, protection of existing utilities, maintenance of sewage flow, pipe embedment, laying, jointing, cleaning and inspection, conducting acceptance tests, installation of pipe wyes, connection to manholes, adapters and couplings, stoppers, and removal and/or abandonment of existing pipe within the limits of excavation and backfilling outside pavement areas. All pipeline material will be generically the same throughout the project except connecting solid wall PVC pipe service connections to truss pipe mainlines.

6.08 OMITTED

6.09 SEWAGE FORCE MAIN

A. The accepted quantities of sewage force main will be paid for at the contract unit price per linear foot furnished and laid for the various sizes, types and classes or wall thicknesses, which will be full compensation for material and material testing, excavation, special protection, protection of existing utilities, pipe embedment, laying, jointing, fittings, shut-off valves, relief valves, valve pits, thrust blocks, cleaning and inspection, conducting acceptance tests, connection to existing sewer manholes or structures, removal and/or abandonment of existing pipe within the limits of excavation and backfilling outside pavement areas.

6.10 OMITTED

6.11 SERVICE CONNECTIONS

A. The accepted quantities of building connections will be paid for at the contract unit price per linear foot furnished and laid for the various sizes and types, including cleanouts. The accepted quantities of drop service connection will be paid for at the contract unit price per vertical foot furnished and installed. The contract unit price will be full compensation for material and material testing, excavation, special protection, protection of existing utilities, pipe embedment, laying, jointing, adapters and couplings, stoppers, reducers, marking reducer, removal and/or abandonment of existing pipe within the limits of excavation and backfilling outside of pavement areas.

6.12 Reserved.

6.13 PLAIN CONCRETE FOR GENERAL USE

A. The accepted quantities of plain concrete for general use including but not limited to pipe bedding, encasement and collars will be paid for at the contract unit price per cubic yard complete in place, which will be full compensation for material, testing, excavation, pipe support, form work, removal of forms, and curing and protection of concrete.

6.14 REINFORCED CONCRETE

A. The accepted quantities of reinforced concrete including but not limited to pipe encasement and collars will be paid for at the contract unit price per cubic yard, complete in place that will be full compensation for material, testing, excavation, pipe support, form work, reinforcing steel, removal of forms, and curing and protection of concrete.

6.15 INVERTED SIPHON

A. Payment will be made for Inverted Siphon at the contract lump sum price, which price will be full compensation for material and material testing, excavation, special protection, cofferdams, temporary bulkheads, maintenance of sewage flow during construction, protection of existing utilities, inlet manhole and outlet manhole with rims and covers, intermediate manholes, siphon pipe and fittings, concrete encasement, conducting acceptance test, removal and/or abandonment of existing pipe within the limits of excavation and backfilling.

6.16 SEWER IN EARTH TUNNEL

A. The accepted quantities of sewers in earth tunnels will be paid for at the contract unit price per linear foot furnished and constructed for the various sizes, which price will be full compensation for material and material testing, pit excavation, sheeting, timber bracing, liner if required, excavation, temporary shafts, pumping, protection of existing utilities, maintenance of sewage flow, pipe, laying pipe, making pipe joints, grouting, cleaning and inspection, conducting acceptance tests and backfilling of pits and shafts.

6.17 SEWER IN BORED HOLE

A. The accepted quantities of sewers in a bored hole will be paid for at the contract unit price per linear foot furnished and constructed for the various sizes, which will be full compensation for material and material testing, pit excavation, sheeting, timber bracing, liner if required, excavation, boring temporary shafts, pumping, protection of existing utilities, maintenance of sewage flow, pipe, casing spacers, laying pipe, making pipe joints, grouting, cleaning and inspection, conducting acceptance test, and backfilling of pits and shafts.

B. Reserved.

6.18 JACKED SEWER

A. The accepted quantities of jacked sewers will be paid for at the contract unit price per linear foot furnished and constructed for the various sizes; the price will be full compensation for material and material testing, pit excavation, jacking equipment and concrete slab foundation, jacking back stop, temporary shafts, pumping, protection of existing utilities, maintenance of sewage flow, pipe, jacking pipe, making pipe joint cushions, cleaning and inspection, conducting acceptance tests, and backfilling of pits and shafts.

6.19 SEWER IN JACKED LINER

A. The accepted quantities of sewers in jacked liner will be paid for at the contract unit price per linear foot furnished and constructed for the various sizes; the price will be full compensation for material and material testing, pit excavation, jacking equipment and concrete slab foundation, jacking back stop, temporary shafts, pumping, protection of existing utilities, maintenance of sewage flow, pipe liner, laying pipe, making pipe joints, grouting, cleaning and inspection, conducting acceptance tests, and backfilling of pits and shafts.

6.20 DELETED

6.21 OMITTED

6.22 REMOVAL OF EXISTING PIPE

A. The accepted quantities of existing pipe removal will be paid for at the contract unit price per linear foot regardless of pipe size or type which price will be full compensation for excavation, special protection, protection of existing utilities, pipe removal, salvage or disposal, backfilling and site restoration.

6.23 PAYMENT WILL BE MADE UNDER:

Item No.	Pay Item	Pay Unit
02530-6.01	SITE PREPARATION AND RESTORATION	Lump Sum
02530-6.02	UNDERCUT BACKFILL	Ton
02530-6.04	PAVEMENT BACKFILL	Ton
02530-6.07.06.12.01	12” Ductile Iron Pipe, Class 50, 0’-6’ Depth	LF
02530-6.07.06.12.02	12” Ductile Iron Pipe, Class 50, 6.1’-10’ Depth	LF
02530-6.07.06.12.03	12” Ductile Iron Pipe, Class 50, 10.1’-14’ Depth	LF
02530-6.07.06.12.04	12” Ductile Iron Pipe, Class 50, 14.1’-18’ Depth	LF
02530-6.07.06.12.05	12” Ductile Iron Pipe, Class 50, 18.1’-22’ Depth	LF
02530-6.07.06.12.06	12” Ductile Iron Pipe, Class 50, 22.1’-26’ Depth	LF
02530-6.07.15.12.01	12” Polyvinyl Chloride (PVC) Pipe, 0’-6’ Depth	LF
02530-6.07.15.12.02	12” Polyvinyl Chloride (PVC) Pipe, 6.1’-10’ Depth	LF
02530-6.07.15.12.03	12” Polyvinyl Chloride (PVC) Pipe, 10.1’-14’ Depth	LF
02530-6.07.15.12.04	12” Polyvinyl Chloride (PVC) Pipe, 14.1’-18’ Depth	LF
02530-6.07.15.12.05	12” Polyvinyl Chloride (PVC) Pipe, 18.1’-22’ Depth	LF
02530-6.07.15.12.06	12” Polyvinyl Chloride (PVC) Pipe, 22.1’-26’ Depth	LF
02530-6.07.16.24.01	24” Glass Fiber Reinforced Polymer Mortar Pipe, 0’-6’ Depth	LF
02530-6.07.16.24.02	24” Glass Fiber Reinforced Polymer Mortar Pipe, 6.1’-10’ Depth	LF
02530-6.07.16.24.03	24” Glass Fiber Reinforced Polymer Mortar Pipe, 10.1’-14’ Depth	LF
02530-6.07.16.24.04	24” Glass Fiber Reinforced Polymer Mortar Pipe, 14.1’-18’ Depth	LF
02530-6.07.16.24.05	24” Glass Fiber Reinforced Polymer Mortar Pipe, 18.1’-22’ Depth	LF
02530-6.07.16.24.06	24” Glass Fiber Reinforced Polymer Mortar Pipe, 22.1’-26’ Depth	LF
02530-6.17.16.20.07	20" Casing with 12" Carrier Pipe	LF

Examples of Pay Item Numbering System for Sewer Pipes

02530-6.07.03.48	Pay Item Number
02530-6	Section of Specification
.07	Last digit(s) of applicable paragraphs for payment
.03	Type of Pipe: e.g., Reinforced Concrete, Class III
.48	Size of Pipe; e.g., 48" diameter

END OF SECTION 02530

PART 1 – SCOPE

1.01 This Work consists of the replacement of existing or installation of new manholes for sanitary sewers as shown on the Drawings, stipulated in the Contract Documents, or as directed by the Purchaser. The construction will be accomplished by these Specifications and in conformity with the details shown on the Drawings or established by the Purchaser.

1.02 Accurately field measure and size each individual manhole. Each existing sewer manhole designated to be replaced may have a different configuration and varying field dimensions.

1.03 Where existing manholes are being replaced, the Subcontractor will arrange the work such that sewage flow will be maintained during the construction period with no discharge of sewage into an open trench, provide necessary bypass pumping capacity to carry flow downstream of the manhole to be replaced.

1.04 All new manholes shall be precast concrete. The top section of the manholes shall be either flat top or eccentric cones as shown on Drawings.

1.05 Cast iron frames shall be set at the required elevation and properly bonded to the flat top, eccentric cone, or grade rings with two rings of butyl mastic sealant and anchor bolts.

PART 2 - MATERIALS AND EQUIPMENT

2.01 MATERIALS

A. Unless otherwise specified all sample submittals shall be delivered to the Program Manager within two weeks of the NTP.

B. Site Contractor emergency phone numbers.

C. Schedules of work on a weekly basis that will be delivered no later than 2:00 PM on Thursday for the week following with daily AM email updates of approximate crew locations each day.

1. Weekly schedule format shall contain the following elements:

a. Map format.
b. Sufficient streets labeled and identified at a scale to provide clarity.
c. Nature and type of crew location by map area.

D. Confined space entry Drawings.

E. Shop Drawings:

1. Precast Manholes: Details of construction.

2. Precast Base, Cones, and Top Slab Sections: Details of construction.

3. Manholes Over Existing Piping: Drawings and schedule for diverting flow.
a. Certificate from manufacturer of castings indicating they meet applicable requirements of these Specifications.
b. Precast Manhole Sections: Manufacturer’s results of tests performed on representative sections to be furnished.
c. Certified load test data for precast manhole steps.
d. Plan for diversion of flow during installation of manhole over existing piping

F. Vent Stack

1. Vent stack pipe will be a 4-inch diameter galvanized steel pipe conforming to the requirements of ASTM A 53 with a minimum wall thickness of standard weight pipe. One end of the vent stack pipe will have a 180-degree bend fabricated by either shop welding a manufactured 180 degree elbow or fitting the pipe with a manufactured 180 degree threaded elbow and coupling. The opposite end of the pipe will be plain end. The maximum height for vent stacks for this specification shall be 20 vertical feet.

2. Vent stack supports will be fabricated from steel shapes conforming to ASTM A 36, and to the dimensions and details shown on the Plans. The vent stack supports will be welded to the vent stack pipe and to the vent stack support bottom ring around the entire contact surface.

3. The vent stack support bottom ring will be shop fabricated with bolt holes at the spacing shown on the plans for anchorage to the manhole top. All welding will be according to the American Welding Society Structural Welding Code.

4. A vent stack support ring with threaded coupling may be cast in the flat top for installation of the vent stack.

2.03. CONSTRUCTION MATERIAL

A. All material furnished by the Subcontractor will be new, high quality and free from defects. Previously used material in acceptable condition is allowed for bracing, forms, false work, and similar uses. Material not conforming to the requirements of the Specifications will be considered defective and will be removed immediately from the site.

2.04. QUALIFICATION OF MANUFACTURER

A. Manhole for sanitary sewers will be the standard product of an established, reputable manufacturer made in a permanent plant. Suppliers for each material to be used by the Contractor are subject to the approval of the Purchaser. No material will be delivered until the manufacturer and product have been approved by the Purchaser.

2.05. MORTAR

A. Mortar shall be composed of one part Portland cement and two parts sand (volumetric measure) thoroughly mixed in a tight box, with water added gradually and mixed continually until mortar has attained the proper consistency for use in brick masonry; prepared only in such quantities as needed for immediate use; mortar mixed for more than 30 minutes, retempered, or previously set will not be allowed.

2.06. CAST IRON CASTINGS

A. Castings shall be cast iron conforming to the Standard Drawings and the requirements of Class 30 ASTM A48; made accurately to the required dimensions; sound, smooth, clean, and free from blisters and other defects; not plugged or otherwise treated to remedy defects; machined so that covers rest securely in the frames with no rocking, and such that they are in contact with frame flanges for the entire perimeter of the contact surfaces.

2.07. MANHOLE STEPS

A. Manhole steps are not allowed in sewer structures.

Composition	Test Method	Minimum	Maximum
Bitumen (Petroleum Plastic Content	ASTM D4	50	70
Ash Inert Mineral Matter	AASHTO T11	30	50
Volatile Matter	ASTM D6	---	2.0
Property	**Test Method**	**Minimum**	**Maximum**
Specific Gravity at 77 degrees F	ASTM D71	1.2	1.3
Ductility at 77 degrees F(cm)	ASTM D113	5.0	---
Softening Point	ASTM D36	320 degrees F	---
Penetration 77 degrees F (150 gms) 5 sec.	ASTM D217	50	120

2.08. BUTYL MASTIC SEALANT

A. The sealant shall be used when joining the casting frame to the precast manhole to provide a watertight structure. The sealing compound shall be produced from blends of refined hydrocarbon resins and plasticizing compounds reinforced with inert mineral filler, and shall contain no solvents, irritating fumes, or obnoxious odors. The compound shall not depend on oxidizing, evaporating, or chemical action for its adhesive or cohesive strength. It shall be supplied in extruded rope form of suitable cross section and in such sizes as to seal the joint space. Use two complete ropes at each joint. The sealing compound shall be protected by a suitable removable two-piece wrapper, which shall be designed so that half may be removed longitudinally without disturbing the other half in order to facilitate application of the sealing compound. The sealant shall also meet the requirements of the following table:

2.09. PRECAST MANHOLES

A. All components shall meet the requirements of the Standard Drawings, ASTM C478, and ASTM C76 Class III. The mix design shall be:

Type I Portland Cement Content	615 Pounds per Cubic Yard
Fly Ash Content	85 Pounds per Cubic Yard
Coarse Aggregate Content	1,600 Pounds per Cubic Yard
Fine Aggregate Content	1,250 Pounds per Cubic Yard
Maximum Water/Cement Ration	0.40
Superplasticizer shall be added to create a workable slump.	

B. All cone sections and transition sections shall be eccentric. Barrel sections will be custom made with openings to meet indicated pipe alignment and invert elevations.

C. The circumferential reinforcement for the manhole sections shall consist of welded wire fabric per ASTM C478

D. Manholes shall be constructed with the minimum number of sections possible that the precaster can provide, to minimize the number of joints in the manhole. Minimum manhole section shall be 16 inches deep.

E. Lifting holes through the manhole structure shall not be permitted.

F. Each joint shall be a tongue and groove with two layers of butyl mastic sealant.

G. Pipe Connections: Pipe connections to precast concrete manholes shall be with A-LOK cast in-place gaskets for new and replacement manholes. Grout shall not be allowed to encase A-LOK gaskets. Pipe connections for cured in place or for existing pipe shall be KOR N SEAL flexible connectors. Proper torque shall be applied to KOR-N-SEAL flexible connectors with a torque wrench per manufacturer's specifications.

H. Channels and benches shall be factory grouted only. There shall be no field grouting of channels or benches.

I. Where possible a minimum line drop of 0.1 foot shall be provided across new manholes.

J. Where the difference in invert elevation of two intersecting sewers in a manhole is 2 feet or more, a drop connection shall be installed as directed by the Purchaser.

K. Where invert elevations are not shown on the Drawings, pipes of differing sizes enter and exit manholes, all pipe crowns shall be matched to the same elevation.

L. The bottom of all precast base sections 4 feet in diameter will extend a minimum of 6-inches beyond the outside wall of the manhole riser. The bottom of all precast base sections and cast-in-place bases 5 feet in diameter will extend a minimum of 7-inches beyond the outside wall of the manhole riser. The bottom of all precast base sections and cast-in-place bases 6 feet and larger in diameter will extend a minimum of 8-inches beyond the outside wall of the manhole riser.

M. For fewer manholes four to six feet in diameter and less than twenty feet deep, precast reinforced concrete manhole base sections shall be a minimum of 8 inches thick. For reinforced concrete manhole base sections shall be a minimum of 12 inches thick. All precast manhole base sections shall be reinforced with Number 4 steel reinforcing bars placed 6 inches on center each way and at mid depth of the slab, unless shown otherwise on the Drawings.

N. The interior of the manhole sections will be a smooth, cylindrical surface. Lifting holes, when provided, will be filled with expanding grout, or other approved materials.

O. All precast reinforced concrete manhole sections specified herein shall be inspected by the Purchaser's Representative. All materials that fail to conform to these Specifications shall be rejected. After delivery to the Site, any materials that have been damaged in transit or are otherwise unsuitable for use in the Work shall be rejected and removed from the Site by the Subcontractor at no cost to the Owner.

2.10. EQUIPMENT

A. The Subcontractor will furnish in good condition all equipment and facilities as required for the proper execution and inspection of the work. All equipment and facilities will be on site and approved by the Purchaser before work will be permitted to begin.

PART 3 – CONSTRUCTION REQUIREMENTS

3.01 SITE PREPARATION AND RESTORATION

A. Rights-of-Way and Easements

1. Rights of way and/or easements as shown on the Drawings and/or rights of way/easement plats are provided by the City to the Subcontractor for construction of sanitary sewer facilities. The Subcontractor will confine his construction activities to these areas. The Subcontractor will be responsible for obtaining written agreements for use of private property outside City acquired rights of way/easements for such purposes as storage of material and equipment and access to the construction site. The Subcontractor will immediately provide a copy of all such written agreements to the City and Purchaser upon obtaining the same.

B. Clearing of Rights-of-Way and Easements

1. The Subcontractor will confine his clearing of rights of way and easements to the least area necessary for construction of facilities shown on the Drawings. The Subcontractor will protect as many trees and shrubs within the area as possible. Where necessary for construction the Subcontractor will clear all live and dead vegetation and growth, pole stubs, logs, and other objectionable material. Cleared material will be removed to within 3 inches of existing ground. This work will be done well before excavation operations but only after erosion controls have been placed.

C. Location of Existing Obstructions

1. Locations of obstructions shown on the Drawings are approximate and are not intended as an accurate location of such obstructions. Obstructions not shown on the Drawings but encountered by the Subcontractor will be removed and replaced in their original state or protected by the Subcontractor at no additional cost to the Purchaser.

D. Removal of Obstructions

1. The Subcontractor will demolish and remove all structures and structure foundations, abandoned vehicles, appliances, and rubbish within the right of way/easement limits necessary for the performance of the work.

E. Protection of Obstructions Outside Easement Limits

1. The Subcontractor will protect and avoid damage to all trees, shrubs, plants, fences, structures, and all other objects outside the right of way/easement limits shown on the Drawings and/or Plats due to construction operations. All damage will be repaired or restored at the Subcontractor's expense. Particular attention will be paid to avoid damage to trees, shrubs, bushes, and private property located next to rights of way/easements. No trees, plants, or other objects may be removed outside such limits without written permission of the property owner.

F. Special Protection of Obstructions Inside Easement Limits

1. Wherever the underground installation of sanitary sewer facilities will go through surface improvements previously made by the City, other governmental bodies, or property owners, the Subcontractor will be responsible for their protection and preservation. This responsibility includes the removal and storage of such improvements to allow replacement and restoration as close as possible to the undisturbed condition.

G. Disposal of Debris

1. All trees, brush, logs, snags, leaves, sawdust, bark, and refuse will be collected and disposed of according to the City Code of Ordinances at the expense of the Subcontractor. There will be no separate pay item for disposal of debris. Debris will be removed from the site when practical and will not be left until the completion of the contract. Burning of debris is not allowed. When material is to be disposed of outside the easement, the Subcontractor will first obtain written permission from the property owner on whose property the disposal is to be made and will file a copy with the Purchaser. Unless otherwise provided in the Contract Documents, the Subcontractor will arrange for disposing of such material outside the right of way/easement. No debris will be deposited in wetlands.

H. Replacement of Fences

1. Any fences disturbed inside the right of way/easement limits will be replaced or restored to their original or better condition. Any fences removed will be replaced in their original location. Fences in such poor condition that they cannot be taken down and rebuilt with the same material will be replaced with new fence material similar in original quality, size, construction, and appearance to the removed fence. Exceptions to this requirement will be allowed if written releases are obtained from the property owners by the Subcontractor and submitted to the Purchaser.

I. Restoration of Turfed Areas

1. All areas will be restored as nearly as practicable to their original condition. Finished lawn areas where soil has been deposited will be cleared to the level of the existing sod and then raked and watered. Areas where sod has been damaged, destroyed, or ruts have been filled will be resodded After final restoration of the settled trench surfaces, trench areas and areas regraded as part of the construction will be resodded, unless otherwise shown on the Drawings or directed by the Purchaser. New sod shall consist of live, dense, well rooted growth of Bermuda grass, free from Johnson grass, nutgrass, and other obnoxious grasses or weeds, well suited for the intended purpose and for the soil in which it is to be planted. All sod shall be cleanly cut in strips having a reasonably uniform thickness. Subcontractor shall water sodded areas as frequently as required for a period of at least two weeks and shall apply fertilizer as necessary. Sod must be living at the time of final acceptance of the project.

3.02 BACKFILLING

A. General

1. After sanitary sewer facilities have been bedded and installed according to these Specifications and upon permission of the Purchaser, the backfill may be placed. Backfilling operations will continue following as closely behind pipe installation as practical. All backfill will be placed in uniform horizontal layers. Pushing backfill material down a ramp into excavated areas will not be permitted. No trash will be allowed to accumulate in the space to be backfilled. Particular care will be taken to avoid allowing wood to be included in the backfill, other than sheeting and shoring that has been approved to be left in place.

2. The Subcontractor will be responsible for the condition of the trenches and filled areas during the contract and warranty period. The Subcontractor will maintain frequent inspection of the same. Anytime during the 12-month warranty period the trenches or filled areas settle and sunken places appear, the Subcontractor will be required to refill these sunken places when they are discovered with suitable material and will replace all damaged curb, gutter, and sidewalk. All soft or dangerous trenches will be marked, barricaded and caution lighted for the protection of the public.

3. Property with an existing dwelling located on it or lots within a developed subdivision or planned development are considered improved property.

B. Street Right of Way and Improved Property

1. Backfill Material: Backfill for pipe trench excavations through pavements in street or highway right of way or where the Purchaser orders, will be made with pit run gravel or other acceptable material as approved by the Purchaser. The backfill will be from the top of the pipe embedment material or manhole foundation to the subgrade elevation of the pavement. Pea gravel or similar granular material approximately uniform in size and without bonding properties will not be used.

2. Backfill for pipe trench excavations beyond pavements in street or highway right of way or outside public right of way will be made with select earth from the top level of the pipe embedment material or foundation to the subgrade elevation in paved area, or within 1 inch of the surface in areas to be sodded, or to the surface in all other areas.

3. Select material will be free from debris, organic matter, perishable compressible material and will contain no stones or lumps larger than 6 inches. Rocks and lumps smaller than 6 inches will not exceed an amount that will interfere with the consolidating properties of the fill material. Care will be taken that stones and lumps are kept separated and well distributed, and that all voids are completely filled with fine material. No rocks or lumps will come in direct contact with the pipe. The upper 3 feet of backfill in sodded or planted areas will be free of rocks or lumps larger than 1 inch in diameter.

4. Placement and Compaction: Backfill material will be placed by hand in 6 inch loose layers and tamped to a point 2 feet above the outside top of the pipe. Backfill will be compacted with suitable mechanical tamping equipment with special care being

taken not to damage the pipe or joints. Use of compaction equipment directly above semi-rigid and flexible pipe should be avoided until sufficient backfill has been placed to ensure that the equipment will not damage the pipe. A minimum of 36 inches of compacted backfill above the top of semi-rigid and flexible pipe will be in place before wheel loading and a minimum of 48 inches of compacted backfill before use of pneumatic tampers. From these elevations to the subgrade elevation of the pavement, bottom of the sod, or to the original ground surface, suitable backfill will be mechanically placed in 9 inch, maximum, loose layers. All backfill material will be compacted to 95 percent of maximum density at plus or minus 2 percent of optimum moisture content as determined by Laboratory Standard Proctor Test (ASTM D 698).

C. Open Areas and Unimproved Property

1. Backfill of excavations on unimproved property will be made with select material from the top level of pipe embedment material or foundation to the surface. Non-granular select material to be used for backfill will be free from debris, organic matter and perishable compressible material, and will contain no stones or lumps or rock fragments larger than 6 inches. Rocks or lumps smaller than 6 inches in diameter will not exceed an amount that will interfere with the consolidating properties of the fill material. No rocks or lumps will come in direct contact with the pipe. Stones and lumps will be kept separated and well distributed, and all voids will be completely filled with fine material.

3.03 REMOVAL OF EXISTING MANHOLES

A. Existing manholes and structures to be removed will be shown on the Drawings or as directed by the Purchaser. The City reserves the right to retain or reject salvage of any materials encountered. Unless otherwise specified, salvaged rims and covers remain the property of the City and will be delivered by the Subcontractor to the City yard as directed by the Purchaser. All remaining materials become the property of the Contractor who shall be responsible for disposal.

3.04 GENERAL CONSTRUCTION REQUIREMENTS

A. New manholes and structures will be constructed of plain or reinforced concrete. Where the top elevation is not shown on the Drawings, the manhole or structure shall be built to conform to the elevation ordered by the Purchaser. Standard depth manholes are those having a depth of 6’-0” from rim to invert of the sewer. Completion of the manhole will include the installation of fittings, connections to pipes, placing of castings, testing, and other construction as shown on the Drawings.

B. Inlet and outlet pipes will extend through the walls of manholes to allow for water tight connections with the manhole walls. The ends will be cut off flush with the inside surface of the wall as shown on the Drawings, design standards, or otherwise directed by the Purchaser. The pipes will intersect at the structures so the inlet pipe will be aligned in the direction of outlet pipe such that counterflow is prevented. Water stops will be installed around pipes as they pass through the sanitary manhole wall.

C. Inverts will be of Class A concrete poured to conform to the shapes shown on the Plans or otherwise directed. The inverts will be constructed as to cause the least possible resistance to flow. The shape of the inverts will conform uniformly to inlet and outlet pipes. A smooth and uniform finish will be required.

D. Dewatering

1. Subcontractor shall furnish, install and operate pumps, pipes, appurtenances, and all equipment of sufficient capacity required to remove any groundwater encountered in the excavation. Subcontractor shall conduct said groundwater away from the construction site in an approved manner. Generally, dewatering is considered to be an incidental to the construction of sewer manholes.

E. Bypass Pumping

1. Contractor shall furnish, install, and operate pumps, pipes, appurtenances, and all equipment of sufficient capacity required to maintain sewage flow around the work area. Contractor shall conduct said bypass pumping in an approved manner. Generally, bypass pumping is considered to be ab incidental to the construction of sewer manholes.

F. Traffic Control

1. All traffic control shall be installed and maintained in accordance with the Manual on Uniform Traffic Control Devices (MUTCD). At a minimum, the Subcontractor must have two trucks with flashing yellow lights on the work site. Traffic cones must also be placed downstream of the construction site to divert cars into the adjacent lane(s) per MUTCD requirements. On roads with heavy traffic volume, a flagman may also be needed to assist with traffic control. For bidding purposes, the Subcontractor should assume that a flagman will be needed on 30 percent of the setups.

3.05 INSTALLATION – PRECAST MANHOLES

A. Manhole Foundations

1. Precast concrete manholes shall be built according to the Drawings or as directed by the Purchaser. All precast manholes will use either a concrete slab constructed of Class A concrete on a 12-inch thick No. 67 crushed limestone foundation and will be cast integrally with the base section and the inlet and outlet pipes as shown on the Drawings or the precast manhole will use a precast base section conforming to this specification. The stone base will be fully encapsulated in a geotextile fabric as indicated on the plans or as directed by the Purchaser. The Subcontractor shall dewater sufficiently to maintain the ground water level at or below the bottom of the manhole foundation prior to and during placement of the foundation.

B. Manhole Installation on Existing Lines

1. For all lines 12 inches in diameter or less, a section of pipe shall be removed and a complete precast manhole installed. The existing pipes shall be joined by a flexible coupling to pipe extensions from the manhole. Minimum 4-foot pipe extension shall be required from manhole to connect to existing pipe.

C. Manhole Diameters

1. In general, the internal diameter of manholes shall be 4 feet.

2. Manhole diameter sizing, however, is contingent upon limitations of manufacturer due to pipe sizes and pipe deflections at manhole. Subcontractor shall verify proper manhole diameter is provided based on proposed manhole pipe configuration and pipe sizes indicated. Manhole sizing shall be approved by the Purchaser.

D. Frames and Covers

1. Cast iron frames and covers shall be set at the required elevation and properly bonded to the masonry with two rings of butyl mastic sealant and anchor bolts.

2. City standard watertight frame and cover shall be used in flood prone areas, and areas where water ponds or could pond, including traffic areas.
   a. Where shown on the Drawings, vents shall be installed in long runs of sewers, potentially with watertight frames and covers. Vents shall be designed and constructed to preclude water entering the sewer system during storm events through the vents.

3. City standard frame and cover shall be used in all other areas.

4. Manhole rim elevations shall be set at grade in traffic areas and finished landscaped areas (finished grade is at the top of mulch in finished landscape areas), shall be set at 3 inches above grade in nonfinished landscaped areas, and to be set at 2 feet or more above finish grade in nontraffic and nonlandscaped areas.

5. Wherever manholes are constructed in paved areas, the top surface of the frame and cover shall conform to the exact slope, crown, and grade of the existing adjacent pavement.

PART 4 – ACCEPTANCE AND DELIVERABLES

4.01 MANHOLE ACCEPTANCE

A. All manholes shall be subject to visual inspection by the Purchaser's Representative for faults, defects, or deviations from the Drawings and any such deviation or omission will be corrected by the Subcontractor. All tests shall be made by the Subcontractor who will provide necessary equipment for testing in the presence of and under the supervision and instructions of the Purchaser's Representative.

4.02 MANHOLE VACUUM TESTING FOR PRECAST MANHOLES

A. The Subcontractor shall provide all labor and equipment for vacuum testing.

B. All manholes are to be vacuum tested following backfill and compaction. The ring and lid casting assembly shall be installed prior to testing. The testing equipment shall consist of a gasoline-powered vacuum pump with sufficient vacuum hose length and a test head of proper size to fit the inside opening of the manhole. The test head shall be equipped with an inflatable rubber bladder to affect the seal to the manhole, an air pressure gauge, and a safety valve for filling the bladder, a 30 inch Hg liquid-filled vacuum gauge, a double air exhaust manifold with quarter turn ball valves, three bolt-on feet, and a bridge assembly with height adjustment rod.

C. Subcontractor shall plug all pipe openings, taking care to securely brace the plugs and the pipe. The plugs shall be placed a minimum of 6 feet beyond the manhole wall.

D. With the vacuum tester in place, inflate the compression to affect a seal between the vacuum base and the structure. Connect the vacuum pump to the outlet port with the valve open and evacuate the manhole to 10 inches Hg (0.3 bar) for 48 inch diameter manholes and 5 inches Hg (0.15 bar) for 60-inch and greater diameter manholes.

E. Close vacuum inlet/outlet ball valve, disconnect the vacuum pump, and monitor the

vacuum for the specified time period. If the vacuum does not drop in excess of 1 inch Hg over the specified time period, the manhole if considered acceptable passes the test. If the manhole fails the test, identify the leaking areas by removing the head assembly, coating the interior surfaces of the manhole with a soap and water solution, and repeating the vacuum test for approximately thirty seconds. Once the leaks have been identified, complete all necessary repairs by sealing the leaks of the manhole to the satisfaction of the Purchaser, and repeat test procedures until satisfactory results are obtained.

Vacuum Test Timetable			
Depth (Feet)	**Manhole Diameter (Inches)**		
	48”	**60”**	**72”**
4’	10 sec.	13 sec.	16 sec.
8’	20 sec.	26 sec.	32 sec.
12’	30 sec.	39 sec.	48 sec.
16’	40 sec.	52 sec.	64 sec.
20’	50 sec.	65 sec.	80 sec.
24’	60 sec.	78 sec.	96 sec.
*	5.0 sec.	6.5 sec.	8.0 sec.
*Add extra testing time “T”, for each additional 2-foot depth. (The values listed above have been extrapolated for ASTM designation C924-85.			

4.03 WARRANTY AND GUARANTEE FOR PRECAST MANHOLES

A. The Contractor shall guarantee the rehabilitated manholes for ten (10) years after acceptance by the Owner to the extent that he will repair any leaks that may appear in them during this period because of faulty workmanship or materials furnished by him at no additional expense to the Owner.

4.04 MEETINGS

A. The Program Team will arrange bi-weekly (every other week) meetings with the contractor to discuss progress and field issues.

4.05 DELIVERABLES

A. The Subcontractor shall provide post-rehabilitation MACP inspections for each manhole in accordance with Specification 00001 – Manhole GPS and MACP Inspection.

PART 5 – MEASUREMENTS

5.01 SITE PREPARATION AND RESTORATION

A. The area to be considered for measurement will be the limit of the construction area unless otherwise directed by the Purchaser.

B. When the Proposal Sheet(s) do(es) not contain an item for Site Preparation and Restoration, this work will be required within the construction limits and will not be paid

for directly but will be considered as a subsidiary obligation of the Subcontractor under other contract items.

5.02 PRECAST MANHOLE REPLACEMENT

A. Precast manhole replacement shall be measured per vertical foot of manhole from the downstream invert up to the bottom of the frame casting.

5.03 PRECAST MANHOLE INSTALLATION

A. Precast manhole installation shall be measured per vertical foot of manhole from the downstream invert to the bottom of the frame casting.

5.04 PAVEMENT BACKFILL

A. Pit run gravel or other acceptable material used for backfill under pavements or other areas directed by the Purchaser will be measured by the cubic yard in the following manner. Cubic yards of Pavement Backfill equals the linear feet of sewer pipe installed directly below pavement as measured along the centerline of the pipe multiplied by the trench payline width in feet multiplied by the depth of pavement backfill material in feet divided by 27. The trench payline width is defined as the outside diameter of the sewer pipe plus 2 feet. The depth of pavement backfill is defined as the distance from 6 inches above the top of the sewer pipe to the subgrade elevation of the pavement.

5.05 TRAFFIC CONTROL

A. Traffic control will be paid per each manhole installed or replaced.

5.06 DEWATERING

A. Dewatering is considered to be an incidental to sewer manhole rehabilitation.

5.07 BYPASS PUMPING

A. Bypass pumping is considered to be an incidental to sewer manhole installation and replacement.

5.08 VENT STACK

A. Vent stacks will be measured per each set consisting of stack pipe, 180˚ bend and support. No measurement of height will be made.

5.09 SEWER MANHOLE RIM & COVER

A. Manhole rims and covers will be measured per each set consisting of one rim and one cover for the various types.

5.10 SEWER MANHOLE DROP CONSTRUCTION

A. Drop construction in new or existing manholes will be measured per vertical foot as measured from the upper inlet pipe flowline to the flowline of drop pipe elbows at the bottom of the drop construction. Payment for drop construction for new manholes will be in addition to payment for precast manhole installation (if required).

PART 6 – PAYMENT

6.01 SITE PREPARATION AND RESTORATION

A. Payment will be made for Site Preparation and Restoration at the contract lump sum price, which will be full compensation for removal of trees, shrubs, plants, brush, rubbish, fences, manmade obstructions including but not limited to structures, abandoned cars and appliances, building foundations, and all other obstructions as may be directed by the Purchaser; the disposal of debris, removing of obstructions, and the restoration of fences, turfed areas, and all other items will be as specified in the Drawings and Contract Documents or as directed by the Purchaser.

6.02 PRECAST MANHOLE REPLACEMENT

A. Precast Manhole replacement payment shall include base, precast sections, adjusting rings, as needed, gaskets, steps, cast-in or core drilled pipe openings, pipe connectors, grout, and vacuum testing, and removal and approved offsite disposal of materials.

6.03 PRECAST MANHOLE INSTALLATION

A. Precast Manhole installation payment shall include base, precast sections, adjusting rings, as needed, gaskets, steps, cast-in or core drilled pipe openings, pipe connectors, grout, and vacuum testing, and removal and approved offsite disposal of materials.

6.04 PAVEMENT BACKFILL

A. Accepted quantities of pit run gravel or other acceptable material used for backfill under pavements or other areas designated by the Purchaser will be paid for at the contract unit price per cubic yard furnished and placed, which will be full compensation for furnishing, placing and compacting the selected material.

6.05 TRAFFIC CONTROL

A. Traffic control will be paid per each manhole rehabilitated including all appurtenances required to comply with MUTCD standards.

6.06 DEWATERING

A. Dewatering is considered to be an incidental to sewer manhole rehabilitation. No payment will be made for this item.

6.07 BYPASS PUMPING

A. Bypass Pumping is considered to be an incidental to sewer manhole rehabilitation. No payment will be made for this item.

6.08 VENT STACK

A. The accepted quantities of vent stacks will be paid for at the contract unit price per each, complete in place, which will be full compensation for materials and materials' testing, fabrication, painting, and installation of vent stacks.

6.09 SEWER MANHOLE RIM & COVER

A. The accepted quantities of sewer manhole rim and cover set will be paid for at the contract unit price per each complete in place for various types which price will be full compensation for materials and materials' testing, setting rim and cover, placing gaskets and bolts, protection and curing of mortar, and cleaning and inspection.

6.10 SEWER MANHOLE DROP CONSTRUCTION

A. The accepted quantities of sewer manhole drop construction will be paid for at the contract unit price per vertical foot, complete in place for drop construction in new manholes or drop construction in existing manholes, which will be full compensation for materials and materials testing, excavation, special protection, maintenance of sewage flow during construction, construction of drop pipe, pipe fitting and connections, installation of steel support straps, placement, curing, and protection of concrete from the manhole base to the top of drop construction, cleaning and inspection, and backfilling outside of pavement areas. Payment for drop construction for new manholes will be in addition to payment for standard depth manhole and extra depth construction (if required).

6.11 PAYMENT WILL BE MADE UNDER:

Item No.	Pay Item	Pay Unit
02531-6.01	SITE PREPARATION AND RESTORATION	Lump Sum
02531-6.02	PRECAST MANHOLE REPLACEMENT	Vertical Foot
02531-6.03	PRECAST MANHOLE INSTALLATION	Vertical Foot
02531-6.04	PAVEMENT BACKFILL	Cubic Yard
02531-6.05	TRAFFIC CONTROL	Each
02531-6.08	VENT STACK	Each
02531-6.09.01	NO. 7 SEWER MANHOLE RIM & COVER	Each
02531-6.09.02	SEWER MANHOLE WATER TIGHT RIM & COVER	Each
02531-6.09.03	SEALED MANHOLE FOR VENT STACK	Each
02531-6.09	SEWER MANHOLE DROP CONSRUCTION	Vertical Foot

END OF SECTION 02531

CITY OF MEMPHIS – STANDARD CONSTRUCTION SPECIFICATIONS modified by SARP10 Program

SECTION 02950 REMOVAL AND REPLACEMENT OF PAVEMENTS AND INCIDENTALS

PART 1 – SCOPE

1.01 This Work shall consist of the removal and replacement of pavements, sidewalks, driveway aprons, curbs and gutters, driveways, paved areas, and curbs made necessary by the improvement of sanitary sewer infrastructure, and other items of construction that require temporary cuts. Such replacement shall be to a condition at least equal to the condition existing prior to removal and of in-kind material and shall be compliance with the Drawings, these Specifications, or as directed by the Purchaser. The Work which will be included in the Subcontract and for which the Subcontractor shall be compensated therefore is limited to that area within the rights-of-way and construction easements for the Project. The Subcontractor will not be compensated for the removal and replacement of facilities outside the rights-of-way, easements, and limits of construction of the Project.

PART 2 – MATERIALS AND EQUIPMENT

2.01 MATERIALS

A. Concrete: Portland cement concrete shall be in accordance with Section 03050 Portland Cement Concrete.

B. Asphaltic Concrete Pavement: Asphaltic concrete surface courses shall meet the requirements of Mix No. 1 and bases courses shall meet the requirements of Mix No. 2 as described below.

1. The composition of the mixes shall be as follows:

	Total Percent Passing by Weight	
Sieve Size	Mix No. 1	Mix No. 2
2”	100	100
1-1/2”	100	100
3/4”	100	100
3/8”	76 - 96	65 - 95
No. 4	51 - 76	45 - 70
No. 8	36 - 60	25 - 50
No. 30	16 - 40	12 - 30
No. 100	3 - 12	2 - 12
No. 200	2 - 8	1 - 6

2. The proportions of the total mixture, in percent by weight, shall be as follows:

Courses	Combined Mineral Aggregate	Asphalt Cement
Mix No. 1, Surface	92.0 – 96.0	4.0 – 8.0
Mix No. 2, Binder	93.0 – 97.5	2.5 – 7.0

3. It is the intent of this Section of the Specifications that the above described mixes shall conform to the following mixtures specified in the Tennessee Department of Transportation Standard Specifications for Road and Bridge construction.

Mix No. 1 – Section 411, Asphaltic Concrete Surface (Hot Mix), Grading E.
Mix No. 2 – Section 307, Bituminous Plant Mix Base (Hot Mix), Aggregate Grading C.

4. For multiple layer construction, succeeding layers shall not be laid until the previous layer has cooled sufficiently to support the construction equipment

5. When Mix No. 1 is to be used as a surface for traffic lanes, the mineral aggregate shall be composed of not less than 50 percent nor more than 55 percent crushed limestone and not more than 50 percent nor less than 45 percent natural sand. When Mix No. 1 is used for surfacing of shoulders or other non-traffic lane construction, the mineral aggregate may be composed entirely of limestone, including screening and manufactured sand, but in no case shall the mineral aggregate for this construction consist of less than 50 percent limestone. The natural sand shall be so graded that not more than 5 percent will be retained on the No. 4 sieve.

C. Expansion Joint Filler: Preformed expansion joint filler shall be of the bituminous type, shall conform to the requirements of AASHTO M 213 and shall not be more than 1 inch or less than 1/2 inch in thickness. The filler shall be cut to the full depth of pavement, curb and gutter, sidewalk, or driveway being replaced.

D. Gravel Pavement or Base: Crushed limestone with such material as manufactured sand or other fine materials naturally contained or added thereto as needed to match existing conditions and conform to the gradations shown below:

Grading Table for Graded Aggregate Base Course
Total Percent, by Dry Weight, Passing Each Sieve (U.S. Standard)

Size No.	2 ½ "	2"	1 ½ "	1"	3/8"	No. 40
1	100	95-100			35-65	10-30

2.02 EQUIPMENT

A. Equipment and tools necessary for cutting, removal, and hauling of existing items; handling and placement of new material; and all equipment necessary to perform all parts of the Work shall be at the job site sufficiently ahead of the start of construction operations to be examined and approved by the Purchaser.

B. When saws are used to cut pavement, the Subcontractor shall provide sawing equipment adequate in power to complete the sawing to a minimum of 1-1/2 inches below the pavement surface in one pass. An ample supply of saw blades shall be maintained at the site of the Work at all times during sawing operations.

C. Other types of pavement cutting equipment shall be capable of cutting the pavement to a neat straight line of 1-1/2 inch minimum depth below the pavement surface in one pass.

D. The Subcontractor shall provide equipment capable of removal of pavements, sidewalks, driveway aprons, curbs and gutters, driveways, paved areas, and curbs without disturbance of adjacent items to remain in place.

PART 3 – CONSTRUCTION REQUIREMENTS

3.01 REMOVAL OF ASPHALT PAVEMENT

Asphalt pavement shall be removed to a clean straight line as shown on the drawing details. Pavement shall be cut by saw or other equipment approved by the Purchaser in advance. Edges of existing asphalt pavement adjacent to trenches, where damaged, shall be recut in a clean straight line within the limits of damaged pavement only. Such recuts shall be parallel to the original cuts and perpendicular to the pavement surface.

3.02 REMOVAL OF CONCRETE PAVEMENT

Concrete pavement shall be removed to a neat straight line as shown on the drawing details. Care shall be used to avoid damage to pavements and to the pavement base remaining in place.

3.03 REMOVAL OF CONCRETE SIDEWALK, CURB AND GUTTER, AND DRIVEWAY

Concrete sidewalks, curbs and gutters, and driveways shall be removed to the nearest contraction or expansion joint. Care shall be used to avoid damage to sidewalks, curbs and gutters, and driveways remaining in place.

3.04 REMOVAL OF GRAVEL PAVEMENT

Gravel surfaces encountered in construction shall be removed as needed to allow for the adjustment of the manhole frame and cover.

3.05 REPLACEMENT OF PAVEMENT

A. Asphalt Pavements

1. Replace asphalt paving courses to match existing thickness. The minimum surface course thickness shall be 2 inches. Asphalt pavement and base replacement shall be constructed for the entire cross-section of pavement removal area including all areas where pavement was re-cut subsequent to the initial pavement removal.

B. Concrete Pavements

1. Concrete pavement shall be replaced with Class A concrete pavement equal in thickness to the pavement removed but not less than 4 inches thick. Concrete pavement and base replacement shall be constructed for the entire cross-section of pavement removal area including all areas where pavement was re-cut subsequent to the initial pavement removal.

2. Reasonable efforts shall be made to avoid contrast in the color and texture of existing and restored surfaces.

C. Placing, Curing, and Protection of Concrete

1. After the backfill in the trench has been brought to the appropriate subgrade elevation shown on the Plans, compacted to the specified density, and permission has been given by the Purchaser, a concrete slab of the appropriate thickness shall be placed within the entire disturbed area.

2. Any loose or disturbed pavement or base shall be removed prior to placement of the concrete. Concrete shall be placed only on a moist subgrade and shall not be placed unless the ambient temperature is 35^{o} F and rising. In no case shall concrete be placed on a frozen or frosty subgrade. After the concrete is placed, it shall be struck off in an approved manner to the appropriate grade as shown on the Plans and shall be finished with floats and straight edges until the required surface texture has been obtained.

3. No vehicles or loads shall be permitted on any concrete until the Purchaser has determined that the concrete has obtained sufficient strength for such loads. The Subcontractor shall construct and place such barricades and protection devices as are necessary to protect the concrete.

3.06 REPLACEMENT OF SIDEWALKS, DRIVEWAY APRONS, CURBS AND GUTTERS, DRIVEWAYS AND OTHER PAVED AREAS, AND CURBS

A. Concrete sidewalks and driveway aprons shall be replaced in accordance with the City of Memphis Standard Construction Specifications.

B. Unless otherwise directed, curb and gutter shall be replaced with new concrete curb and gutter of the same cross-section and at the same top of curb elevation and flow line as that removed. Where curb and gutter of a different type than existing is to be used for replacement, the replacement flow line shall match existing and a transitions section provided between the existing and replacement cross-sections. Curb heights shall be transitioned at a rate of 1 inch in 5 feet. Granite curb shall be replaced with new concrete curb whose height matches existing adjacent curb top elevations. Any expansion joint material removed shall be replaced at the original locations. Existing concrete edges shall be cleaned prior to placement of concrete. The finished curb and gutter cross-section, elevations, texture, and color shall conform to the adjacent concrete surfaces.

C. Replacement of paved areas other than street pavement; concrete, asphalt, or gravel driveways; and asphalt or concrete curb within the right-of-way or construction easement limits shall be in kind for those cross-sections removed, unless directed otherwise by the Purchaser.

3.07 DAMAGE DUE TO SETTLEMENT

A. The Subcontractor shall be responsible for any damage caused by settlement of backfill placed beneath pavements, sidewalks, driveway aprons, curbs, curbs and gutters, driveways, paved areas other than street pavement, and asphalt or concrete curb within the right-of-way or construction easement limits. This includes any damage which may occur at any time prior to, and during a period of one year from the date of Final Completion of the Work covered by the Subcontract.

B. During such period, the Subcontractor shall at his own cost and expense refill all excavations where settlement damage has occurred and replace damaged pavements, sidewalks, driveway aprons, curbs, curbs and gutters, paved areas, driveways, and all other damaged items to the satisfaction of the Purchaser. Should the Subcontractor fail to repair settlement damage which may occur as described above within 5 days after being given notice thereof, the Purchaser shall have the right to repair such settlement and charge the cost of such repairs to the Subcontractor.

3.08 DAMAGE OUTSIDE CONSTRUCTION EASEMENT LIMITS

The Subcontractor will be held responsible for all damage to roads, highways, shoulders, curbs and gutters, ditches, embankments, bridges, culverts, and other property, caused by him or any of this Sub-subcontractors in hauling or otherwise transporting materials to and from the several sites of Work, regardless of the location of such damage. The Subcontractor shall make arrangements relative to the payment for, or repair or replacement of, such damage or damaged surfaces or structures which are satisfactory and acceptable to the Purchaser, at the Subcontractor's cost and expense.

PART 4 – MEASUREMENT

4.01 PAVEMENT REMOVAL AND REPLACEMENT
Pavement removal and replacement shall be measured for payment by the square yard, complete in place.

4.02 CONCRETE SIDEWALK REMOVAL AND REPLACEMENT
Sidewalk removal and replacement shall be measured for payment by the square foot, complete in place.

4.03 CONCRETE CURB AND GUTTER REMOVAL AND REPLACEMENT
Curb and gutter removal and replacement shall be measured for payment by the linear foot, complete in place.

4.04 GRAVEL DRIVEWAY AND GRAVEL AREA REMOVAL AND REPLACEMENT
Gravel driveways and gravel area removal and replacement shall be measured for payment by the ton of crushed limestone, complete in place.

PART 5 – PAYMENT

5.01 PAVEMENT REMOVAL AND REPLACEMENT
The accepted quantities of pavement removal and replacement shall be paid for at the Subcontract unit price per square yard for the type specified, which price will be full compensation for cutting and recutting pavement; removal and disposal of pavement and base; preparing the subgrade; placing, finishing, curing, and protection of concrete; and placing and compacting asphaltic concrete wearing surfaces, complete in place.

5.02 CONCRETE SIDEWALK REMOVAL AND REPLACEMENT
The accepted quantities of sidewalk removal and replacement shall be paid for at the contract unit price per square foot, which price will be full compensation for removal and disposal of sidewalk; preparing the subgrade; and placing, finishing, curing and protection of concrete, complete in place.

5.03 CONCRETE CURB AND GUTTER REMOVAL AND REPLACEMENT.
The accepted quantities of curb and gutter removal and replacement shall be paid for at the Subcontract unit price per linear foot for the type specified, which price will be full compensation for removal and disposal of curb and gutter; preparing the subgrade; and placing, finishing, curing and protection of concrete, complete in place.

5.04 GRAVEL DRIVEWAY AND GRAVEL AREA REMOVAL AND REPLACEMENT
The accepted quantities of gravel driveway and gravel area removal and replacement shall be paid for at the Subcontract unit price per ton of crushed limestone, which price will be full compensation for preparing the subgrade and replacing the gravel, complete in place.

5.05 PAYMENT WILL BE MADE UNDER:

Item No.	Pay Item	Pay Unit
02950-5.01.01	Asphaltic Concrete Pavement Removal and Replacement	Square Yard
02950-5.01.02	Concrete Pavement Removal and Replacement	Square Yard
02950-5.02	Concrete Sidewalk Removal and Replacement	Square Foot

02950-5.04	Concrete Curb And Gutter Removal and Replacement	Linear Foot
02950-5.05	Gravel Driveway And Gravel Area Removal and Replacement with Crushed Stone	Ton

END OF SECTION 02950

CITY OF MEMPHIS - STANDARD CONSTRUCTION SPECIFICATIONS
Modified by SARP10 Program
SECTION 03310 CONCRETE STRUCTURES

PART 1 – SCOPE

1.01 This work shall consist of the construction of all structures, or parts of structures, composed of Portland cement concrete whether plain, reinforced, or a combination of both. Concrete structures shall be constructed of Class A Concrete, unless otherwise specified. They shall be constructed on prepared foundations, at the locations indicated or directed in conformity with the dimensions, lines and grades shown on the Plans or as directed by the Purchaser and in accordance with these Specifications.

1.02 The concrete used in this construction shall be composed of a mixture or mixtures of Portland cement, aggregates, air-entraining agents, water, and chemical additives when approved, combined by the methods an in the proportions defined for the particular class of concrete designated as shown in Specification Section 03050.

1.03 Parts of a structure, or structures, indicated to be constructed with materials other than Portland cement concrete and concrete reinforcement steel shall be constructed in accordance with the provisions set out in the Specification Section covering the particular type of construction.

PART 2 – MATERIALS AND EQUIPMENT

2.01 MATERIAL

A. Materials used in this construction shall meet the requirements of the applicable Sections or Paragraphs of Specification Section 03050, “Portland Cement Concrete” and the following:

B. Waterstops.

1. Waterstops shall be of the type, shape, and dimensions shown on the Plans.

2. Metallic.
Metallic waterstops shall be sheet copper conforming to the requirements as specified in the current Specifications for Copper Sheet, Strip, Plate, and Rolled Bar, Type ETP, ASTM Designation B 152. The weight per square foot shall be as specified on the Plans.

3. Nonmetallic

a. Nonmetallic waterstops shall be manufactured from either natural rubber, synthetic rubber, or polyvinylchloride (PVC) at the option of the Subcontractor. Waterstops shall be produced by such a process that, as supplied for use, they will be dense, homogeneous, and free from holes and other imperfections. The cross-section of the waterstop shall be uniform along its length and transversely symmetrical so that the thickness at any given distance from either edge of the waterstop will be uniform.

b. Rubber Waterstop.

(1) The waterstop shall be fabricated from a high grade thread-type compound. The basic polymer shall be natural rubber or a copolymer of butadiene and styrene, or a blend of both. The compound shall contain no less than 70 percent by volume of the basic polymer, and remainder shall consist of reinforcing carbon black, zinc oxide, accelerators, antioxidants, vulcanizing agents and plasticizers, but shall contain no factice.

(2) Samples taken from the finished waterstop shall meet the following requirements when tested in accordance with the current specified ASTM method of test.

ASTM

Title	Requirement	Method of Test
Tensile Strength (Die "C")	2500 psi. min.	D 412
Ultimate Elongation (Die "C")	450 percent, min.	D 412
Shore Durometer Hardness	60-70	D 2240
Specific Gravity	1.15 + 0.03	D 297 (Sec. 17)
Water Absorption (% by Wt.)	5 percent, max.	D 570
Tensile Strength after accelerated Aging, oxygen-pressure method	80 percent, min.	D 572

c. Polyvinylchloride Waterstop.

(1) This waterstop shall be extruded from an elastomeric plastic material. The material shall be a plastic compound, the basic resin of which shall be polyvinylchloride. The compound shall contain any additional resins, plasticizers, stabilizers, or other materials needed to insure that when the material is compounded it will meet the performance requirements of this Specification. No reclaimed polyvinylchloride shall be used.

Title	Requirement	ASTM Method of Test
Tensile Strength (Die "C")		
Sheet Material	2,000 psi	D 412
Finished Waterstop	1,700 psi	D 412
Ultimate Elongation (Die "C")		
Sheet Material	350% Min.	D 412
Finished Waterstop	300% Min.	D 412
Stiffness in Flexure	750 psi Min.	D 747
Accelerated Extraction		CRD C 572
Tensile Strength (Die "C")	1,750 psi	D 412
Elongation (Die "C")	300%	D 412
Effect of Alkali (After 7 Days)		
Change in Weight	-0.1 to +0.25%	
Change in Hardness, Shore Durometer	+ or – 5%	
Low Temperature Brittleness	-35°	D 746
Specific Gravity	1.3	D 792

(2) For polyvinylchloride waterstops, the supplier shall submit a certificate stating that all of the performance requirements specified for the sheet material under Polyvinylchloride Waterstops have been complied with. Field splices for Polyvinylchloride waterstops shall be performed by heat sealing the adjacent surfaces in accordance with the manufacturer's recommendations. Waterstops shall be manufactured with an integral cross-section which shall be uniform within plus or minus 1/8 inch in width, and the web thickness or bulb diameter within plus 1/16 inch and minus 1/32 inch.

(3) The Subcontractor shall furnish the Purchaser at this request and at no cost to the Purchaser a certified test report from an approved laboratory covering each lot or unit of finished waterstops. These test reports shall contain the numerical laboratory test data of the required test.

B. Epoxy Resin Systems.

Two Component epoxy resin systems shall conform to the requirements of the appropriate class designation of AASHTO M 200, M 234, M 235, unless otherwise designated on the Plans or in the Contract. The appropriate class designation is determined by the proposed use of the material.

1. Requirements for Specific Uses:

   a. Bonding fresh concrete to cured concrete.
   Requirements: The material shall meet the compositional specification fo AASHTO M 235, Class I and applicable requirements of the Class III performance specification.

   b. Bonding cured concrete to cured concrete.
   Requirements: The material shall meet the compositional specification of AASHTO M 235, Class II and the applicable requirements of the Class III performance specification.

   c. Binder in epoxy resin concrete and mortar for repairing spalls and other defects in concrete.
   Requirements: The material shall meet the compositional specification of AASHTO M 235, Class II and the applicable requirements of the Class III performance specification.

C. Bar Reinforcement.
Unless otherwise specified, all steel reinforcement for concrete shall be billet steel bars conforming to the requirements of ASTM A 615.

D. Dowel Bars.
Dowel bars shall be plain and shall conform to the requirements of ASTM A 306, Grade 55, 60, 65, or 70.

E. Welded Wire Fabric.
Fabric for reinforcement shall conform to ASTM A 185, or as indicated on the Plans, and shall be supplied in mats of the size, design and weight shown on the Plans.

2.02. EQUIPMENT.

A. Equipment and tools necessary for handling materials and performing all parts of the Work shall be subject to approval by the Purchaser as to design, capacity, and mechanical condition. Equipment shall be on hand sufficiently ahead of the start of construction operations to be examined and approved. The equipment and organization shall be of sufficient capacity to accomplish the maximum continuous concrete placement, as governed by the construction joints shown on the Plans or as directed by the Purchaser.

B. The requirements for batching plant and mixers shall be as prescribed in Specification Section 03050.

C. Ample and satisfactory equipment for conveying concrete from the mixer to final position in the forms shall be provided. Closed chutes or pipes shall be used when concrete is to be dumped or dropped for a distance greater than 5 feet. Where steep slopes are required, the chutes shall be equipped with baffle boards or shall be in short lengths that will enable the direction of movement to be reversed.

D. Vibrators shall be of an approved type and design and shall operate under load at a rate as recommended by the manufacturer and approved by the Purchaser.

PART 3 – CONSTRUCTION REQUIREMENTS

3.01 FORMS.

A. Construction.

1. Forms shall be mortar-tight and sufficiently rigid to prevent distortion due to the pressure of the concrete and other stresses incidental to the construction operations, including vibration. Forms shall be so constructed and maintained as to prevent the opening of joints due to shrinkage of the lumber.

2. The forms shall be built true to line and grade and shall be held in place by means of studs or uprights, and waling, which shall be sufficiently and substantially braced and tied.

3. All forms and studding shall be cut off and capped with not less than a 2 inch by 4 inch piece so that the top of the cap will be at the elevation of the finished exposed surface of the concrete.

4. All edges shall be chamfered with ¾ inch material, unless otherwise specified. All chamfer strips shall be straight, of uniform width, and dressed.

5. Wood devices of any kind used to separate forms shall be removed before placing concrete within 4 inches of such devices.

B. Form Lumber.

1. Form lumber for all exposed concrete surfaces shall be dressed at least on one side and two edges and shall be so constructed as to produce mortar-tight joints and smooth, even concrete surfaces.

2. Plywood forms, or forms face-lined with plywood, masonite, or other approved similar material may be used, provided the plywood forms and form linings are substantial, of uniform thickness, and are mortar-tight when in position.

C. Metal Ties.

Metal ties or anchorages within the forms shall be so constructed as to permit their removal to a depth of at least one inch from the face without injury to the concrete. In case wire ties are permitted, the wires shall be cut back at leas ¼ inch from the surface of the concrete, and the surface left sound, smooth, even, and uniform in color.

D. Walls.

Sufficient openings shall be provided at intervals along the bottom of wall forms to permit thorough cleaning prior to concrete placement. Such openings shall be closed before placing concrete in the forms.

E. Surface Treatment.

Prior to placing reinforcement, all forms shall be treated to prevent the adherence of concrete. Forms not provided with a special treatment shall be treated with an approved oil. Any material that will adhere to or discolor the concrete shall not be used.

F. Metal Forms.

1. The specifications for forms, as regards design, mortar tightness, filleted corner, beveled projections, bracing, alignment, removal, and reuse and oiling apply to metal forms. The metal used for forms shall be of such thickness that the forms will remain true to shape. All bolt and revet heads shall be countersunk on the face forming the concrete surface. Clamps, pins, or other connecting devices shall be designed to hold the forms rigidly together and to allow removal without injury to the concrete. Metal forms which do not present a smooth surface or do not line up properly shall not be used. Care shall be exercised to keep metal forms free from rust, grease, or other foreign matter.

2. When the Subcontractor wishes to utilize a special forming system not specifically authorized in this Specification, he shall submit his design and calculation to the Purchaser for review and approval.

3.02 FALSEWORK.

A. The falsework used to support the forms and concrete for concrete structures shall be supported on sills resting on rigid foundations composed of piles driven until the bearing capacity of each pile is sufficient to support the load to which it will be subjected, or earth-borne footings as hereinafter provided.

B. Earth-borne footings will be permitted only when, in the opinion of the Purchaser, the soil can adequately support the superimposed loads and the following conditions are met:

1. Spread footings will only be permitted on stable ground, capable of supporting the superimposed load.

2. The site is graded and so maintained to prohibit ponding of water or erosion of soil in the proximity of the spread footings.

3. The falsework system shall be designed and constructed to preclude exceeding the bearing capacity of the soil but in no case shall exceed 3,000 pounds per square foot.

4. The footings shall be designed and constructed to carry the superimposed loads.

5. All footings shall be constructed on a level plane.

C. The falsework shall be designed and constructed to support the required loading without distortion or settlement of the forms.

D. The Subcontractor shall place “tell-tales” for observation of the amount of falsework settlement at locations designated by the Purchaser.

E. The Purchaser may require the Subcontractor to submit detailed falsework plans, together with a soils report, design calculations or any other information necessary for a thorough review. The Subcontractor is totally responsible for the design and construction of the falsework system and shall repair, or remove and replace, as directed and at his expense, any concrete, other material or portions of the structure which are damaged or destroyed due to failure of the falsework.

3.03 REINFORCEMENT

A. All reinforcement shall consist of deformed steel bars, unless otherwise indicated or directed. Deformed steel bars shall have a net area at all sections equivalent to that of plain round or square bars of the corresponding nominal size.

B. Structural steel shapes shall conform strictly to the shapes indicated or required.

C. Steel wire fabric may be furnished in rolls or sheets.

D. Reinforcing steel shall be stored above the ground surface upon platforms, skids or other supports located without the scope of the active construction operations and shall be protected at all times from injury and damage. All brush and weeds shall be removed from the area immediately prior to storing reinforcing steel thereon.

E. Reinforcing steel, where indicated, shall be accurately bent, without heating, to the forms and dimensions indicated on the Plans. Minimum bend diameters shall be in accordance with the requirements of the American Concrete Institute. Unless otherwise indicated, all bends shall be in one plane. Bars of ¾ inch or less which have only hooks or a single bend may be bent in the field, provided satisfactory equipment for proper and accurate work is used and provided the bending is accomplished true to form and dimensions without damage to the bars. All other bending shall be done in the shop before shipment.

F. Substitution of bars of different sizes from those indicated on the Plans may only be made with the written permission of the Purchaser. If substitution is permitted, the following shall apply:

1. The total area of steel in any one linear foot in each direction shall not be reduced.

2. For cast-in-place concrete the clear distance between parallel bars in a layer shall not be less than 1.5 bar diameters, 1.5 times the maximum size of the coarse aggregate, nor 1-1/2 inches.

3. Where positive or negative reinforcement is placed in two or more layers, bars in the upper layers shall be placed directly above those in the bottom layer with the clear distance between layers not less than 1 inch.

4. Clear distance limitation between bars shall also apply to the clear distance between a contact lap splice and adjacent splices or bars.

5. Groups of parallel reinforcing bars bundled in contact to act as a unit shall be limited to 4 in any one bundle. Bars larger than #11 shall be limited to two in any one bundle in beams. Bundled bars shall be located within stirrups or ties. Individual bars in a bundle cut off within the span of a member shall terminate at different points with at least 40 bar diameters stagger. Where spacing limitations are based on bar diameter, a unit of bundled bars shall be treated as a single bar of a diameter derived from the equivalent total area.

6. In walls and slabs, the primary flexural reinforcement shall be spaced not farther apart than 1.5 times the wall or slab thickness, nor 18 inches.

G. All reinforcement shall be furnished in the full lengths shown on the Plans, unless otherwise approved in writing by the Purchaser. No splices shall be made unless indicated on the Plans or authorized by the Purchaser. Splices shall be so arranged and manipulated as to provide a minimum of 2 inches net clearance between the splices and the surface of the complete concrete work, unless otherwise indicated or directed. Splices of tension reinforcement at points of maximum stress shall be avoided. The members at all splices shall be rigidly clamped by means of at least two approved metal clips located approximately 3 inches from the ends of the bars and bolted around them or securely wired in a manner satisfactory to the Purchaser.

H. Steel shapes shall be spliced only as indicated on the Plans.

I. Steel fabric shall be spliced by overlapping of the sheets by not less than 12 inches; by matching at least three transverse member; and by securely wiring the overlapped sections in a manner satisfactory to the Purchaser.

J. All reinforcing steel before being placed shall be thoroughly cleaned of mill scale, rust, dirt, paint, oil, or other foreign substances or coating of any character that will reduce the bond. If reinforcement which has been placed becomes dirty, rusty, or spattered with mortar which dries before concrete is placed around it, such reinforcement, or part affected, shall be thoroughly cleaned before being covered with concrete.

K. Reinforcement shall be accurately placed and firmly held in position as indicated on the Plans. Steel bars shall be securely fastened together with metal clips or wire at each intersection, except where spacing is less than on 1 foot in each direction then alternate intersections shall be fastened. All reinforcing steel shall be securely spaced from the forms and between adjacent reinforcement by means of precast mortar blocks, metal spacers or other approved devices or methods, and where possible, all spacer devices shall be so arranged that their use cannot be detected in the completed structure. Spacer blocks shall be cast of mortar mixed in the same proportions as that in the concrete mixture and shall not have a length or width greater than the depth required for proper spacing from the forms or between adjacent reinforcement. The use of gravel, concrete, brick, or wooden blocks is prohibited.

L. All the reinforcing steel necessary for a section of a concrete structure shall be accurately and securely placed and the placement approved by the Purchaser before any concrete is deposited in the section, and care shall be observed not to disturb it during the placing of the concrete.

M. All dimensions relating to reinforcing bars are to the centers of the bars, unless otherwise indicated.

N. Tolerances for bending and cutting during fabrication shall be in accordance with the “Manual of Standard Practice” published by the Concrete Reinforcing Steel Institute.

3.04 DRAINAGE AND WEEP HOLES

Drainage openings and weep holes shall be constructed using materials in the manner and at the locations shown on the Plans or established by the Purchaser. Ports or vents for equalizing hydrostatic pressure, when required, shall be placed as directed.

3.05 PLACING PIPES, CONDUITS, ANCHORS, CASTING, AND OTHER APPURTENANCES

A. Pipes, conduits, anchors, castings, bolts, plates, grillage, and other appurtenances which are necessary or desirable to be placed in the concrete of a structure, whether indicated on the Plans or not, shall be placed by the Subcontractor during construction, as directed.

B. No compensation will be allowed for placing such pipes, conduits, and other appurtenances, except that no deductions will be made for the volume of concrete displaced by those items.

3.06 EXPANSION JOINTS

A. Expansion devices shall be as indicated on the Plans. The devices shall be securely anchored in correct position. All sliding surfaces shall be true and smooth and shall form complete contact throughout. Movement shall not be impeded by the concrete in which they are embedded.

B. Unless otherwise provided, where portions of concrete bridge superstructure rest on the substructure, the contact area shall be separated by at least two layers of three-ply bituminous-saturated paper.

C. Open joints shall be constructed using forms which will permit removal without injury to the concrete. After removal of the forms, the joints shall be cleaned thoroughly. Filled joints shall be constructed with premolded filler, unless otherwise indicated. Joints requiring a sealant shall be thoroughly cleaned and sealed with one of the specified joint sealing materials before the structure is opened to traffic. Edges of open and filled joints shall be chamfered or edged, as directed. Mortised joints shall be constructed as shown on the Plans or as directed.

3.07 PLACING CONCRETE

A. General

1. Concrete shall not be placed until forms and reinforcing steel have been checked and approved. The forms shall be clean of all debris and kept wet immediately before concrete is placed. The method and sequence of placing concrete shall be approved by the Purchaser. Unless otherwise permitted, all concrete shall be placed in daylight, and the placing of concrete in any portion of the structure shall not be started unless it can be entirely completed in daylight. When the placing of concrete is permitted during other than daylight hours, an adequate and approved artificial lighting system shall be provided and operated.

2. All concrete shall be thoroughly worked during the placing by means of tools of approved type. The working shall be such as to force all coarse aggregate from the surface and to bring mortar against the forms to produce a smooth finish, substantially free from water and air pockets or honeycomb.

3. If the forms show bulging or settlement while concrete is being placed, the placing shall be stopped until correction has been made.

4. T-beam girders, slabs, arch rings, and all horizontal sections of bridges except curbs and sidewalks shall be constructed monolithically and continuously, unless otherwise permitted. Curbs and sidewalks shall be constructed after the bridge deck is completed, unless otherwise indicated on the Plans.

5. After initial set and prior to final set of the concrete, the forms shall not be jarred, and no strain shall be placed on the ends of the projecting reinforcement. Piles shall not be driven closer than 20 feet to footings less than 7 days old nor to foundations supporting concrete less than 7 days old.

B. Railings and Curbing.

1. When constructing curb, careful attention shall be given to the installation of railing steel or anchoring devices.

2. Concrete railings shall not be constructed on any structure until the falsework has been struck.

C. Chutes and Troughs

1. Concrete shall be placed so as to avoid segregation of the materials and the displacement of the reinforcement.

2. All chutes, troughs, and pipes shall be kept clean and free from coatings of hardened concrete by thoroughly flushing with water after each run. The water used for flushing shall be discharged clear of the concrete already in place.

3. Care shall be taken to fill each part of the form by depositing the concrete as near final position as possible. The coarse aggregate shall be worked back from the forms and around the reinforcement without displacing the bars. After initial set of the concrete, the forms shall not be jarred and no strain shall be placed on the ends of projecting reinforcement.

D. Vibrating

1. Unless otherwise directed, the concrete shall be compacted with suitable mechanical vibrators operating within the concrete. When required, vibrating shall be supplemented by hand spading with suitable tools to assure proper and adequate compaction.

2. Vibrators shall be so manipulated as to work the concrete thoroughly around the reinforcement and embedded fixtures and into corners and angles of the forms. Vibrators shall not be used as a means to cause concrete to flow or run into position in lieu of placing. The vibration at any point shall be of sufficient duration to accomplish compaction but shall not be prolonged to the point where segregation occurs.

3. At least on additional standby vibrating unit shall be available for all individual pours in excess of 10 cubic yards.

E. Joints

1. Feather-edge construction joints will not be permitted. Transverse or longitudinal joints through spans will not be permitted, except where specified.

2. In no case shall the concreting of any section or layer be stopped or temporarily discontinued within 18 inches of any finished surface, unless the details of the structure provide for a coping having a thickness of less than 18 inches, in which case, at the option of the Purchaser, the construction joint may be made at the underside of the coping.

3. Layers completing a day's work or placed just prior to temporarily discontinuing operations shall be cleaned of all laitance or other objectionable material as soon as the surface has become sufficiently firm to retain its form.

3.08. BONDING CONSTRUCTION JOINTS

A. Where dowels, reinforcing bars, or other adequate ties are not indicated on the Plans, keys of a directed size shall be made by constructing projections above the concrete and monolithically with the concrete.

B. In resuming work, the forms shall be drawn tightly against the face of the concrete. The entire surface of the concrete to be bonded shall be cleaned thoroughly and roughened with a steel tool. In addition, if directed, the surface to be bonded shall be cleaned and roughened by sandblasting. The surface shall then be soaked with clean water, after which concreting may proceed.

3.09. REMOVAL OF FORMS AND FALSEWORK.

A. Forms for ornamental work, railings, parapets, columns, and vertical surfaces that do not carry loads shall be removed in from 12 to 48 hours, unless otherwise directed by the Purchaser. In cold, damp, or freezing weather, all vertical forms shall remain in place until the concrete has set sufficiently to withstand damage when the forms are removed. In removing forms, care shall be exercised not to mar the surface of the concrete nor to subject it to any undue pressure.

B. Projecting wires or other metal devices used for holding forms in place and which pass through the body of the concrete shall be removed or cut as specified in Specification Section 03310 Paragraph 3.01.A, and the holes or depressions thus made and all other holes, depressions, and small voids which show upon the removal of the forms shall be filled with cement mortar mixed in the same proportions as that which was used in the body of the concrete which is being repaired.

C. Falsework and supports under slab or girder spans, any length, may be released and removed when representative specimens of the concrete in the spans, cured by the methods and in the manner the concrete which the test specimens represent is cured, attain a compressive strength of 3,000 pounds per square inch. In addition to the above requirement, the concrete

shall have been placed a minimum of 10 days, not counting the days of 24 hours each in which the temperature falls below 40° F., or 21 calendar days, whichever occurs first.

D. For continuous concrete girder or slab units, any length, the falsework and supports shall not be released or removed from any span in the continuous unit until the concrete in all spans in the unit has been placed a sufficient length of time to meet all requirements for the removal of falsework and supports as set forth above.

E. Forms supporting bridge decks between girders and outside curb overhangs may be removed after seven days.

3.10. DEFECTIVE CONCRETE

A. Any defective concrete discovered after the forms have been removed shall be removed immediately and replaced. If the surface of the concrete is bulged, uneven, or shows honeycombing which cannot be repaired satisfactorily, the entire section shall be removed and replaced.

B. Concrete having a 28 day strength of less than the minimum specified shall be removed and disposed of by the Subcontractor, at his expense, unless specifically authorized by the Purchaser, in writing, to remain in place. The removal shall be in such a manner as will not cause damage to the remaining concrete or to other structural units or other facilities and property.

3.11. FINISHING CONCRETE SURFACES

A. Unless otherwise authorized, the surface of the concrete shall be finished immediately after form removal.

B. All concrete surfaces shall be given a Class 1 finish. The following surfaces of all structures shall be given a Class 2 Finish: roadway face and top of curb, vertical outside face of curb overhang or sidewalk slab, bottom surface of slab overhang, bridge railings, barrier railings, all vertical surfaces of the superstructure of dual bridges exposed to view from either structure, and all surfaces of retaining walls, wingwalls, and end walls which are visible from passing vehicles.

1. Class 1, Ordinary Surface Finish.

   a. Immediately following the removal of the forms, all fins and irregular projections shall be removed from all surfaces which are to be exposed or waterproofed. On all surfaces, the cavities produced by form ties and all other holes, honeycomb spots, broken corners or edges, and other defects, shall be thoroughly cleaned, saturated with water, and carefully pointed and trued with a mortar of cement and fine aggregate mixed in the proportions used in the Class of the concrete being finished. Mortar used in pointing shall not be more than 30 minutes old. All construction and expansion joints in the completed work shall be left carefully tooled and free of all mortar and concrete. The joint filler shall be left exposed for its full length with clean and true edges.

   b. All surfaces which cannot be repaired to the satisfaction of the Purchaser shall be “rubbed” as specified for a Class 2 finish.

2. Class 2, Rubbed Finish.

   a. After removal of forms, the rubbing of concrete shall be started as soon as its condition will permit. Immediately before starting this work, the concrete shall be kept thoroughly saturated with water. Sufficient time shall have elapsed before the wetting down to allow the mortar used in the pointing to thoroughly set. Surfaces to be finished shall be rubbed with a wetted wooden block or a medium coarse carborundum stone.

The carborundum stone shall not be used until the concrete has hardened to the state where the sand will grind, rather than ravel or roll. Rubbing shall be continued until all form marks, projections, and irregularities have been removed; all voids filled; and a uniform surface has been obtained. The paste produced by this rubbing shall be left in place. A brush finish or painting with grout will not be permitted.

b. After all concrete above the surface being finished has been cast, the final finish shall be obtained by rubbing with a fine carborundum stone and water. This rubbing shall be continued until the entire surface is of a smooth texture and uniform color.

c. After the final rubbing is completed and the surface has dried, it shall be rubbed with burlap to remove loose powder and shall be left free from all unsound patches, paste, powder, and objectionable marks.

3. Class 3, Float Finish

a. This finish, for unformed surfaces, except slab surfaces for pavements or bases, shall be achieved by placing an excess of material in the form and removing or striking off the excess with a template, forcing the coarse aggregate below the mortar surface. Creation of concave surfaces shall be avoided after the concrete has been struck off, the surface shall be thoroughly worked and floated with a suitable floating tool of wood, canvas, or cork. Before the finish has set, the surface cement film shall be removed with a fine brush in order to have a fine-grained, smooth but sanded texture.

3.12. FINISHING SLAB SURFACES FOR PAVEMENTS OR BASES.

A. Bridge floors or top slabs of structures serving as finished pavements or bases shall be finished either by hand methods or approved mechanical finishing machines.

B. When the hand method is used, the bridge floors or slabs shall be struck off with a screed which is parallel to the centerline of the roadway, resting on bulkheads or screed strips cut or set to the required cross-section of the roadway. This screed shall be so constructed as to have sufficient strength to retain its shape and that the cutting edge may be adjusted to conform to the profile of the roadway. Screeds shall be of sufficient length to finish the full length of spans 40 feet or less in length. Spans over 40 feet in length shall be finished in two or more sections, but no section shall be less than 20 feet in length. Screed strips or headers shall be accurately set to the4 specified grades, checked, and adjusted as necessary prior to the final screeding operation. The screed shall be worked back and forth over the surface until the proper profile and cross-section is obtained.

C. When mechanical finishing machines are used, they shall be approved power driven machines, traveling on rails adjusted to conform to the profile of the roadway. The machines shall be equipped with oscillating or vibrating transverse or longitudinal screeds that may be adjusted to conform to the profile or the required cross-section of the roadway. The screeds shall have sufficient strength to retain their shape after adjustment. The finishing machine shall go over each area of the bridge floor as many times as is required to obtain the required profile and cross-section.

D. Regardless of the method of finishing, the Subcontractor shall maintain a minimum rate of placement of 20 linear feet of bridge deck per hour when concrete is placed in a longitudinal section.

E. After finishing as described above, the surface shall be checked with a 12 foot straightedge and shall show no deviation is excess of 1/8 inch from the testing edge of the straightedge when placed parallel to the centerline. Deviations in excess of this requirement shall be corrected before the concrete sets.

F. The surface shall be finished by dragging a seamless strip of damp burlap over the full width of the surface. The burlap drag shall consist of sufficient layers of burlap to slightly groove the surface and shall be moved forward with minimum bow of the lead edge. The drag shall be kept damp, clean, and free of particles of hardened concrete. A light broom or brush herring bone finish that leaves a texture similar to that obtained by the burlap drag may be used when permitted by the Purchaser. For bases, the surface shall be finished by grooving lightly with a wire broom at an angle of 60^{o} with the centerline. All strokes shall begin at the center and end at the edge. After the slab has been finished by the burlap drag, surfaces which will become traffic lanes shall be textured by the formation of transverse grooves. The grooves shall be formed in the surface at an appropriate time during the stiffening of the concrete, so that in the hardened concrete the grooves will be between 0.09 inch and 0.13 inch in width; between 0.12 inch to 0.19 inch in depth; and spaced at random intervals between 0.3 inch and 1.0 inch. The grooves shall terminate approximately 18 inches from curbs, parapets, barrier walls, and other vertical walls. The grooves shall be relatively smooth and uniform; shall be formed without tearing the surface and without bringing pieces of coarse aggregate to the top of the surface; and shall be formed to drain transversely. All areas which do not conform to these requirements shall be corrected at the Subcontractor's expense by approved methods.

G. As soon as the surface has set sufficiently to withstand damage when walking on it and not later than the morning following the placing of the concrete, it shall be straightedged with the 12 foot straightedge and all variations exceeding 1/8 inch shall be plainly marked. The Subcontractor shall correct an seal such variations in the same manner as specified for Portland Cement Concrete Pavement.

3.13. CURING CONCRETE

A. All concrete surfaces, except those surfaces protected by forms that remain in place seven days or longer as required under the provisions of Specification Section 03310 Paragraph 3.09, "Removal of Forms and Falsework", shall be cured as specified below. Curing shall begin as soon as the concrete has hardened sufficiently to withstand surface damage to unformed surfaces and immediately after the forms have been removed from formed surfaces.

B. When the temperature is expected to fall below 35^{O} F., the concrete shall be protected in accordance with the provisions of Specification Section 03310 Paragraph 3.14.

C. The initial curing period for concrete surfaces shall be by the "Water Method" for a period of not less than 24 hours, or until the concrete surfaces have been prepared for the application of curing compound, in accordance with the provisions under B below. During the initial curing period, the concrete shall be protected from the sun by burlap mats or other approved materials and kept completely and continuously moist.

D. The "Water Method" and membrane-forming compound method of curing will be required for all bridge decks, and on all concrete slabs when the temperature exceeds 90^{O} F. during placement.

1. Water Method

a. All concrete slabs shall be covered immediately with material suitable for use with the water cure and kept thoroughly wet for at least 120 hours from the beginning of the initial curing period. All surfaces other than slabs shall be protected from the sun and shall be kept wet for a period of at least 72 hours from the beginning of the initial curing period. Curbs, walls, handrails, and other surfaces requiring a Class 2 finish may have the covering temporarily removed for finishing, but the covering shall be restored as soon as possible.

2. Membrane-Forming Compound Method

a. All surfaces shall be given the required surface finish prior to application of the curing compound. Prior to the application of curing compound, the surface shall be kept moist.

b. The rate of application of curing compound shall be as recommended by the manufacturer but shall not be less than one gallon for 150 square feet of concrete surface. The curing compound shall be applied, under pressure, immediately after completion of the initial curing period or acceptance of the concrete finish. If the surface is dry, the concrete shall be thoroughly wet with water and the curing compound applied just as the surface film of water disappears. At the time of use, the compound shall be in a thoroughly mixed condition with the pigment uniformly dispersed throughout the vehicle. If the application of the compound results in a streaked or blotchy appearance, the method shall be stopped and water curing, as set out above, applied until the cause of the defective appearance is corrected. The coating shall be protected against marring for a period of seven days from date of application. Any coating marred or otherwise disturbed within the seven day period shall be replaced at once.

3.14 PROTECTION OF CONCRETE IN COLD WEATHER

Concrete shall be protected in cold weather a specified in Specification Section 03050.

3.15 WATERPROOFING AND WATERSTOPS

A. Waterproofing shall be applied as indicated in the Division 2 Specifications.

B. Metallic or nonmetallic waterstops, as specified, shall be installed in accordance with the details shown on the Plans and in conformity with the requirements of these Specifications.

C. Metallic waterstops shall be spliced, welded or soldered, as necessary, to form continuous, watertight joints.

D. Nonmetallic waterstops shall be installed in continuous strips without splices, except that splices will be permitted at changes in direction when necessary to avoid buckling or distortion of the web or flange. All splices of nonmetallic waterstops shall be performed in accordance with the manufacturer's recommendations and in the case of polyvinylchloride waterstops, the heat used shall be sufficient to melt but not char the plastic.

E. Adequate provisions shall be made to support the waterstops during the progress of work and to insure their proper embedment in the concrete. The concrete shall be thoroughly worked in the vicinity of the joints to insure maximum density and imperviousness. Forms shall be so designed that they can be removed without damaging the waterstops. Suitable guards shall be provided to protect exposed projecting edges and ends of partially embedded waterstops from mechanical damage.

PART 4 – MEASUREMENT

4.01 MEASUREMENT

A. All concrete will be measured for payment as stipulated under the Specification Section specifying each individual type of construction.

B. No allowance will be made for furnishing the material and the construction of drainage openings and weep holes as indicated or as directed, provided such openings are 6 inches in diameter or less, except that no deduction will be made for such openings in the computation of concrete quantities. Allowance will be made for other openings as indicated.

C. No allowance will be made for additional cement used in depositing concrete underwater; for use of calcium chloride or chemical additives; for fillers, sealer, and tar paper used in expansion joints; for dowels or other materials used in bonding construction joints; for waterstops; and for painting metals.

D. No allowance will be made for concrete placed below the foundation elevation shown on the Plans or as directed by the Purchaser.

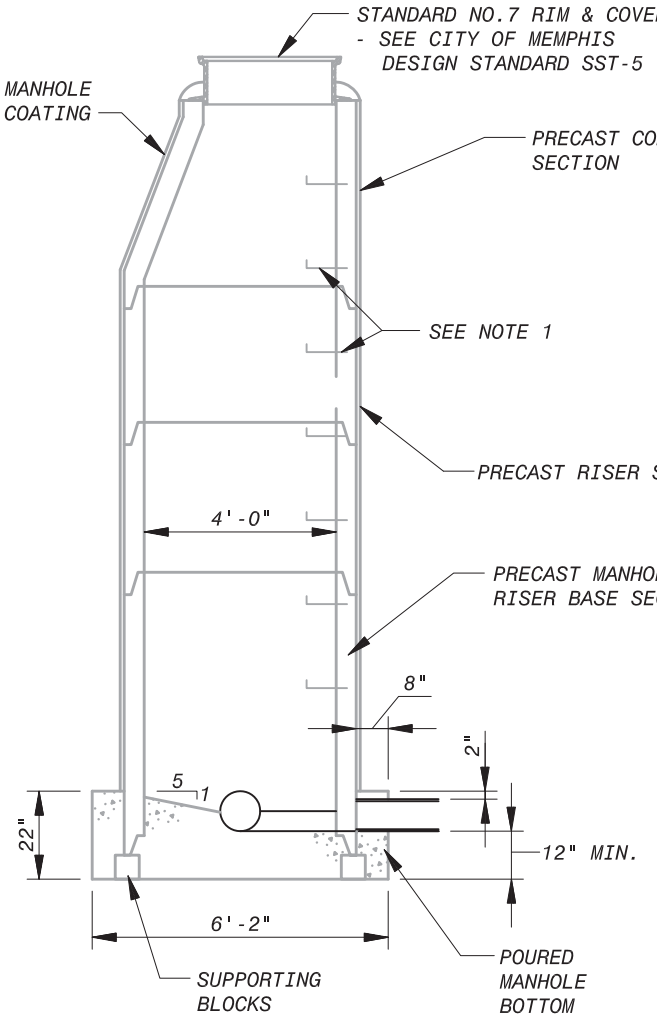
E. No additional compensation will be made for high-early-strength concrete substituted by the Subcontractor.

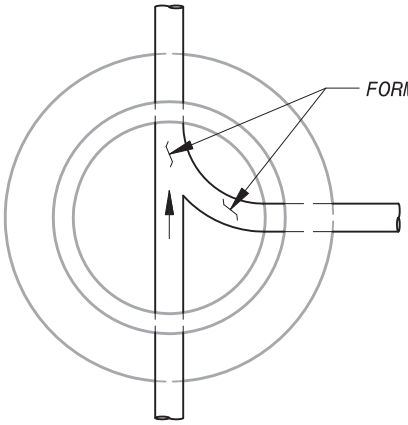
PART 5 – PAYMENT

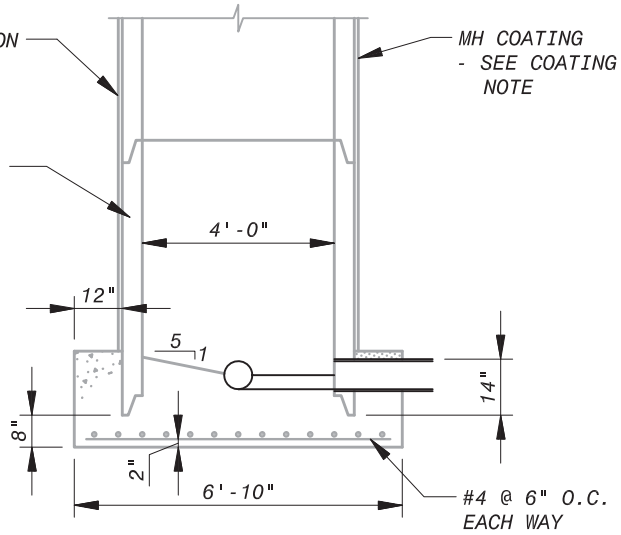
5.01 PAYMENT

All concrete will be paid for as stipulated under the Specification Section specifying each individual type of construction.

END OF SECTION 03310







NOTES:
1. CAST IRON STEPS STAGGERED LATERALLY 12" C-C & UNIFORMLY SPACED VERTICALLY AT 16" O.C. MAXIMUM - SEE "MANHOLE STEPS" NOTE BELOW

MANHOLE COATING NOTE:
OUTSIDE COATING OF MANHOLE SHALL BE WITH ASPHALTIC BLACK, AS AVAILABLE AT UNITED PAINT COMPANY.

METHOD OF APPLICATION SHALL BE PERFORMED BY BRUSH OR BY LOW PRESSURE SPAYER.

TYPICAL PRECAST MANHOLE

ALTERNATE

(MANHOLES IN EXCESS OF 20' DEEP)

JOINT SEALANT: CONCRETE MORTAR SHALL BE USED TO SEAL JOINTS AFTER THE INSTALLATION OF AN APPROVED GASKET MATERIAL BETWEEN ALL PRECAST MANHOLE SECTIONS.

BASE SECTIONS: MANHOLE BOTTOM SHALL NOT BE POURED UNTIL PRECAST BASE SECTION OF MANHOLE AND PIPE STUBS OUT & IN ARE IN PLACE. PIPE STUBS OUTSIDE OF MANHOLE SHALL HAVE A MINIMUM LENGTH OF 12" AND A MAXIMUM LENGTH OF 15" FROM OUTSIDE OF MANHOLE TO THE FIRST JOINT OF PIPE. CONCRETE USED TO FORM BASES AND INVERTS SHALL BE 3,000 p.s.i.

SUBSTITUTES: POURED-IN-PLACE MANHOLES MAY BE SUBSTITUTED FOR PRECAST MANHOLES, PROVIDED A FORMAL, WRITTEN REQUEST HAS BEEN SUBMITTED TO & APPROVED BY THE ENGINEER OF DESIGN. ALL POURED-IN-PLACE MANHOLES SHALL CONFORM TO CITY OF MEMPHIS STANDARD DRAWINGS NO. SST-6 AND SST-7.

MANHOLE STEPS: THE FOLLOWING MANHOLE STEPS HAVE BEEN APPROVED FOR USE:
1. TOWER GROVE MH STEP NO. B-1096 BY TOWER GROVE FOUNDRY CO.
2. M.A. MANHOLE STEPS BY M.A. INDUSTRIES, INC., EAST POINT, GA.
3. WEDGE-LOK SAFETY STEP BY DELTA PIPE PRODUCTS, INC., ATLANTA, GA.

MEMPHIS SEWER ASSESSMENT & REHABILITATION PROGRAM SARP 10

BLACK & VEATCH Building a world of difference.

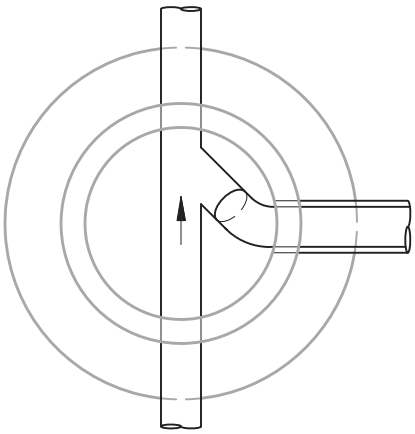
SARP10

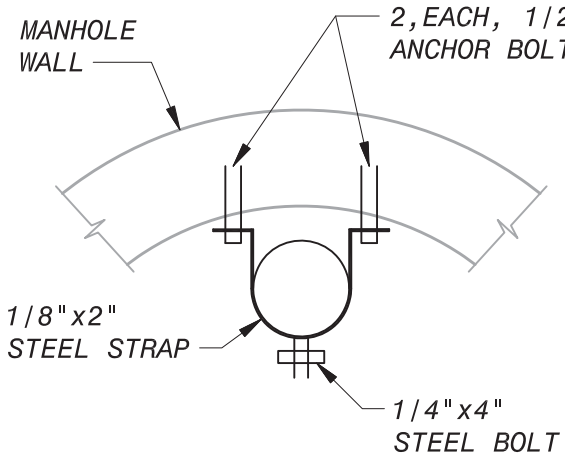
PRECAST SANITARY MANHOLE SST-1

SCALE: NOT TO SCALE

REV 0.0

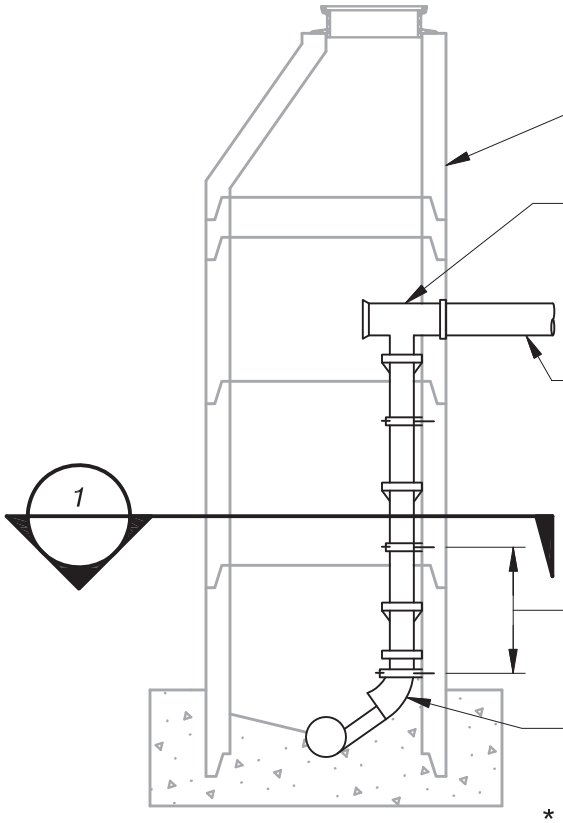
DATE: 06/04/15





1 SECTION

NTS (ENLARGED)



* OPENING IN MH WALL TO BE GROUTED WITH HIGH STRENGTH, QUICK SETTING, NON-SHRINKING CEMENT GROUT.

INSIDE DROP

(SEE NOTE 2)

NOTES:

1. TO BE USED, WHERE REQUIRED, ON NEW MANHOLES.
2. TO BE USED ON ALL EXISTING MH'S, WHERE REQUIRED.

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SANITARY MANHOLE DROP CONSTRUCTION SST-2

SCALE: NOT TO SCALE

REV 0.0

DATE: 06/04/15

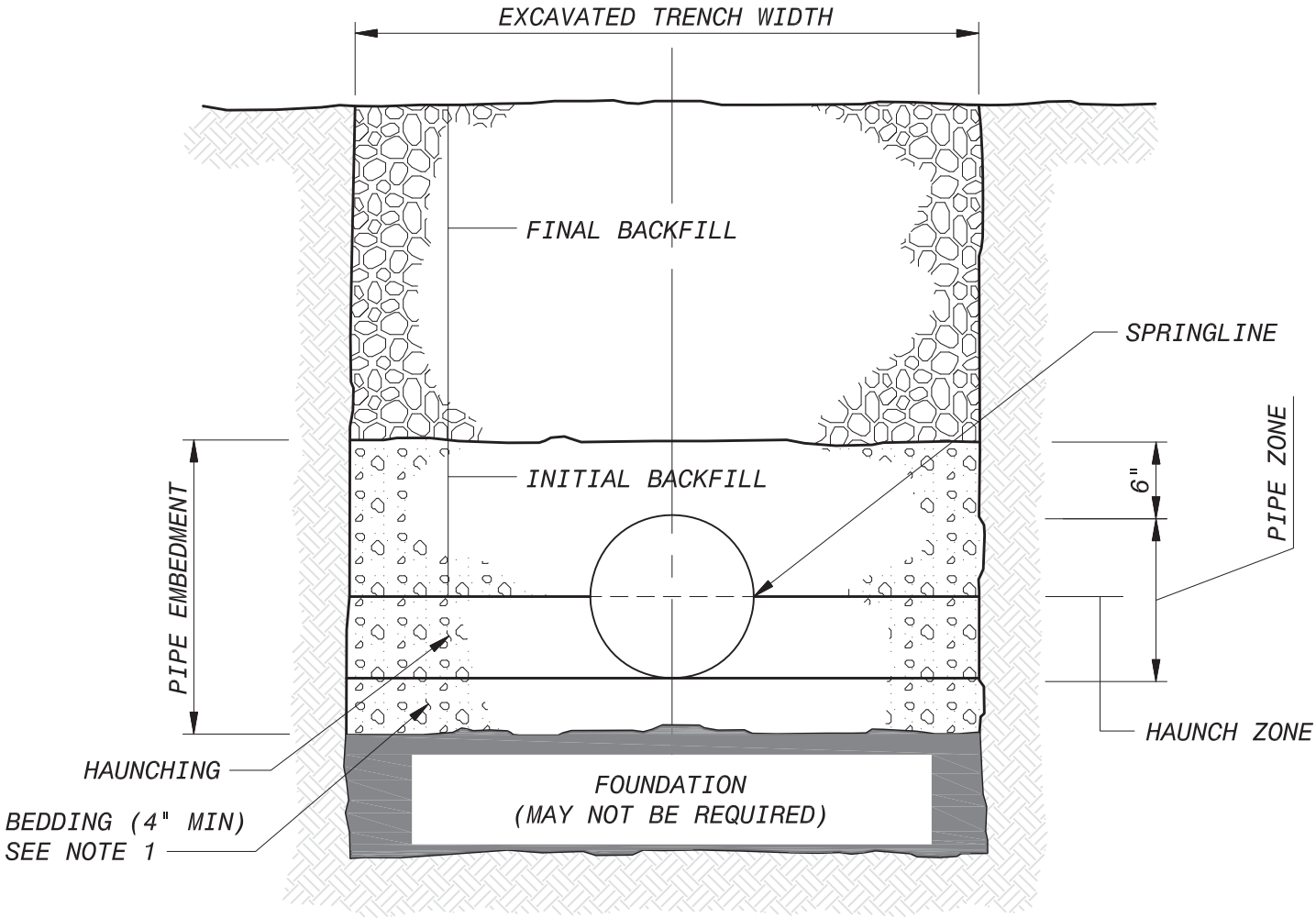

FIGURE 1

TRENCH CROSS SECTION SHOWING TERMINOLOGY

NOTES

1. INSTALL CRUSHED LIMESTONE ASTM D-448-54 TABLE 1, #67 FOR BEDDING AND HAUNCHING MATERIAL. THE QUANTITY OF CRUSHED LIMESTONE FOR BEDDING AND HAUNCHING IS PART OF THE "SEWER POINT REPAIR" LINE ITEM AND NO SEPARATE PAYMENT WILL BE MADE.
2. INSTALL EITHER CRUSHED LIMESTONE OR RECYCLED CRUSHED CONCRETE FOR INITIAL BACKFILL AND FINAL BACKFILL PER CITY OF MEMPHIS SPECIFICATIONS.

MEMPHIS SEWER REHABILITATION PROGRAM SARP 10 ASSESSMENT &

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SARP10

TRENCH CROSS SECTION SHOWING TERMINOLOGY

SCALE: NOT TO SCALE

REV 0.0

DATE: 1/5/15

CITY OF MEMPHIS
SHELBY COUNTY, TENNESSEE

RODNEY BABER PARK SEWER IMPROVEMENTS
MAY 2016

LOCATION MAP:

DRAWING INDEX

REVISION

ITEM NO.	DESCRIPTION OF CHANGE	APPROVAL DATE
1.	REVISED PER CITY CMTS.	05/18/16

DIVISION OF ENGINEERING
RODNEY BABER PARK SEWER IMPROVEMENTS
DEVELOPER: City of Memphis
ENGINEER: LDA ENGINEERING

SEWER BASIN WN-2
SHEET 1 OF 15

C0.0

DIVISION OF ENGINEERING
SARP10
RODNEY BABER PARK COVER SHEET

LOCATION: RODNEY BABER PARK
MEMPHIS, TENNESSEE

SURVEY ____ DATE ____ BOOK ____
DESIGN BY LDA ENGIN. DATE 4/28/2016 SCALE 1"=1,000'
REVIEWED:

DEPUTY CITY ENGINEER ____ DATE ____ CITY ENGINEER ____ DATE ____

GENERAL SANITARY SEWER NOTES:

1. ALL SEWER CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE SPECIFICATIONS OF THE CITY OF MEMPHIS, SARP 10 PROGRAM.
2. THE CONTRACTOR IS TO BE RESPONSIBLE FOR INFORMING THE CITY OF MEMPHIS 2 WEEKS BEFORE THE START OF CONSTRUCTION, CONFORMING TO THE REQUIREMENTS OF THE INSPECTOR DURING CONSTRUCTION AND TO REQUEST THE FINAL INSPECTION FOR APPROVAL BY THE CITY OF MEMPHIS.
3. CONNECTIONS TO EXISTING FACILITIES SHALL BE MADE ONLY UNDER THE SUPERVISION OF A REPRESENTATIVE OF THE CITY OF MEMPHIS.
4. BACKFILL FOR SEWER LINES UNDER STREETS AND DRIVEWAYS IS TO BE COMPACTED CRUSHED STONE MEETING CITY OF MEMPHIS STANDARDS.
5. AS-BUILT PLANS MUST BE COMPLETED AND SUBMITTED PRIOR TO ACCEPTANCE OF SEWER LINES BY THE CITY OF MEMPHIS.
6. NO OTHER UTILITIES MAY BE INSTALLED IN THE SAME TRENCH AS THE SEWER LINES OR LATERAL SERVICE LINES.
7. CONTRACTOR SHALL DETERMINE "LIVE OR ABANDONED" STATUS OF ALL EXISTING SERVICES CONNECTED TO MAIN LINE SEGMENTS AS DESIGNATED FOR REPLACEMENT PRIOR TO RE-CONNECTION. ABANDONED OR INACTIVE SERVICES ARE NOT TO BE RECONNECTED TO THE NEW LINE UNLESS DIRECTED BY THE OWNER'S REPRESENTATIVE.
8. CONTRACTOR SHALL RECONNECT TO EXISTING SEWER LINES IN CONJUNCTION WITH NEW MANHOLE INSTALLATION.
9. CONTRACTOR SHALL CONFER WITH PROPERTY OWNER TO CONFIRM INSTALLATION OF CONCRETE RING AROUND CLEAN OUT ASSEMBLY, AND/OR STANDARD SEWER CLEANOUT COVER.
10. BACKFILL AROUND CLEAN OUT ASSEMBLY MUST BE PLACED AND COMPACTED TO FINAL GRADE TO MATCH EXISTING PROPERTY AND ADJOINING PROPERTY.
11. CONTRACTOR SHALL ENSURE UNINTERRUPTED SEWER SERVICES ON EXISTING SEWER AND SERVICE CONNECTIONS BY PROVIDING AMPLE TEMPORARY WASTEWATER PUMPING AND/OR BYPASSING.
12. CONTRACTOR SHALL NOTIFY THE CITY MEMPHIS CONSTRUCTION INSPECTION OFFICE AT (901)729-2462 A MINIMUM OF 24 HOURS PRIOR TO BEGINNING ANY CONSTRUCTION.
13. THE CONTRACTOR SHALL VERIFY EXISTING DATA AND REPORT ANY SIGNIFICANT DISCREPANCIES TO THE ENGINEER.
14. ALL SANITARY SEWER TO BE CONSTRUCTED AS PER CITY OF MEMPHIS STANDARD CONSTRUCTION SPECIFICATIONS. SANITARY SEWER SERVICE CONNECTIONS TO BE INSTALLED AS PER CITY OF MEMPHIS STANDARD SST-16.
15. ALL SEWER MANHOLE LIDS IN OPEN AREAS ARE TO BE CONSTRUCTED 1.5' ABOVE PROPOSED GRADE.
16. ALL SANITARY SEWER, INCLUDING SERVICE CONNECTIONS, WHICH HAS LESS THAN 1.5' CLEARANCE (OUTSIDE OF PIPES) WITH DRAINAGE OR IN FILL AREAS SHALL BE CLASS 50 D.I.P. OR CONCRETE ENCASED, 10' MINIMUM BOTH SIDES OF CROSSING. ALL DUCTILE IRON PIPE (D.I.P.) SHALL BE POLYETHYLENE LINED OR SHALL BE TREATED WITH PROTECTO 401 OR AN APPROVED EQUIVALENT.
17. MANHOLES LOCATED WITHIN 100-YEAR FLOOD PLAIN SHOULD EXTEND MINIMUM OF 12" (1'-0") ABOVE THE 100-YEAR FLOOD LEVEL REGARDLESS OF WHETHER THE MANHOLE IS IN RESIDENTIAL, COMMERCIAL, OR RURAL PROPERTY. AS AN ALTERNATIVE, A MANHOLE LOCATED WITHIN THE 100-YEAR FLOOD PLAIN MUST HAVE 4 SEALED COVER AND VENT STACK IF IT EXTENDS LESS THAN THE MINIMUM 12" ABOVE THE 100-YEAR FLOOD LEVEL. WITHIN THIS ALTERNATIVE THE VENT STACK COULD BE LIMITED TO EVERY OTHER MANHOLE IF LOCATED WITHIN A RESIDENTIAL AREA.
18. THIS PROPERTY IS LOCATED IN A SPECIAL FLOOD HAZARD AREA (ZONE AE) AS SHOWN ON FEMA MAP PANEL 47157C0280F, DATED 9/28/2007. BFE=233.0

CONSTRUCTION SEQUENCE NOTES:

1. CONSTRUCTION AND IMPLEMENTATION OF EROSION AND SEDIMENT CONTROLS AS SHOWN ON THE CONSTRUCTION PLANS;
2. MODIFICATION OF EXISTING UTILITIES, IF NECESSARY;
3. EXCAVATION OF TRENCH AND PIPE INSTALLATION. NO MORE THAN 500'LF OF CONSTRUCTION DISTURBANCE WILL TAKE PLACE AT A TIME;
4. INSTALLATION OF PIPES, VALVES, AND APPURTENANCES IN ACCORDANCE WITH THE PLANS AND SPECIFICATIONS;
5. BACKFILL OF PIPE AND INITIAL CLEANUP, TEMPORARY STABILIZATION WITH SEEDING AND STRAW;
6. FINAL CLEANUP;
7. FINAL STABILIZATION WITH SEEDING/STRAWING;
8. REMOVAL OF EROSION AND SEDIMENT CONTROLS.

EROSION AND SEDIMENT CONTROL NARRATIVE:

THIS PROJECT IS A LINEAR PROJECT TOTALING 2,453 L.F. OF PROPOSED SANITARY SEWER LINE. DUE TO THE LINEAR NATURE, SILT FENCE, USING TDOT DETAIL EC-STR-38, IS PROPOSED ALONG THE LENGTH OF THE PROPOSED SEWER LINES. TOTAL DISTURBANCE WIDTH IS 20', WITH THE SILT FENCE TO BE PLACED AT A 10' OFFSET FROM THE SEWER LINE ALONG EACH SIDE.

THERE ARE NO STREAMS OR OUTFALLS, AS WELL AS NO DETENTION OR STORMWATER FACILITIES, ON THIS PROJECT.

NO MORE THAN 500 L.F. SHALL BE DISTURBED AT ANY GIVEN TIME.

GENERAL NOTES

1. THE CONTRACTOR SHALL CONTACT THE TENNESSEE ONE-CALL CENTER AT 811 PRIOR TO DIGGING.
2. THE CONTRACTOR SHALL MAINTAIN TRAFFIC AND PROVIDE ADVANCE WARNING SIGNS AND TEMPORARY TRAFFIC CONTROL DEVICES IN ACCORDANCE WITH THE CITY OF MEMPHIS AND TDOT REQUIREMENTS AND THE LATEST EDITION OF THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD). THE CONTRACTOR SHALL FURNISH, INSTALL, AND MAINTAIN ADVANCE WARNING SIGNS AND TEMPORARY TRAFFIC CONTROL SIGNS AND MARKINGS AS REQUIRED BY THE MUTCD THROUGHOUT CONSTRUCTION. CONTRACTOR SHALL SUBMIT A TRAFFIC CONTROL PLAN IN ACCORDANCE WITH THE CITY OF MEMPHIS AND TDOT REQUIREMENTS AND THE LATEST EDITION OF THE MUTCD PRIOR TO ANY CONSTRUCTION ACTIVITIES FOR OWNER APPROVAL.
3. THE CONTRACTOR SHALL MAINTAIN VEHICULAR AND PEDESTRIAN ACCESS TO RESIDENTS AND BUSINESSES THROUGHOUT CONSTRUCTION.
4. REPLACE CONCRETE AND ASPHALT DRIVEWAYS BY STRAIGHT LINEAR SAW CUT 12 INCHES OUTSIDE THE DISTURBED TRENCH AREA ON PROPERTY SIDE. REPLACE TO EDGE OF PAVEMENT OF EXISTING CITY STREET AND/OR COUNTY ROAD ON ROADWAY SIDE. SHOULD CUTS FALL WITHIN 2 FEET OF AN EXISTING JOINT, REPLACE TO JOINT.
5. EXISTING UTILITY SERVICE LINES, METERS, ETC. DAMAGED DURING CONSTRUCTION ARE TO BE REPAIRED OR REPLACED IN ACCORDANCE WITH THE GOVERNING UTILITY REQUIREMENTS.
6. THESE PLANS ARE BASED ON AN ACTUAL FIELD SURVEY AND LAYOUT OF THE SEWER SYSTEM. ANY DISCREPANCIES BETWEEN THE PLAN LOCATIONS AND THE ACTUAL FIELD LOCATIONS SHALL BE IMMEDIATELY COMMUNICATED TO THE DESIGN ENGINEER.
7. CONTRACTOR TO REMOVE EXISTING CULVERTS AND INSTALL NEW CULVERTS UNDER DRIVEWAYS AS REQUIRED FOR NEW SEWER LINE INSTALLATION. CULVERT REPLACEMENT COST TO BE INCLUDED IN UNIT PRICE OF NEW SEWER LINE.
8. ALL DUCTILE IRON PIPE SHALL BE INSTALLED WITH RESTRAINED JOINTS (PRESSURE PIPE ONLY) AND SHALL BE LINED (INTERIOR) WITH PROTECTO 401.
9. WATER LINES AND OTHER UTILITIES SHOWN FOR INFORMATIONAL PURPOSES. VERIFY LOCATION PRIOR TO CONSTRUCTION TO PREVENT DAMAGE TO EXISTING UTILITIES.
10. REPLACEMENT OF CONCRETE DITCHES SHALL BE IN ACCORDANCE WITH TDOT STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION.
11. EXISTING PIPE SIZES, MATERIALS, MANHOLE DEPTHS, AND LATERAL LOCATIONS TAKEN FROM THE CITY OF MEMPHIS DRAWINGS AND FIELD INFORMATION.
12. CONTRACTOR TO VERIFY MANHOLE ANGLES, PIPE TYPES AND SIZES, AND, INVERT ELEVATIONS PRIOR TO ORDERING NEW PRECAST MANHOLES.
13. CONTRACTOR SHALL FIELD VERIFY LOCATION OF ALL SEWER LATERALS AND RECONNECT TO NEW SEWER LINE AS NECESSARY.
14. CONTRACTOR WILL BE REQUIRED TO OBTAIN A BUSINESS LICENSE FROM THE CITY OF MEMPHIS PRIOR TO CONSTRUCTION. CONTACT MICHELLE PARVIN AT 423-585-4610.
15. LOCATION OF EXISTING UNDERGROUND UTILITIES ARE APPROXIMATE AND NOT NECESSARILY ALL OF SAME. THE CONTRACTOR SHALL BE RESPONSIBLE FOR CONTACTING THE APPROPRIATE UTILITY COMPANY TO DETERMINE THE EXACT LOCATION OF ALL UTILITIES AND/OR UNDERGROUND STRUCTURES PRIOR TO THE INITIATION OF ANY CONSTRUCTION. CONTRACTOR SHALL ASSUME FULL RESPONSIBILITY FOR DAMAGE TO ANY UTILITIES ENCOUNTERED WITHIN CONSTRUCTION PERIMETERS. FOR SITE LOCATION OF EXISITNG UTILITIES INVOLVING MLD&W, SOUTH CENTRAL BELL, AND/OR TEXAS GAS COMPANY, PLEASE CALL 1-800-351-1111.
16. CONTRACTOR SHALL MAINTAIN ACCESS TO ALL PROPERTIES.
17. THE CONTRACTOR SHALL VERIFY EXISTING DATA AND REPORT ANY SIGNIFICANT DISCREPANCIES TO THE ENGINEER.
18. THE CONTRACTOR IS RESPONSIBLE FOR ACQUIRING THE NECESSARY PERMITS TO COMPLETE THE WORK PRIOR TO BEGINNING CONSTRUCTION.
19. THE CONTRACTOR SHALL BE RESPONSIBLE FOR DEWATERING AS NEEDED TO PROPERLY AND SAFELY COMPLETE THE WORK.

EROSION AND SEDIMENT CONTROL NOTES:

1. CONSTRUCTION ENTRANCES (TO OFFICE OR LAY DOWN AREA, AND TO WORK AREAS) TO BE MINIMUM 6" DEPTH T.D.O.T. NO. 1 OR NO. 2 STONE.
2. ALL GRADED SLOPES 2:1 OR STEEPER SHALL BE COVERED WITH AN EROSION CONTROL BLANKET BY NORTH AMERICAN GREEN OR OTHER APPROVED MANUFACTURER. BLANKET SHALL BE DESIGNED FOR THE SLOPE CONDITIONS AND INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.
3. INSTALL WATTLES OR SILT FENCE ALONG CONTOURS TO MINIMIZE PONDING. SEE DETAILS FOR MORE INFORMATION.
4. RIP-RAP CHECK DAMS SHALL BE PLACED IN ALL DIVERSION DITCHES AND, AS OTHERWISE SHOWN ON THE THE PLANS (SEE DETAIL FOR SPACING).
5. ALL STOCK PILE AREAS TO BE PROTECTED BY A COMBINATION OF WATTLES AND SILT FENCE.
6. INSTALL INLET PROTECTION DEVICES AT STORM SEWER INLETS PRIOR TO CONSTRUCTION. SEE PLANS FOR LOCATIONS.
7. IT IS THE CONTRACTOR'S RESPONSIBILITY TO INSURE THAT ALL REQUIRED PERMITS HAVE BEEN OBTAINED PRIOR TO BEGINNING ANY CONSTRUCTION OR OTHER ACTIVITY ON THE SITE.
8. ALL NEWLY CUT OR FILL AREAS LACKING ADEQUATE VEGETATION SHALL BE FERTILIZED, MULCHED, SEEDED, AND/OR SODDED TO EFFECTIVELY CONTROL SOIL EROSION.
9. A SPECIFIC INDIVIDUAL SHALL BE DESIGNATED TO BE RESPONSIBLE FOR EROSION AND SEDIMENT CONTROLS ON EACH PROJECT SITE.
10. THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING SOIL EROSION CONTROL MEASURES AS NOTED ON THE PLANS, AS REQUESTED BY THE OWNER DURING CONSTRUCTION, AND AS NECESSARY TO PREVENT SEDIMENT FROM LEAVING THE SITE. THE CONTRACTOR SHALL ALSO BE RESPONSIBLE FOR SATISFYING THE REQUIREMENTS OF THE STATE OF TENNESSEE DEPARTMENT OF WATER POLLUTION CONTROL AS SET FORTH IN THE TENNESSEE EROSION & SEDIMENT CONTROL HANDBOOK. ALL SOIL EROSION CONTROL MEASURES SHALL BE MAINTAINED THROUGHOUT THE DURATION OF THE CONTRACT SO AS TO PREVENT ANY SEDIMENTATION FROM WASHING OFF THE SITE ONTO ADJACENT PROPERTY OR PUBLIC RIGHT-OF-WAY. SEDIMENT FENCE SHALL BE INSTALLED AS DIRECTED. THE CONTRACTOR SHALL MAINTAIN A LOG OF ALL MAINTENANCE ACTIVITIES FOR THE EROSION CONTROL ELEMENTS AS REQUIRED BY THE STATE OF TENNESSEE DEPARTMENT OF WATER POLLUTION CONTROL.
11. THE PERMIT SHALL BE POSTED ON-SITE AND A COPY OF THE EROSION CONTROL PLAN MUST BE AVAILABLE ON SITE FOR THE DWPC INSPECTOR ON REQUEST.
12. EROSION AND SEDIMENT CONTROL MEASURE MUST BE IN PLACE AND FUNCTIONAL BEFORE EARTH MOVING OPERATIONS BEGIN, AND MUST BE CONSTRUCTED AND MAINTAINED THROUGHOUT THE CONSTRUCTION PERIOD. TEMPORARY MEASURES MAY BE REMOVED AT THE BEGINNING OF THE WORK DAY, BUT MUST BE REPLACED AT THE END OF THE WORK DAY OR PRIOR TO RAINFALL EVENTS.
13. ALL CONTROL MEASURES SHALL BE CHECKED PER THE SWPPP AND STATE REQUIREMENTS. MAINTENANCE AND REPAIRS SHALL BE MADE AS NECESSARY. DURING PROLONGED RAINFALL, DAILY CHECKING AND REPAIRING MAY BE NECESSARY. THE PERMITTEE SHALL MAINTAIN RECORDS OF INSPECTION CHECKS, MAINTENANCE AND REPAIRS.

LEGEND

EXISTING SANITARY SEWER MANHOLE		PROPOSED SANITARY SEWER MANHOLE		STRAW BALE		SILT FENCE	SF
PAVED ROADWAY OR DRIVEWAY		UNDERGROUND TELEPHONE BOX	UG/T BOX	PERMANENT UTILITY EASEMENT		TEMPORARY CONSTRUCTION EASEMENT	
GRAVEL ROADWAY OR DRIVEWAY		POWER POLE	P/P	MAIL BOX	M.B.	EXISTING AIR RELEASE VALVE	
CULVERT	18"Ø	EXIST. FENCE	X	SIGN		RIP-RAP	
EXISTING WATER LINE	W	NEW VALVE		WATER VALVE	W.V.	GAS VALVE	G.V.
NEW FORCE MAIN		EXISTING VALVE		TOP OF BANK	T.O.B.	BOTTOM OF BANK	B.O.B.
RIGHT-OF-WAY		NEW AIR RELEASE VALVE		BLOW-OFF VALVE		EXISTING BLOW-OFF VALVE	
PROPERTY LINE	PL	IRON PIN FOUND	I.P.F.	CHECK DAM	CD	CONSTRUCTION ENTRANCE	CE
NEW FIRE HYDRANT ASSEMBLY		UNDERGROUND TELEPHONE	UG T	SEDIMENT TRAP	ST	INLET PROTECTION	IP
EXISTING FIRE HYDRANT ASSEMBLY		STREAM/DITCH		OUTLET PROTECTION	OP	BUFFER ZONE	BF
OVERHEAD ELECTRICAL	OH E	EXISTING WATER METER	W.M.	RIP RAP FILTER RING	FR	EROSION CONTROL BLANKET	MA
EXISTING FORCE MAIN	FM 14"	NEW WATER METER	W.M.			SILT FENCE	SF
EXISTING SANITARY SEWER	SA 8"						

REVISION		
ITEM NO.	DESCRIPTION OF CHANGE	APPROVAL DATE
1.	REVISED PER CITY CMTS.	05/09/16

05/10/16

DIVISION OF ENGINEERING
RODNEY BABER PARK SEWER IMPROVEMENTS
DEVELOPER: City of Memphis
ENGINEER: LDA ENGINEERING

SEWER BASIN WN-2
SHEET 2 OF 15

C0.1

DIVISION OF ENGINEERING
SARP10
RODNEY BABER PARK GENERAL NOTES AND LEGEND
LOCATION: RODNEY BABER PARK
MEMPHIS, TENNESSEE

SURVEY ____ DATE ____ BOOK ____
DESIGN BY LDA ENGIN. DATE 4/28/2016 SCALE NO SCALE
REVIEWED:

DEPUTY CITY ENGINEER ____ DATE ____ CITY ENGINEER ____ DATE ____

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Name	Size (in)	Material	DS Manhole	US Manhole	DS Invert (ft) / Depth (Rim to Inv)	US Invert (ft) / Depth (Rim to Inv)	Length (ft)	% Slope
100	12	Polyvinyl Chloride (PVC) Pipe	EXIST. M.H.	MH-1	211.89 / 11.55	212.39 / 9.65	165.00	0.30
101	12	Polyvinyl Chloride (PVC) Pipe	MH-1	MH-2	212.49 / 9.55	213.24 / 10.50	250.00	0.30
102	12	Polyvinyl Chloride (PVC) Pipe	MH-2	MH-3	213.34 / 10.4	213.94 / 10.56	200.00	0.30
103	12	Polyvinyl Chloride (PVC) Pipe	MH-3	MH-4	214.04 / 10.46	214.35 / 10.54	105.00	0.30
104	12	Polyvinyl Chloride (PVC) Pipe	MH-4	MH-5	214.45 / 10.44	215.12 / 8.65	225.00	0.30
105	12	Polyvinyl Chloride (PVC) Pipe	MH-5	MH-6	215.22 / 8.55	215.81 / 7.68	196.00	0.30
106	12	Polyvinyl Chloride (PVC) Pipe	MH-6	MH-7	215.91 / 7.58	216.79 / 5.7	294.00	0.30
107	12	Polyvinyl Chloride (PVC) Pipe	MH-7	MH-8	216.89 / 5.6	217.67 / 16.54	260.00	0.30
108	12	Ductile Iron Pipe	MH-8	MH-9	217.77 / 16.44	218.61 / 13.3	280.00	0.30
109	24	Reinforced Fiberglass Pipe	EXIST. M.H.	MH-10	203.63 / 27.36	203.65 / 29.56	26.00	0.08
110	24	Reinforced Fiberglass Pipe	MH-10	MH-11	203.75 / 29.46	204.13 / 34.49	475.00	0.08

LEGEND

EXISTING SEWER TO BE ABANDONED

SARP 10 — MEMPHIS SEWER ASSESSMENT & REHABILITATION PROGRAM

LDA ENGINEERING

REVISION		
ITEM NO.	DESCRIPTION OF CHANGE	APPROVAL DATE
1.	REVISED PER CITY CMTS.	05/18/16

DIVISION OF ENGINEERING
RODNEY BABER PARK SEWER IMPOVEMENTS
DEVELOPER: City of Memphis
ENGINEER: LDA ENGINEERING

JAMES G. JO... REGISTERED ENGINEER NO. 108770 STATE OF TENNESSEE 05/18/16

SEWER BASIN WN-2
SHEET 3 OF 14

C0.2

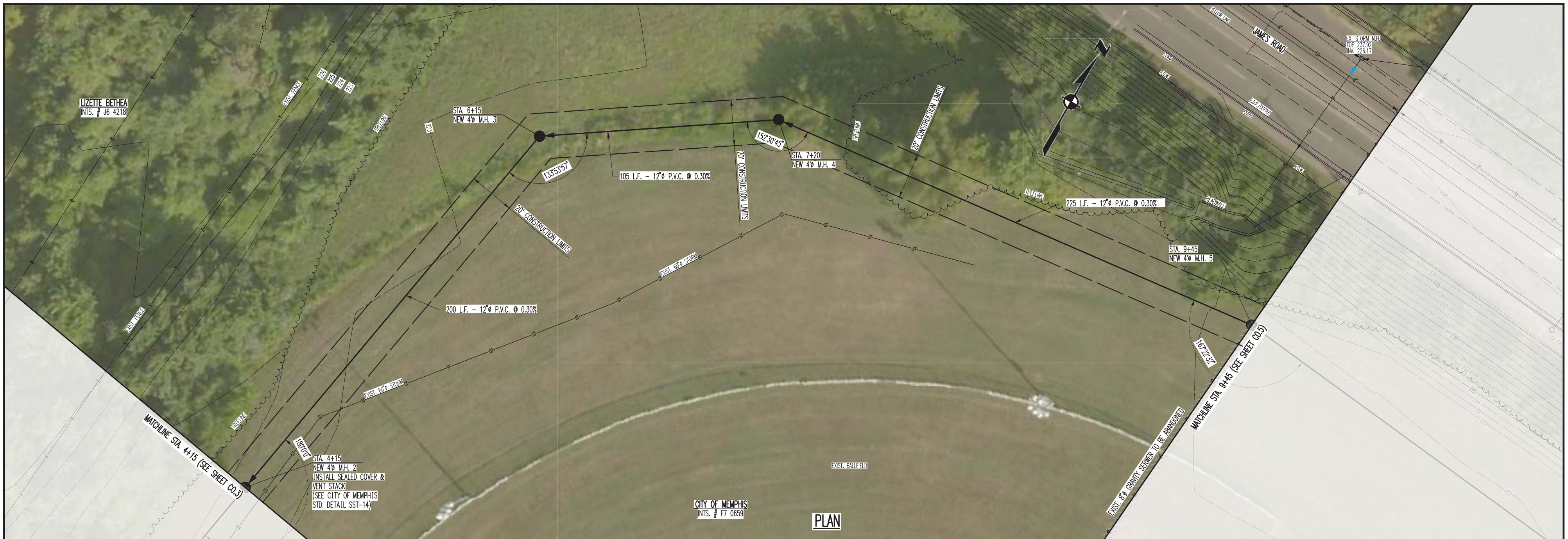
DIVISION OF ENGINEERING
SARP10
RODNEY BABER PARK OVERALL PLAN

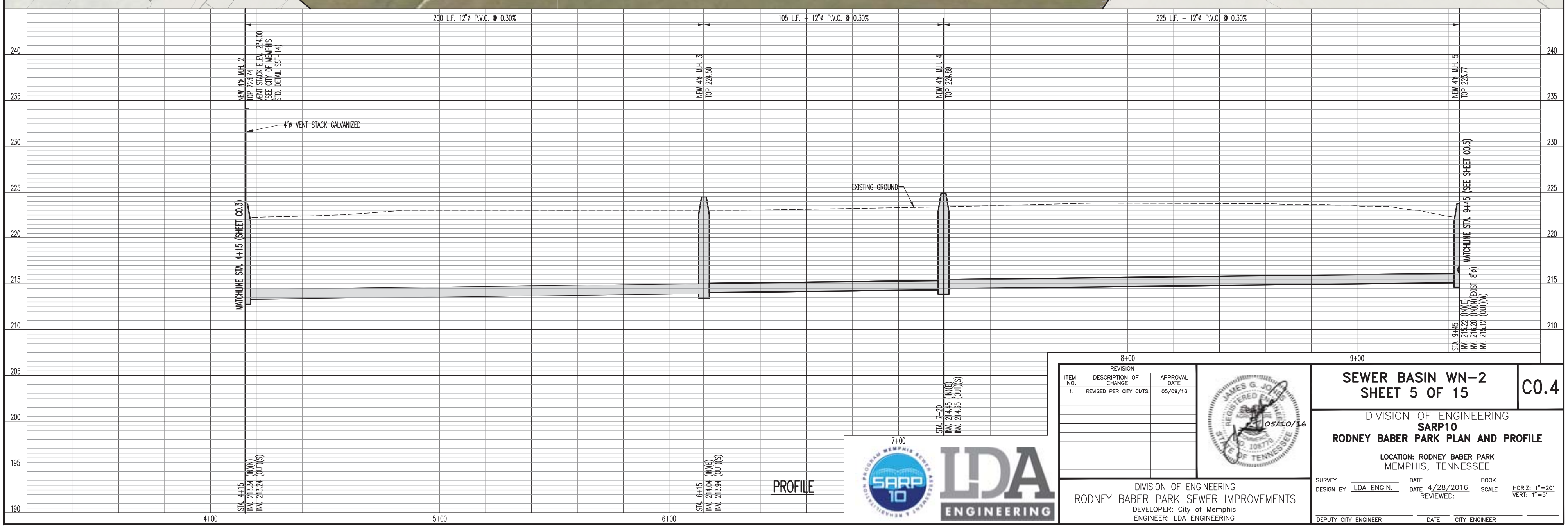
LOCATION: RODNEY BABER PARK
MEMPHIS, TENNESSEE

SURVEY ______ DATE ______ BOOK ______
DESIGN BY LDA ENGIN. DATE 4/28/2016 SCALE 1"=200'
REVIEWED:

DEPUTY CITY ENGINEER ______ DATE ______ CITY ENGINEER ______ DATE ______


PLAN
PROFILE
EXIST. 36"Ø GRAVITY SEWER TO BE ABANDONED
176°16'27"
STA. 0+00
EXIST. M.H.
CORE & BOOT EXIST. M.H.
INSTALL INSIDE DROP
(SEE CITY OF MEMPHIS
STD. DETAIL SST-2)
165 L.F. - 12"Ø P.V.C. @ 0.30%
STA. 1+65
NEW 4'Ø M.H. 1
INSTALL SEALED COVER
INSTALL VENT STACK ELEV. 234.00
(SEE CITY OF MEMPHIS
STD. DETAIL SST-14)
20' CONSTRUCTION LIMITS
250 L.F. - 12"Ø P.V.C. @ 0.30%
STA. 4+15
NEW 4'Ø M.H. 2
INSTALL SEALED COVER
INSTALL VENT STACK ELEV. 234.00
(SEE CITY OF MEMPHIS
STD. DETAIL SST-14)
MATCHLINE STA. 4+15 (SEE SHEET C0.4)
EX. 36"Ø
STA. 0+00
INV. 211.89 (IN)(N)
INV. 200.53 (OUT)(S)
BEGIN STA. 0+00
EXIST. M.H.
TOP 223.44
CORE & BOOT EXIST. M.H.
INSTALL INSIDE DROP
(SEE CITY OF MEMPHIS
STD. DETAIL SST-2)
STA. 1+65
INV. 212.49 (IN)(N)
INV. 212.39 (OUT)(S)
NEW 4'Ø M.H. 1
TOP 222.04
INSTALL SEALED COVER
INSTALL VENT STACK
ELEV. 234.00
(SEE CITY OF MEMPHIS
STD. DETAIL SST-14)
4'Ø VENT STACK GALVANIZED
EXISTING GROUND
STA. 4+15
INV. 213.34 (IN)(N)
INV. 213.24 (OUT)(S)
MATCHLINE STA. 4+15 (SEE SHEET C0.4)
NEW 4'Ø M.H. 2
TOP 223.74
INSTALL SEALED COVER
INSTALL VENT STACK
ELEV. 234.00
(SEE CITY OF MEMPHIS
STD. DETAIL SST-14)
0+00
1+00
2+00
3+00
4+00
5+00
185
190
195
200
205
210
215
220
225
230
235
240
SARP 10
LDA ENGINEERING
ITEM NO. | DESCRIPTION OF CHANGE | APPROVAL DATE
1. | REVISED PER CITY CMTS. | 06/09/16
DIVISION OF ENGINEERING
RODNEY BABER PARK SEWER IMPROVEMENTS
DEVELOPER: City of Memphis
ENGINEER: LDA ENGINEERING
SEWER BASIN WN-2
SHEET 4 OF 15
C0.3
DIVISION OF ENGINEERING
SARP10
RODNEY BABER PARK PLAN AND PROFILE
LOCATION: RODNEY BABER PARK
MEMPHIS, TENNESSEE
SURVEY
DESIGN BY LDA ENGIN.
DATE 4/28/2016
DATE REVIEWED
BOOK
SCALE HORIZ. 1"=20' VERT. 1"=5'
DEPUTY CITY ENGINEER
DATE
CITY ENGINEER
DATE





ITEM NO.	DESCRIPTION OF CHANGE	APPROVAL DATE
REVISION		
1.	REVISED PER CITY CMTS.	05/09/16

SARP10

LDA ENGINEERING

JAMES G. JONES, REGISTERED ENGINEER, STATE OF TENNESSEE, No. 108770 — 05/10/16

DIVISION OF ENGINEERING
RODNEY BABER PARK SEWER IMPROVEMENTS
DEVELOPER: City of Memphis
ENGINEER: LDA ENGINEERING

SEWER BASIN WN-2
SHEET 5 OF 15

C0.4

DIVISION OF ENGINEERING
SARP10
RODNEY BABER PARK PLAN AND PROFILE

LOCATION: RODNEY BABER PARK
MEMPHIS, TENNESSEE

SURVEY		DATE		BOOK	
DESIGN BY	LDA ENGIN.	DATE	4/28/2016	SCALE	HORIZ.: 1"=20' VERT: 1"=5'
		REVIEWED:			

DEPUTY CITY ENGINEER | DATE | CITY ENGINEER

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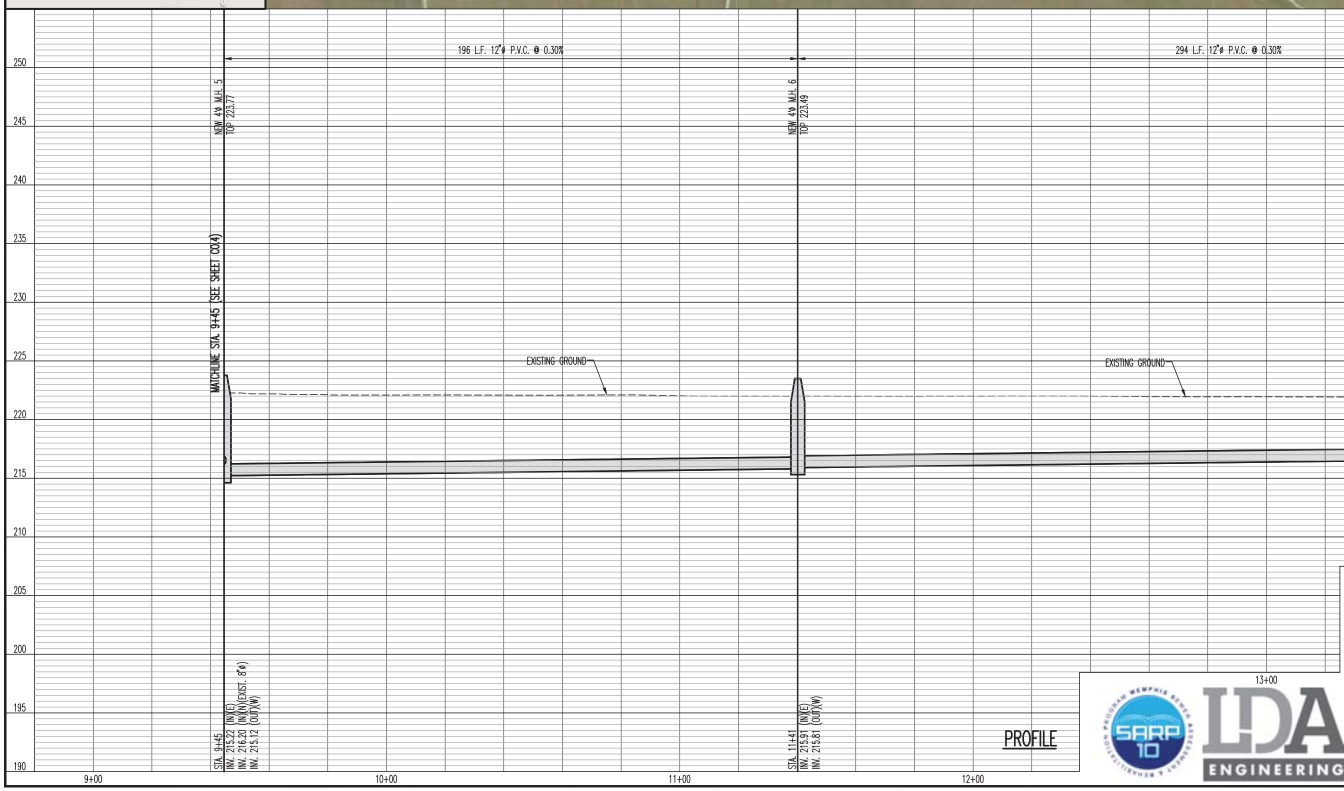


ITEM NO.	DESCRIPTION OF CHANGE	APPROVAL DATE
1.	REVISED PER CITY CMTS.	05/09/16

REVISION

DIVISION OF ENGINEERING
RODNEY BABER PARK SEWER IMPROVEMENTS
DEVELOPER: City of Memphis
ENGINEER: LDA ENGINEERING

JAMES G. JONES — REGISTERED ENGINEER — STATE OF TENNESSEE — 108770 — 05/10/16

SEWER BASIN WN–2
SHEET 6 OF 15

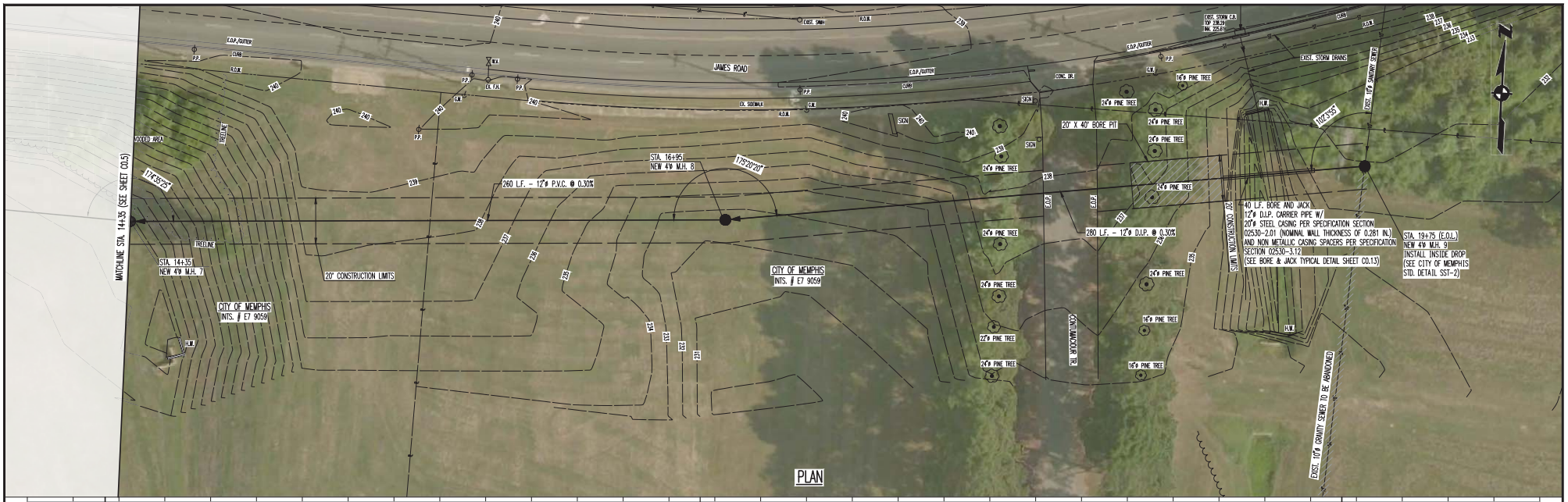
C0.5

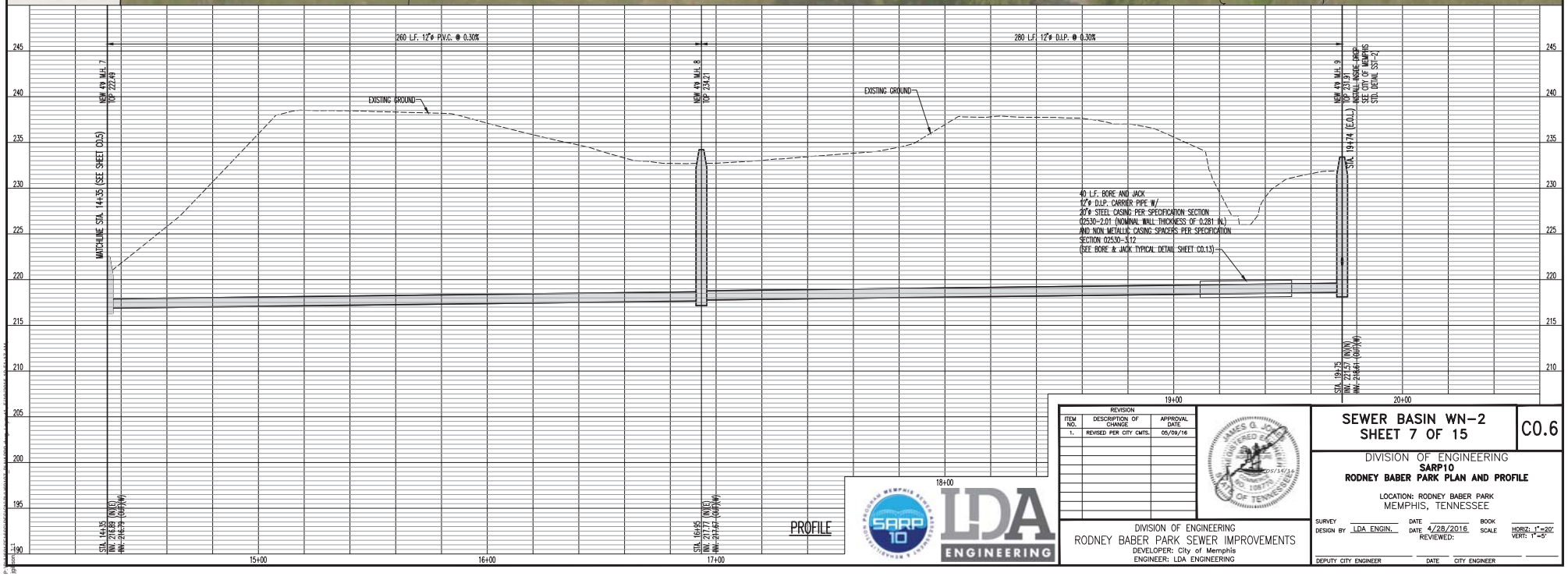
DIVISION OF ENGINEERING
SARP10
RODNEY BABER PARK PLAN AND PROFILE

LOCATION: RODNEY BABER PARK
MEMPHIS, TENNESSEE

SURVEY
DESIGN BY LDA ENGIN.
DATE
DATE 4/28/2016
REVIEWED:
BOOK
SCALE HORIZ: 1"=20' VERT: 1"=5'

DEPUTY CITY ENGINEER — DATE — CITY ENGINEER





REVISION		
ITEM NO.	DESCRIPTION OF CHANGE	APPROVAL DATE
1.	REVISED PER CITY CMTS.	05/09/16

DIVISION OF ENGINEERING
RODNEY BABER PARK SEWER IMPROVEMENTS
DEVELOPER: City of Memphis
ENGINEER: LDA ENGINEERING

SEWER BASIN WN-2
SHEET 7 OF 15

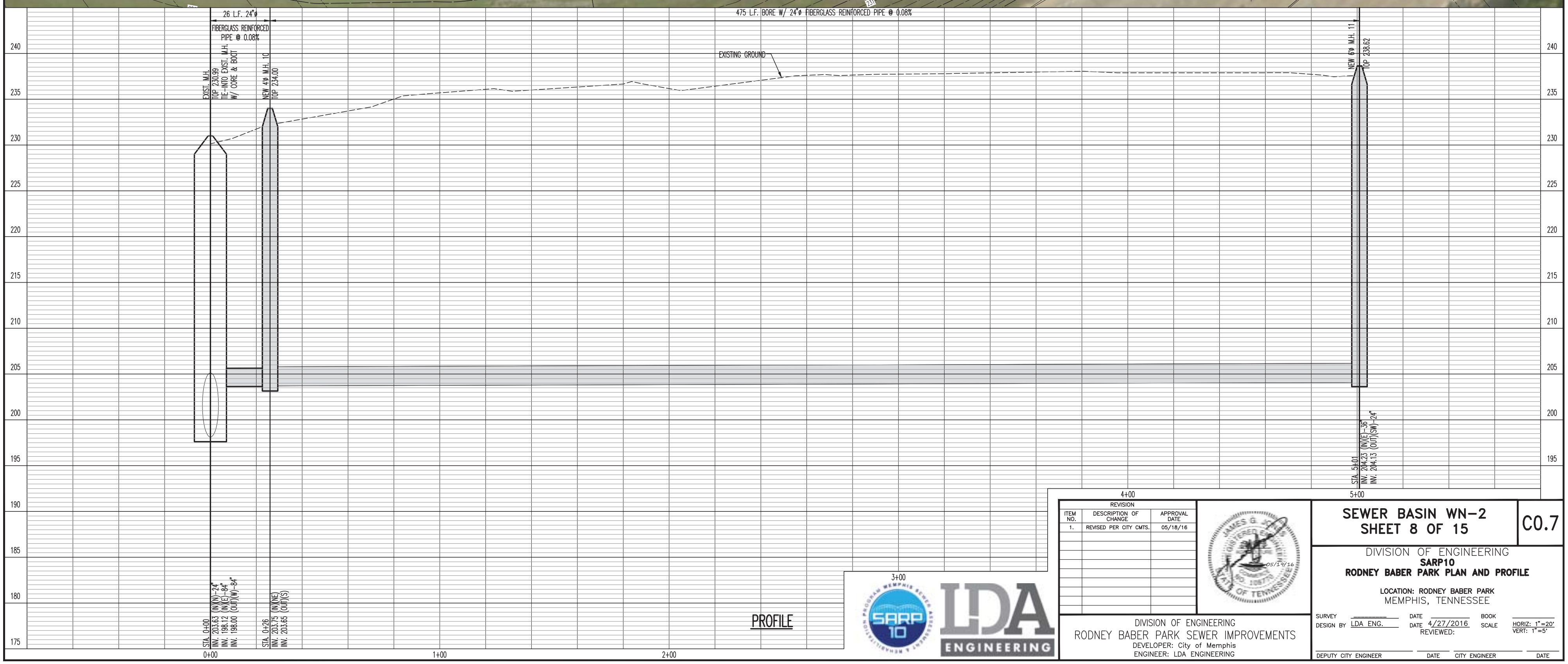
CO.6

DIVISION OF ENGINEERING
SARP10
RODNEY BABER PARK PLAN AND PROFILE

LOCATION: RODNEY BABER PARK
MEMPHIS, TENNESSEE

SURVEY
DESIGN BY LDA ENGIN.
DATE
DATE 4/28/2016
REVIEWED:
BOOK
SCALE
HORIZ: 1"=20'
VERT: 1"=5'

DEPUTY CITY ENGINEER
DATE
CITY ENGINEER



SARP 10 — LDA ENGINEERING

ITEM NO.	REVISION DESCRIPTION OF CHANGE	APPROVAL DATE
1.	REVISED PER CITY CMTS.	05/18/16

DIVISION OF ENGINEERING
RODNEY BABER PARK SEWER IMPROVEMENTS
DEVELOPER: City of Memphis
ENGINEER: LDA ENGINEERING

SEWER BASIN WN-2
SHEET 8 OF 15

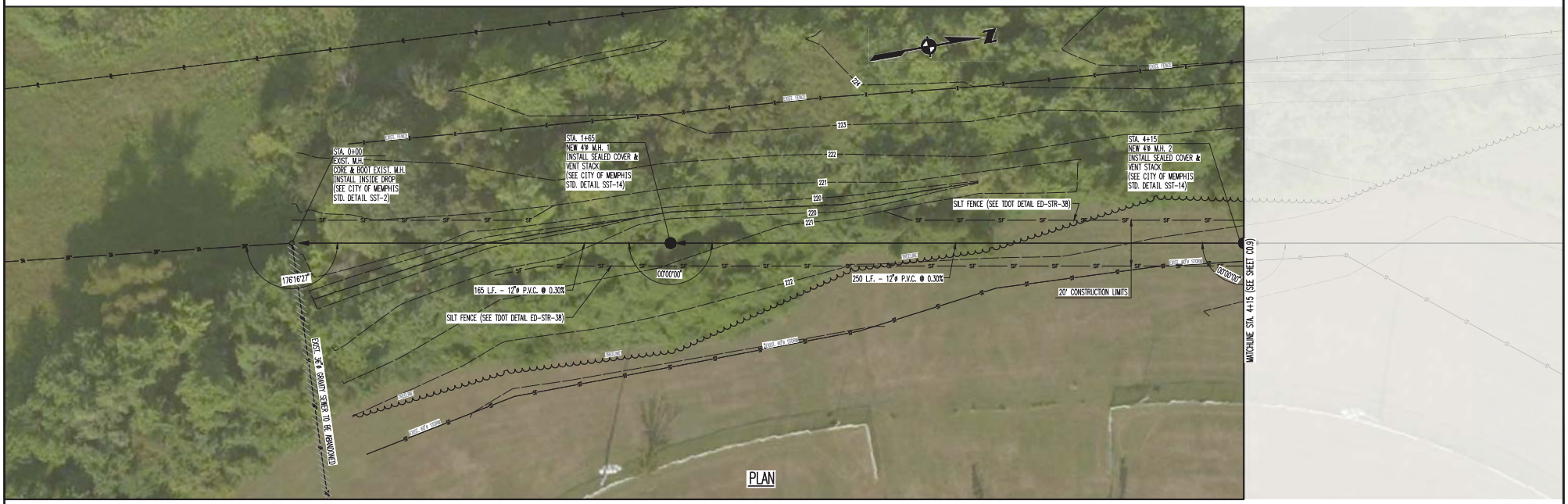
C0.7

DIVISION OF ENGINEERING
SARP10
RODNEY BABER PARK PLAN AND PROFILE

LOCATION: RODNEY BABER PARK
MEMPHIS, TENNESSEE

SURVEY ____ DATE ____ BOOK ____
DESIGN BY LDA ENG. DATE 4/27/2016 SCALE HORIZ: 1"=20' VERT: 1"=5'
REVIEWED:

DEPUTY CITY ENGINEER ____ DATE ____ CITY ENGINEER ____ DATE ____



REVISION		
ITEM NO.	DESCRIPTION OF CHANGE	APPROVAL DATE
1.	REVISED PER CITY CMTS.	05/09/16

05/10/16

DIVISION OF ENGINEERING
RODNEY BABER PARK SEWER IMPROVEMENTS
DEVELOPER: City of Memphis
ENGINEER: LDA ENGINEERING

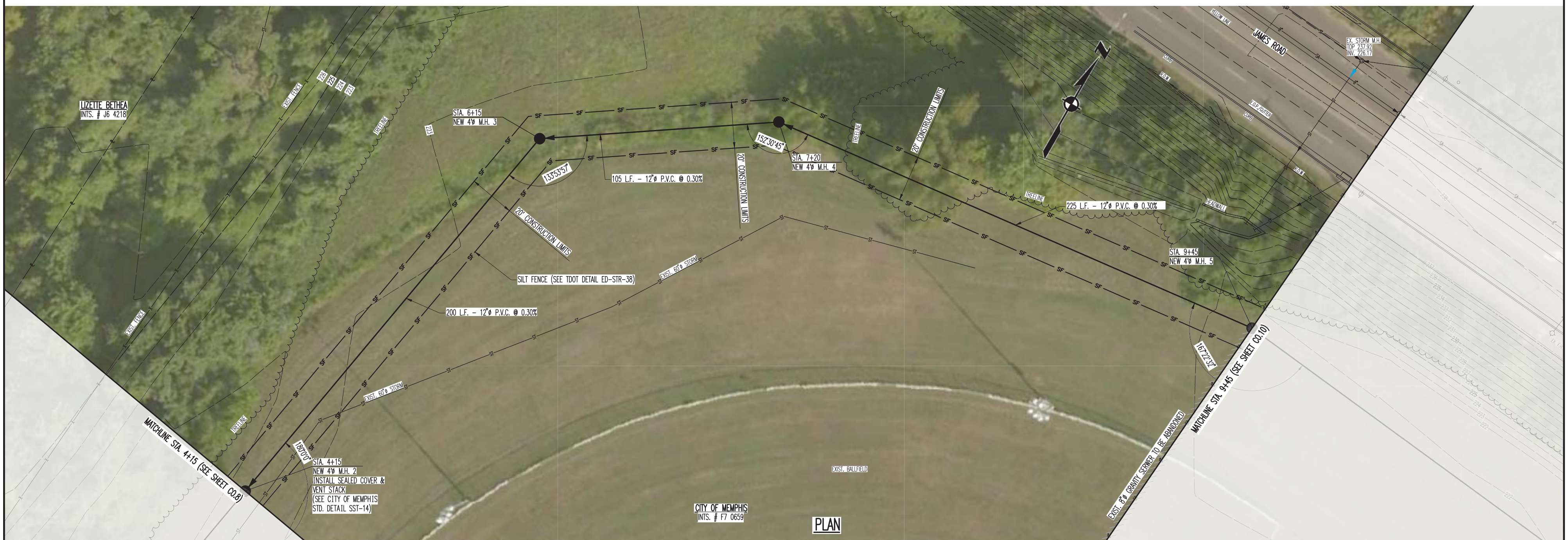
SEWER BASIN WN-2
SHEET 9 OF 15

C0.8

DIVISION OF ENGINEERING
SARP10
RODNEY BABER PARK EROSION AND SEDIMENT CONTROL
LOCATION: RODNEY BABER PARK
MEMPHIS, TENNESSEE

SURVEY ____ DATE ____ BOOK ____
DESIGN BY LDA ENGIN. DATE 4/28/2016 SCALE 1"=20'
REVIEWED:

DEPUTY CITY ENGINEER ____ DATE ____ CITY ENGINEER ____ DATE ____



REVISION		
ITEM NO.	DESCRIPTION OF CHANGE	APPROVAL DATE
1.	REVISED PER CITY CMTS.	05/09/16

JAMES G. JONES, REGISTERED ENGINEER, STATE OF TENNESSEE, NO. 108770 — 05/10/16

DIVISION OF ENGINEERING
RODNEY BABER PARK SEWER IMPROVEMENTS
DEVELOPER: City of Memphis
ENGINEER: LDA ENGINEERING

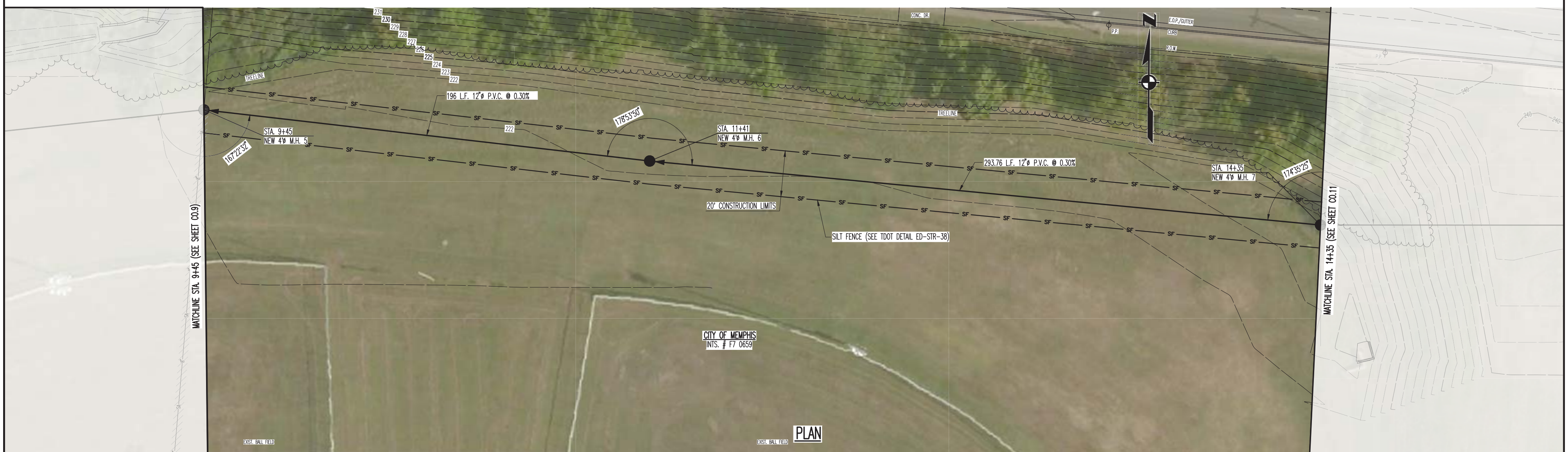
SEWER BASIN WN-2
SHEET 10 OF 15

C0.9

DIVISION OF ENGINEERING
SARP10
RODNEY BABER PARK EROSION AND SEDIMENT CONTROL
LOCATION: RODNEY BABER PARK
MEMPHIS, TENNESSEE

SURVEY ______ DATE ______ BOOK ______
DESIGN BY LDA ENGIN. DATE 4/28/2016 SCALE HORIZ: 1"=20' VERT: 1"=5'
REVIEWED:

DEPUTY CITY ENGINEER ______ DATE ______ CITY ENGINEER ______



REVISION		
ITEM NO.	DESCRIPTION OF CHANGE	APPROVAL DATE
1.	REVISED PER CITY CMTS.	05/09/16

DIVISION OF ENGINEERING
RODNEY BABER PARK SEWER IMPROVEMENTS
DEVELOPER: City of Memphis
ENGINEER: LDA ENGINEERING

JAMES G. JO... REGISTERED ENGINEER ... STATE OF TENNESSEE ... 05/10/16

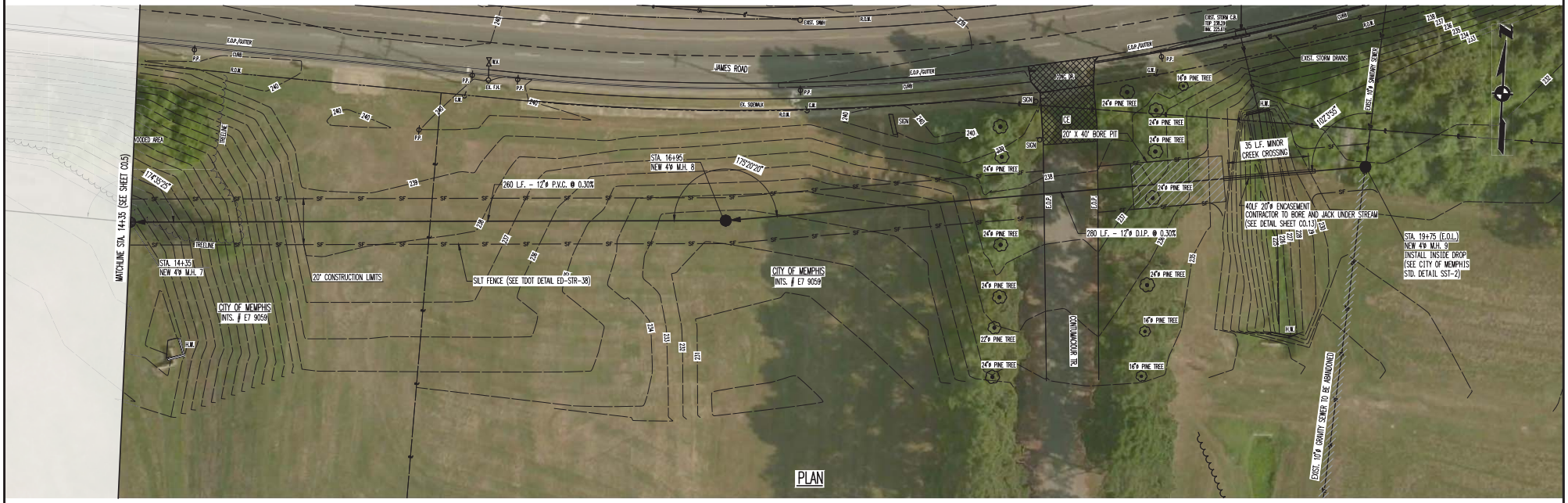
SEWER BASIN WN-2
SHEET 11 OF 15

C0.10

DIVISION OF ENGINEERING
SARP10
RODNEY BABER PARK EROSION AND SEDIMENT CONTROL
LOCATION: RODNEY BABER PARK
MEMPHIS, TENNESSEE

SURVEY ______ DATE ______ BOOK ______
DESIGN BY LDA ENGIN. DATE 4/28/2016 SCALE HORIZ: 1"=20' VERT: 1"=5'
REVIEWED:

DEPUTY CITY ENGINEER ______ DATE ______ CITY ENGINEER ______



PLAN

REVISION		
ITEM NO.	DESCRIPTION OF CHANGE	APPROVAL DATE
1.	REVISED PER CITY CMTS.	05/09/16

DIVISION OF ENGINEERING
RODNEY BABER PARK SEWER IMPROVEMENTS
DEVELOPER: City of Memphis
ENGINEER: LDA ENGINEERING

JAMES G. JOHNSON
REGISTERED ENGINEER
STATE OF TENNESSEE
20870
5/20/16

SEWER BASIN WN-2
SHEET 12 OF 15

C0.11

DIVISION OF ENGINEERING
SARP10
RODNEY BABER PARK PLAN AND PROFILE

LOCATION: RODNEY BABER PARK
MEMPHIS, TENNESSEE

SURVEY _____ DATE _____ BOOK _____
DESIGN BY LDA ENGIN. DATE 4/28/2016 SCALE 1"=20'
REVIEWED:

DEPUTY CITY ENGINEER DATE CITY ENGINEER

REVISION		
ITEM NO.	DESCRIPTION OF CHANGE	APPROVAL DATE
1.	REVISED PER CITY CMTS.	05/18/16

LDA ENGINEERING

SARP 10

DIVISION OF ENGINEERING
RODNEY BABER PARK SEWER IMPROVEMENTS
DEVELOPER: City of Memphis
ENGINEER: LDA ENGINEERING

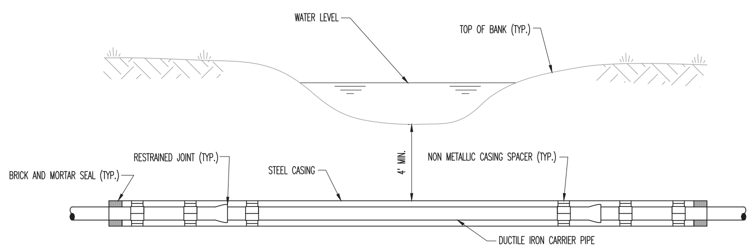
SEWER BASIN WN-2
SHEET 13 OF 15

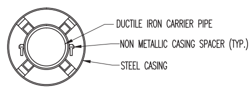
C0.12

DIVISION OF ENGINEERING
SARP10
RODNEY BABER PARK EROSION AND SEDIMENT CONTROL
LOCATION: RODNEY BABER PARK
MEMPHIS, TENNESSEE

SURVEY ______ DATE ______ BOOK ______
DESIGN BY LDA ENG. DATE 4/27/2016 SCALE HORIZ: 1"=20' VERT: 1"=5'
REVIEWED:

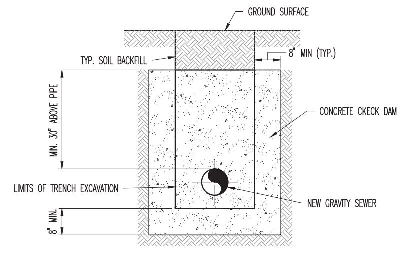
DEPUTY CITY ENGINEER ______ DATE ______ CITY ENGINEER ______ DATE ______





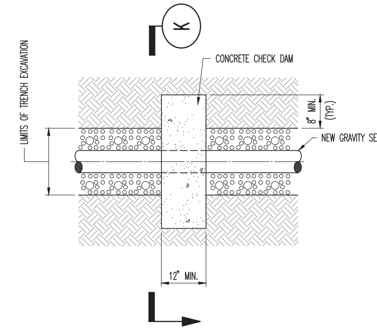
CASING PIPE NOMINAL DIAMETER (IN)	CASING PIPE THICKNESS (IN)
<14	0.188
14 - 16	0.219
18	0.250
20	0.281
22	0.312
24	0.344
28 - 30	0.406
32	0.438
34 - 36	0.469
38 - 42	0.500

TYPICAL BORE AND JACK DETAIL



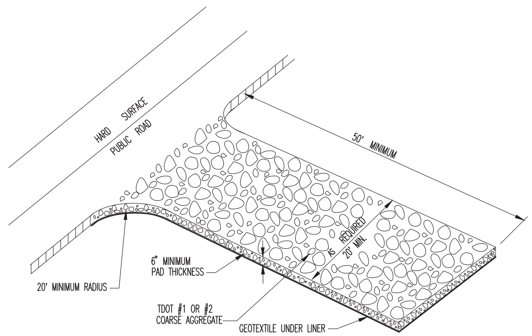
SECTION (K)

GRAVITY SEWERS IN NON-PAVED AREAS

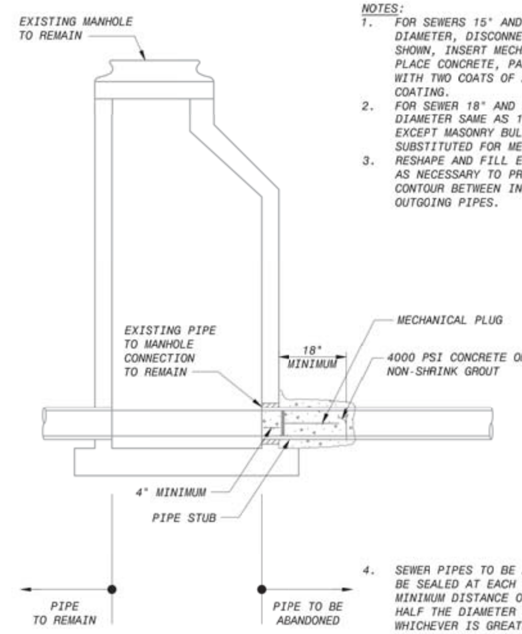


PLAN

CHECK DAMS FOR GRAVITY SEWERS

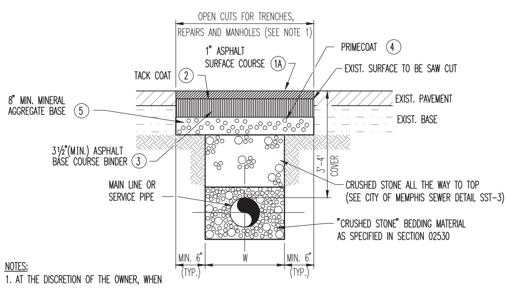


GRAVEL CONSTRUCTION ENTRANCE



NOTES:
1. FOR SEWERS 15" AND SMALLER DIAMETER, DISCONNECT SEWER AS SHOWN, INSERT MECHANICAL PLUGS, PLACE CONCRETE, PARGING AND COAT WITH TWO COATS OF ASPHALT-BASED COATING.
2. FOR SEWER 18" AND LARGER DIAMETER SAME AS 15" AND SMALLER EXCEPT MASONRY BULKHEAD MAY BE SUBSTITUTED FOR MECHANICAL PLUG.
3. RESHAPE AND FILL EXISTING CHANNEL AS NECESSARY TO PROVIDE SMOOTH CONTOUR BETWEEN INCOMING AND OUTGOING PIPES.
4. SEWER PIPES TO BE ABANDONED WILL BE SEALED AT EACH END FOR A MINIMUM DISTANCE OF 18", OR ONE HALF THE DIAMETER OF THE PIPE, WHICHEVER IS GREATER. THE PIPE WILL BE SEALED WITH A BRICK BULKHEAD AND/OR ACCEPTABLE CEMENT GROUT TO FORM A SOLID WATERTIGHT PLUG COMPLETELY BONDED TO THE PIPE.

ABANDONMENT OF PIPE AT MANHOLE



NOTES:
1. AT THE DISCRETION OF THE OWNER, WHEN TRENCH PARALLELS CENTERLINE OF ROADWAY AND WIDTH IS EQUAL TO OR GREATER THAN HALF THE LANE WIDTH, THEN THE PAVEMENT WIDTH FOR THE SURFACE COURSE SHALL BE FOR AN OVERLAY OF THE ROADWAY ENTIRE LANE WIDTH.
2. FOR PATCH SIZES, TRENCH WIDTHS AND PAVEMENT WIDTHS, SEE PAVEMENT WIDTH SCHEDULE THIS SHEET.

TYPICAL ASPHALT PAVEMENT REPLACEMENT - TYPE "I"
CITY STREETS & STATE HIGHWAYS

PAVEMENT SCHEDULE

(1)	BITUMINOUS SURFACING COURSE (ROADWAY) - SEE SPECIFICATION 02610 A. 411E (MODIFIED) B. 411E (T.D.O.T. STD. OR MODIFIED)
(2)	BITUMINOUS MATERIAL FOR TACK COAT (TC) (RATE - 0.02 GAL./SQ.YARD)
(3)	BITUMINOUS BINDER COURSE (ROADWAY) @ MIN. 3½" THICK - 307 B - SEE SPECIFICATION 02610
(4)	BITUMINOUS MATERIAL FOR PRIME COAT (PC) (RATE - 0.35 GAL./SQ. YARD).
(5)	MINERAL AGGREGATE BASE @ MIN. 8" DEEP TYPE "A" BASE, GRADING "D".

NOTES:
1. PAVEMENT DEPTHS SHOWN IN THE DETAILS ARE MINIMUM FOR THIS PROJECT, BUT MAY BE INCREASED AT THE DIRECTION OF THE ENGINEER.
2. ROADWAYS AND HIGHWAYS SHALL HAVE SURFACE COURSE PLACED AND HEAT BLENDED AND SEALED TO EXISTING PAVEMENT TO PRODUCE A SMOOTH/SEALED SURFACE. MEANS, METHODS AND EQUIPMENT SHALL BE SUBMITTED AND APPROVED BY THE ENGINEER PRIOR TO BEGINNING WORK ON THE PROJECT.

PAVEMENT WIDTH SCHEDULE

DEPTH FROM SURFACE TO INVERT (FEET)	WIDTH OF TRENCH (INCHES)	PAVEMENT PATCH WIDTH (INCHES)	MANHOLES SIZE OF PATCH (FEET)
4.0	PIPE DIAMETER + 18"	WIDTH + 12"	12 x 12
4.1 TO 8.0	PIPE DIAMETER + 36"	WIDTH + 12"	14 x 14
8.1 TO 12.0	PIPE DIAMETER + 42"	WIDTH + 12"	16 x 16
12.1 AND UP	PIPE DIAMETER + 42"	WIDTH + 12" (A)	16 x 16 (A)

NOTES:
(A). MAXIMUM PAVEMENT WIDTH AND/OR SIZE FOR ANY DEPTH OF TRENCH.
(B). PAYMENTS SHALL BE MADE IN STRICT ACCORDANCE WITH SECTIONS 01150 AND 02610.

MEMPHIS SEWER ASSESSMENT & REHABILITATION PROGRAM SARP 10

LDA ENGINEERING

ITEM NO.	DESCRIPTION OF CHANGE	APPROVAL DATE
1.	REVISED PER CITY CMTS.	05/09/16

JAMES G. J... REGISTERED ENGINEER COMMERCE NO. 108770 STATE OF TENNESSEE 05/19/16

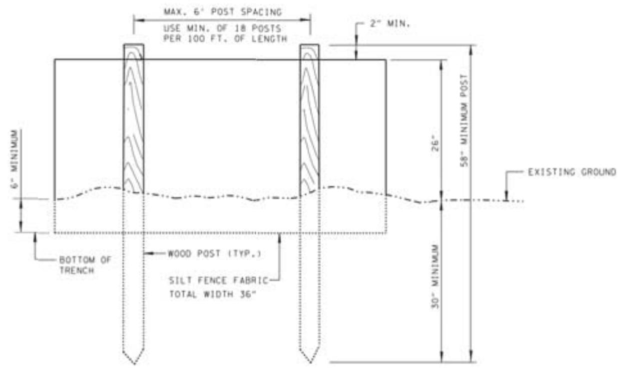
DIVISION OF ENGINEERING
RODNEY BABER PARK SEWER IMPROVEMENTS
DEVELOPER: City of Memphis
ENGINEER: LDA ENGINEERING

SEWER BASIN WN-2
SHEET 14 OF 15

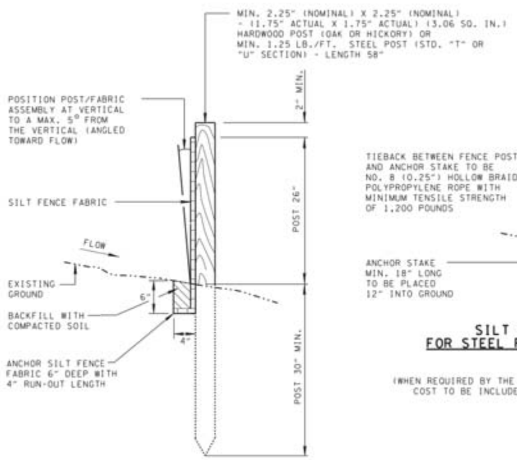
C0.13

DIVISION OF ENGINEERING
SARP10
RODNEY BABER PARK TYP. DETAILS
LOCATION: RODNEY BABER PARK
MEMPHIS, TENNESSEE

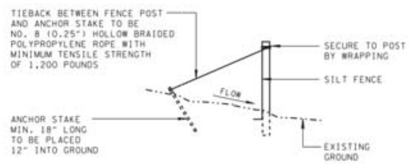
SURVEY ____ DATE ____ BOOK ____
DESIGN BY LDA ENGIN. DATE 4/28/2016 SCALE NO SCALE
REVIEWED:
DEPUTY CITY ENGINEER ____ DATE ____ CITY ENGINEER ____ DATE ____



ELEVATION VIEW



SECTIONAL VIEW



SILT FENCE TIEBACK FOR STEEL POSTS OR WOOD POSTS

(WHEN REQUIRED BY THE ENGINEER OR NOTED IN THE PLANS. COST TO BE INCLUDED IN THE ITEMS FOR SILT FENCE)

EROSION CONTROL PLAN LEGEND: • SF • SF • SF • SILT FENCE

SILT FENCE FABRIC SPECIFICATIONS

FABRIC PROPERTY AND TEST METHODS	REQUIRED PHYSICAL PROPERTIES (MARV VALUES OF TEST DATA)
GEOTEXTILE FABRIC TYPE	WOVEN SLIT FILM
APPARENT OPENING SIZE (ASTM D4751)	■30 TO ■70 STANDARD SIEVE
WATER FLUX (ASTM D4491)	≥ 4 GPM/FT^2
TENSILE STRENGTH (ASTM D4632)	≥ 120 LB. (WARP DIRECTION) X 100 LB. (FILL DIRECTION)
ULTRAVIOLET STABILITY (AFTER 500 HRS PER ASTM D4355)	≥ 70%
ELONGATION (ASTM D4632)	≤ 20% (MAX)
BURST STRENGTH (ASTM D3786)	≥ 250 PSI
PUNCTURE STRENGTH (ASTM D4833)	≥ 60 LB.
TRAPEZOIDAL TEAR (ASTM D4533)	≥ 50 LB. (WARP DIRECTION) X 40 LB. (FILL DIRECTION)

SILT FENCE GENERAL NOTES

(A) SILT FENCE IS USED TO INTERCEPT SMALL AMOUNTS OF SEDIMENT AND REDUCE VELOCITY FROM SHEET FLOW ONLY. DO NOT USE IT ADJACENT TO NATURAL WATER RESOURCES (WETLANDS OR STREAMS) OR ACROSS CONCENTRATED FLOW PATHS.

(B) THE MAXIMUM DRAINAGE AREA SIZE FOR A CONTINUOUS BARRIER SHALL BE ¼ ACRE PER 100 LINEAR FEET OF FENCE LENGTH UP TO A MAXIMUM DRAINAGE AREA OF 2 ACRES. MAXIMUM SLOPE LENGTH BEHIND FENCE ON UPSLOPE SIDE SHALL BE 110 FEET (AS MEASURED ALONG THE GROUND SURFACE).

(C) WHEN INSTALLED AT THE TOE OF A SLOPE, SILT FENCE SHOULD BE PLACED 5 FEET TO 7 FEET AWAY FROM THE TOE TO ALLOW SPACE FOR PONDING OF WATER, COLLECTION OF SEDIMENT, AND EASE OF MAINTENANCE AND REMOVAL.

(D) WHEN TWO SECTIONS OF SILT FENCE FABRIC ADJOIN EACH OTHER THEY SHALL BE JOINED ACCORDING TO THE DETAILS ON STANDARD DRAWING EC-STR-3E.

(E) MAINTENANCE SHALL BE PERFORMED AS NEEDED; CAPTURED SOIL MATERIAL SHALL BE REMOVED WHEN "BULGES" DEVELOP IN THE SILT FENCE AND/OR OTHER EVIDENCE OF FILTER CLOGGING IS OBSERVED.

(F) STEEL POSTS SHALL BE ROLLED FROM HIGH CARBON STEEL AND SHALL HAVE A MINIMUM WEIGHT OF 1.25 LB/FT. POSTS SHALL BE HOT-DIPPED GALVANIZED OR PAINTED WITH HIGH GRADE WEATHER RESISTANT STEEL PAINT. STEEL POSTS SHALL BE EQUIPPED WITH AN ANCHOR PLATE HAVING A MINIMUM AREA OF 14 SQUARE INCHES. POSTS SHALL BE STUDDED, EMBOSSED, OR PUNCHED TO AID IN THE ATTACHMENT OF THE WIRE BACKING. POSTS AND ANCHOR PLATES SHALL CONFORM TO THE REQUIREMENTS OF ASTM A702.

(G) WHEN STEEL POSTS ARE USED THEY SHALL HAVE A PROJECTION FOR FASTENING WIRE TO THEM. THE WIRE FASTENERS SHOULD BE EVENLY SPACED WITH AT LEAST FIVE PER POST.

(H) IF THE FILTER MATERIAL IS STAPLED TO THE WOODEN STAKES, HEAVY DUTY WIRE STAPLES WITH ONE-HALF INCH LENGTH AND 1 INCH WIDTH SHALL BE USED AND EVENLY SPACED WITH AT LEAST FOUR PER POST. SILT FENCE FABRIC SHALL NOT BE STAPLED TO TREES.

(I) SILT FENCES SHOULD BE PLACED ALONG OR NEAR THE GROUND CONTOUR. THE BOTTOM OF FENCE AT GROUNDLINE SHOULD BE ON A ZERO PERCENT (0%) GRADE, PLUS OR MINUS FIVE TENTHS OF ONE PERCENT (±0.5%). THE ENDS OF A ROW OF SILT FENCE SHOULD BE TURNED UPSLOPE FORMING A J-HOOK TO FILTER ANY CONCENTRATED FLOW BEHIND FENCE.

(J) A PREASSEMBLED SILT FENCE MEETING THE REQUIREMENTS OF THIS DRAWING IS ACCEPTABLE IN LIEU OF A FIELD CONSTRUCTED SILT FENCE.

(K) STATIC SLICING IS THE PREFERRED METHOD OF FENCE INSTALLATION. STATIC SLICING INVOLVES THE INSERTION OF A NARROW CUTTING BLADE, PLACED AT THE SPECIFIED ANCHOR DEPTH FOR THE GIVEN FABRIC AS SHOWN ON THE APPLICABLE DETAIL, AND SIMULTANEOUSLY PULLING THE FENCE FABRIC INTO THE TRENCH AS THE TRENCH IS BEING EXCAVATED. ALTERNATE TRENCH-BASED METHODS ARE ALSO ACCEPTABLE. FOR TRENCH-BASED INSTALLATIONS, SILT FENCING SHALL BE INSTALLED PER THE FOLLOWING STEPS AND IN THE FOLLOWING ORDER:

- EXCAVATE TRENCH A MAXIMUM OF 4 INCHES WIDE AND 6 INCHES DEEP. THE TRENCH SHALL BE HAND-CLEANED FOLLOWING EXCAVATION TO REMOVE BULKY DEBRIS SUCH AS ROCKS, STICKS, AND SOIL CLODS FROM THE TRENCH.
- INSTALL FABRIC IN TRENCH.
- BACKFILL TRENCH (OVER-FILL) WITH SOIL PLACED AROUND FABRIC.
- COMPACT SOIL BACKFILL WITH MECHANICAL EQUIPMENT. DO NOT DAMAGE THE FABRIC DURING COMPACTION (DAMAGED FABRIC SHALL BE REPLACED).
- DRIVE AND SET SUPPORT POSTS PER SPACING REQUIREMENTS GIVEN ON THE APPLICABLE FENCE DETAIL. FOR PRE-ASSEMBLED SILT FENCE, DRIVE SUPPORT IN TO GROUND FIRST, FOLLOWED BY FABRIC PLACEMENT IN TRENCH.
- ATTACH FABRIC TO THE POSTS USING WIRE TIES OR STAPLES. SPACING AND DENSITY OF TIES OR STAPLES SHALL BE INSTALLED AS DESCRIBED IN NOTES F AND G.

(L) ONLY SILT FENCE FABRIC LISTED ON THE QUALIFIED PRODUCTS LIST MAY BE USED. ANY PRODUCTS LISTED ON THE QUALIFIED PRODUCTS LIST AS AN APPROVED ALTERNATE MAY ALSO BE USED.

(M) SILT FENCE SHALL BE PAID FOR UNDER THE FOLLOWING ITEM NUMBER:

209-08.03 TEMPORARY SILT FENCE (WITHOUT BACKING) PER LINEAR FOOT

PAYMENT SHALL INCLUDE ALL MATERIALS AND LABOR NECESSARY FOR CONSTRUCTION, MAINTENANCE, AND REMOVAL OF THE SILT FENCE.

(M) SEDIMENT SHALL BE REMOVED FROM BEHIND THE SILT FENCE WHEN IT HAS ACCUMULATED TO ONE-HALF THE ORIGINAL HEIGHT OF THE STRUCTURE AND PAID FOR UNDER ITEM NUMBER 209-05, SEDIMENT REMOVAL PER CUBIC YARD.

☐ REV. 12-18-03: MODIFIED TABLE (1) AND GENERAL NOTE (E).
☐ REV. 7-29-04: CHANGED VALUES IN TABLE 1 FROM MEAN TO MARV VALUES.
☐ REV. 4-15-06: REMOVED POA SPECS. FROM TABLE 1. ADDED NOTE (L). REVISED TABLE TITLE, REORDERED GENERAL NOTES, REFORMATTED SHEET, REVISED NOTES, MISC. EDITS TO DRAWING.
☐ REV. 4-1-08: REMOVED TEMPORARY REFERENCE, REVISED NOTES, AND MISC. EDITS TO DRAWING.
☐ REV. 8-1-12: MINOR EDITS TO GENERAL NOTES.

☐ MINOR REVISION -- FHWA APPROVAL NOT REQUIRED.

SEEDING CHART

TIME OF YEAR	TYPE	% BY WEIGHT
FEBRUARY – MARCH	KY-31 TALL FESCUE ENGLISH RYE KOREAN LESPIDEZA	80 5 15
JUNE – SEPTEMBER	KY-31 TALL FESCUE ENGLISH RYE KOREAN LESPIDEZA GERMAN MILLET	55 20 15 10
OCTOBER – JANUARY	KY-31 TALL FESCUE ENGLISH RYE WHITE CLOVER	70 20 10

* FOR MORE INFORMATION PLEASE SEE SWPPP FOR THIS PROJECT.

ITEM NO.	DESCRIPTION OF CHANGE	APPROVAL DATE
1.	REVISED PER CITY CMTS.	05/09/16

REVISION

DIVISION OF ENGINEERING
RODNEY BABER PARK SEWER IMPROVEMENTS
DEVELOPER: City of Memphis
ENGINEER: LDA ENGINEERING

05/10/16

SEWER BASIN WN-2
SHEET 15 OF 15

C0.14

DIVISION OF ENGINEERING
SARP10
RODNEY BABER PARK TYP. DETAILS
LOCATION: RODNEY BABER PARK
MEMPHIS, TENNESSEE

SURVEY ____ DATE ____ BOOK ____
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